Environmental Impact Assessment

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Philippines: Bataan-Cavite Interlink Bridge Project

Volume 2 Annexes

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NOTES

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Table of Contents

ANNEX 1: CRITICAL HABITAT ASSESSMENT (NOVEMBER 2023)

Bataan-Cavite Interlink Bridge Project

Critical Habitat Assessment

8 November, 2023

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Abbreviations

ADB	Asian Development Bank
AoA	Area of Analysis
AoI	Area of Influence
AOO	Area of Occupancy
BAP	Biodiversity Action Plan
BCIB	Bataan–Cavite Interlink Bridge Project
BFAR	Bureau of Fisheries and Aquatic Resources
CIMP	Corregidor Islands Marine Park
CPA	Conservation Priority Area
CR	Critically Endangered
DD	Data Deficient
DENR	Department of Environment and Natural Resources
DENR-BMB	Biodiversity Management Bureau
DPWH	Department of Public Works and Highways
EAAA	Ecologically Appropriate Area of Analysis
ECC	Environmental Compliance Certificate
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EN	Endangered
EOO	Extent of Occurrence
GN6	Guidance Note 6
IBAT	Integrated Biodiversity Assessment Tool
ICM	Integrated Coastal Management
IFC	International Finance Corporation
IUCN	World Conservation Union
KBA	Key Biodiversity Area
LGU	Local Government Unit
LMMPA	Locally-Managed Marine Protected Area
MBCS	Manila Bay Coastal Strategy
MBEMP	Manila Bay Environmental Management Project
MBSDMP	Manila Bay Sustainable Development Master Plan
MPA	Marine Protected Area
NEDA	National Economic and Development Authority
NT	Near Threatened
PEMSEA	Program on Building Partnerships in Environmental Management for the Seas of East Asia
PS6	Performance Standard 6
RR	Restricted Range
VU	Vulnerable

Table of Contents

List of Exhibits

1 INTRODUCTION

This critical habitat assessment report has been prepared at the direction of the Asian Development Bank (ADB), as one component of the updated environmental impact assessment (EIA) for the Bataan–Cavite Interlink Bridge Project (BCIB) in Manila Bay, Philippines. The critical habitat assessment has been carried out in accordance with the guidance developed by the International Finance Corporation (IFC), as specified in its Performance Standard 6 (2012) and related documents. The critical habitat assessment is based on information available at the time of writing, and it is anticipated that it will be updated based on further ecological baseline surveys to be carried out during the project's pre-construction phase, as have been provided for in the project Environmental Management Plan (EMP).

1.1 Project Background

The proposed Bataan–Cavite Interlink Bridge (BCIB) project will entail construction and operation of a 32-km, four-lane road link across the mouth of Manila Bay, joining the provinces of Bataan and Cavite. The project aims to establish an alternative road transport corridor between Region III (Central Luzon) and Region IV-A (Calabarzon), to help ease traffic congestion in Metro Manila; achieve greater regional economic integration; ease disparities in public service access and economic opportunity that exist between Metro Manila and other parts of Luzon; enable development of ports in Mariveles to take some of the pressure off the overburdened Port of Manila; and boost nature-based tourism on Bataan's west coast. The project has been proposed by the Department of Public Works and Highways (DPWH), and is being pursued under the umbrella of the 'Build, Build, Build' economic development program of the Government of the Philippines. The BCIB project is under consideration for financing by the Asian Development Bank, through its Infrastructure Preparation and Implementation Facility (IPIF) for the Philippines.

The BCIB will connect to the Roman Highway in the Municipality of Mariveles, on the southern tip of the Bataan peninsula, and to the Antero Soriano Highway in the Municipality of Naic, in Cavite. The over-water alignment will be 26 km long, and will encompass two high cable-stayed bridges over navigation channels that transit the mouth of Manila Bay, as well as a smaller nearshore navigation bridge near the Cavite shore. The longest over-water component of the BCIB, at approximately 23 km, will be a series of marine viaducts, with road decks about 20 m above the water. The viaduct will pass nearby the east coast of Corregidor Island, which sits in the mouth of the bay, and an offshore turnaround structure will be integrated with the main alignment there. Besides facilitating safety and emergency traffic management, the turnaround structure will be designed to serve as a tie-in point for a possible spur link to Corregidor Island, should that be considered at some point in the future (a link will not be part of the BCIB project). The BCIB project's location is shown in Exhibit 1.

An environmental impact assessment (EIA) was carried out by Ove Arup & Partners Hong Kong, Ltd. during 2019 and 2020, concurrent with preparation of the Preliminary Engineering Design, and an EIA report was finalized in February 2021, following review by DENR-EMB. An Environmental Compliance Certificate (ECC) was issued by DENR-EMB for the BCIB project in April of 2021. The 2021 EIA report did not include a comprehensive critical habitat assessment.

The Detailed Engineering Design work for the BCIB project is being undertaken by a joint venture of T.Y. Lin International and Pyunghwa Engineering Consultants, Ltd., and an updated EIA is under preparation in parallel with the design process. This critical habitat assessment has been produced as a supporting element of the updated EIA for the BCIB project.

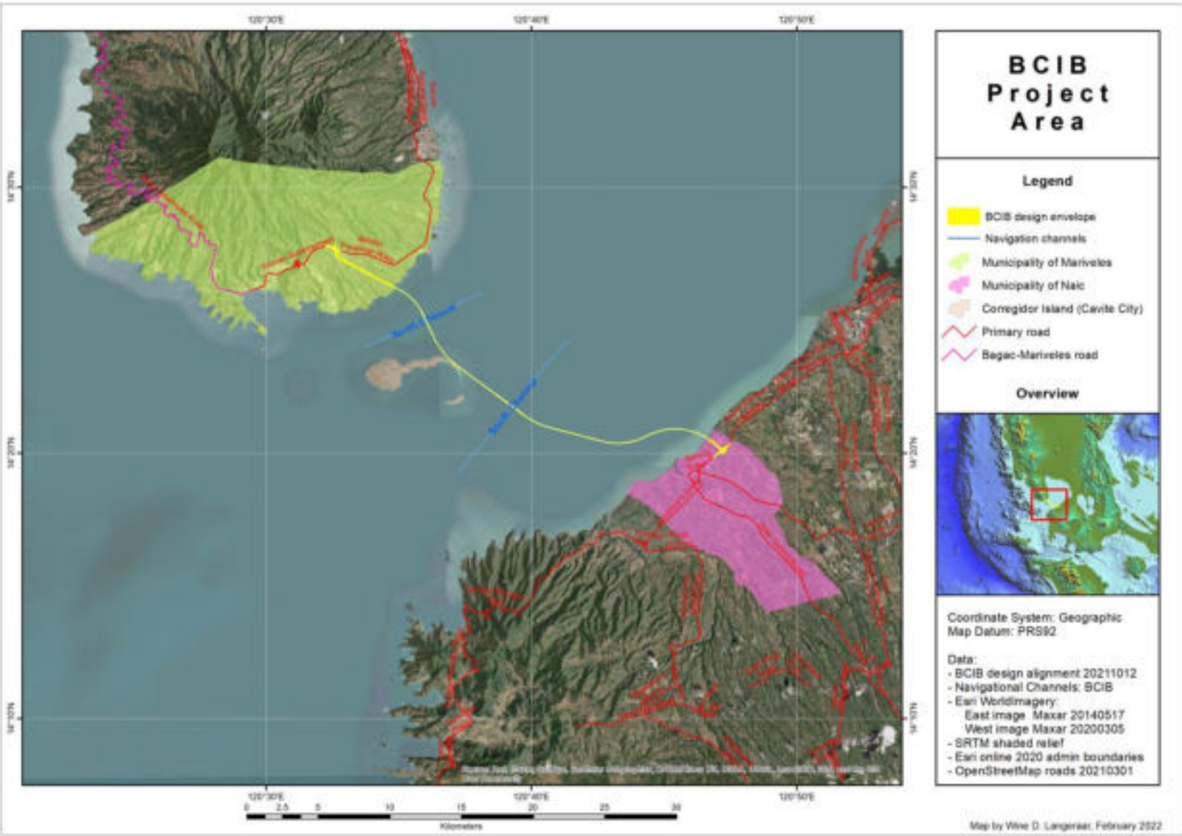


Exhibit 1: Location of BCIB Project

1.2 Habitat Classification Framework

This critical habitat assessment report follows the concepts and methodology developed by the International Finance Corporation (IFC), as specified in its Performance Standard 6 (2012) and the supporting Guidance Note 6 (2019).[1] Key definitions elaborated within the habitat classification framework are those for habitat, modified habitat, natural habitat and critical habitat.

1.2.1 Habitat

Performance Standard 6 (PS6) defines habitat as:

> '…a terrestrial, freshwater, or marine geographical unit or airway that supports assemblages of living organisms and their interactions with the non-living environment. For the purposes of implementation of this Performance Standard,

[1] International Finance Corporation. 2012. Performance Standard 6 – Biodiversity Conservation and Sustainable Management of Living Natural Resources. January 1, 2012.; (2) International Finance Corporation. 2019. International Finance Corporation's Guidance Note 6 – Biodiversity Conservation and Sustainable Management of Living Natural Resources. June 27, 2019 update.

habitats are divided into modified, natural, and critical. Critical habitats are a subset of modified or natural habitats.' (PS6, Para. 9)

1.2.2 Modified Habitat

Modified habitats are defined in PS6 as:

> '…areas that may contain a large proportion of plant and/or animal species of non-native origin, and/or where human activity has substantially modified an area's primary ecological functions and species composition. Modified habitats may include areas managed for agriculture, forest plantations, reclaimed coastal zones, and reclaimed wetlands.' (PS6, Para. 11)

Further direction regarding identification of modified habitat is given in Guidance Note 6 (GN6), which states:

> 'Human activity may modify the structure and composition of natural habitats to the degree that nonnative species become dominant and/or the natural ecological functions of the habitat fundamentally change. At the extreme, this takes the form of urbanized areas. However, there is a wide spectrum of modified habitats that includes agricultural areas, plantation forestry, and lands partially degraded by a range of other human interventions. The landscape context (for example, fragmentation of surrounding natural habitat, if any) will also influence the degree to which a project site is considered modified.' (GN6, Para. 35)

1.2.3 Natural Habitat

Natural habitats are defined in PS6 as:

> '…areas composed of viable assemblages of plant and/or animal species of largely native origin, and/or where human activity has not essentially modified an area's primary ecological function and species composition.' (PS6, Para. 13)

Supporting interpretation with respect to what makes for a natural habitat is provided in GN6:

> 'Natural habitats are not to be interpreted as untouched or pristine habitats. It is likely that the majority of habitats designated as natural will have undergone some degree of historical or recent anthropogenic impact. The question is the degree of impact. If, in the judgement of a competent professional, the habitat still largely contains the principal characteristics and functions of a native ecosystem(s), it should be considered a natural habitat regardless of some degree of degradation and/or the presence of some invasive alien species, secondary forest, human habitation, or other human-induced alteration.' (GN6, Para. 39)

1.2.4 Critical Habitat

Critical habitat is understood as a sub-category to be assigned to a land or sea area following categorization of that area as either modified habitat or natural habitat. Critical habitat is defined in the PS6 as:

'…areas with high biodiversity value, including (i) habitat of significant importance to Critically Endangered and/or Endangered species; (ii) habitat of significant importance to endemic and/or restricted-range species; (iii) habitat supporting globally significant concentrations of migratory species and/or congregatory species; (iv) highly threatened and/or unique ecosystems; and/or (v) areas associated with key evolutionary processes.' (PS6, Para. 16)

A critical habitat determination is an essential factor shaping requirements for consultation, mitigation and management plans, and monitoring in the context of environmental impact assessment and project development. IFC specifies five criteria for use in critical habitat determinations, as follows:

1.2.4.1 Criterion 1 – Critically Endangered and Endangered Species

Thresholds:

(a) Areas that support globally important concentrations of an IUCN Red-listed EN or CR species (≥ 0.5% of the global population AND ≥ 5 reproductive units of a CR or EN species).

(b) Areas that support globally important concentrations of an IUCN Red-listed Vulnerable (VU) species, the loss of which would result in the change of the IUCN Red List status to EN or CR and meet the thresholds in (a).

(c) As appropriate, areas containing important concentrations of a nationally or regionally listed EN or CR species

Applicability as per GN6:

Species threatened with global extinction and listed as CR and EN on the IUCN *Red List of Threatened Species* shall be considered as part of Criterion 1. (GN6, Para. 70)

...the inclusion in Criterion 1 of species that are listed nationally/regionally as CR or EN in countries that adhere to IUCN guidance shall be determined on a project-by-project basis in consultation with competent professionals. (GN6, Para. 71)

1.2.4.2 Criterion 2 – Endemic and Restricted-Range Species

Threshold:

(a) Areas that regularly hold ≥10% of the global population size AND ≥10 reproductive units of a species.

Definitions as per GN6:

For purposes of this Guidance Note, the term endemic is defined as restricted-range. Restricted range refers to a limited extent of occurrence (EOO).

- For terrestrial vertebrates and plants, restricted-range species are defined as those species that have an EOO less than 50,000 square kilometers (km^2).
- For marine systems, restricted-range species are provisionally being considered those with an EOO of less than 100,000 km^2.
- For coastal, riverine, and other aquatic species in habitats that do not exceed 200 km width at any point (for example, rivers), restricted range is defined as having a global range of less than or equal to 500 km linear geographic

span (i.e., the distance between occupied locations furthest apart). (GN6, Para. 74)

1.2.4.3 Criterion 3 – Migratory and Congregatory Species

Thresholds:

(a) Areas known to sustain, on a cyclical or otherwise regular basis, ≥1% of the global population of a migratory or congregatory species at any point of the species' lifecycle.

(b) Areas that predictably support ≥10% of the global population of a species during periods of environmental stress.

Definitions as per GN6:

Migratory species are defined as any species of which a significant proportion of its members cyclically and predictably move from one geographical area to another (including within the same ecosystem). (GN6, Para. 76)

Congregatory species are defined as species whose individuals gather in large groups on a cyclical or otherwise regular and/or predictable basis. Examples include:

- Species that form colonies.
- Species that form colonies for breeding purposes and/or where large numbers of individuals of a species gather at the same time for non-breeding purposes (for example, foraging and roosting).
- Species that utilize a bottleneck site where significant numbers of individuals of a species occur in a concentrated period of time (for example, for migration).
- Species with large but clumped distributions where a large number of individuals may be concentrated in a single or a few sites while the rest of the species is largely dispersed (for example, wildebeest distributions).
- Source populations where certain sites hold populations of species that make an inordinate contribution to recruitment of the species elsewhere (especially important for marine species). (GN6, Para. 77)

1.2.4.4 Criterion 4 – Highly Threatened and/or Unique Ecosystems

Thresholds:

(a) Areas representing ≥5% of the global extent of an ecosystem meeting the criteria for IUCN status of CR or EN under the IUCN's Red List of Ecosystems.

(b) Other areas not yet assessed by IUCN but determined to be of high priority for conservation by regional or national systematic conservation planning.

Applicability as per GN6:

The IUCN is developing a Red List of Ecosystems, following an approach similar to the Red List for Threatened Species. The client should use the Red List of Ecosystems where formal IUCN assessments have been performed. Where formal IUCN assessments have not been performed, the client may use assessments using systematic methods at the national/regional level, carried out by governmental bodies, recognized academic institutions and/or other relevant qualified organizations (including internationally recognized NGOs). (GN6, Para. 79)

1.2.4.5 Criterion 5 – Areas Associated With Key Evolutionary Processes

No quantitative thresholds apply to this criterion. Rather, a qualitative judgement is made as to the presence or absence of idiosyncratic landscape features that catalyze and support evolutionary processes, e.g., speciation, and can be considered to have given rise to genetically unique populations or subpopulations of plant and animal species.

Several examples of landscape attributes understood to promote speciation interaction between landscape features and key evolutionary processes, that may be considered in relation to a possible trigger of Criterion 5 are listed in GN6 (Para. 82):

- Landscapes with high spatial *heterogeneity* are a driving force in speciation, as species are naturally selected based on their ability to adapt and diversify.
- *Environmental gradients*, also known as *ecotones*, produce transitional habitat, which has been associated with the process of speciation and high species and genetic diversity.
- *Edaphic interfaces* are specific juxtapositions of soil types (for example, serpentine outcrops, limestone, and gypsum deposits), which have led to the formation of unique plant communities characterized by both rarity and endemism.
- *Connectivity* between habitats (for example, biological corridors) ensures species migration and gene flow, which is especially important in fragmented habitats and for the conservation of metapopulations. This also includes biological corridors across altitudinal and climatic gradients and from “crest to coast.”
- Sites of demonstrated importance to *climate change adaptation* for either species or ecosystems are also included within this criterion.

Applicability as per GN6:

> The significance of structural attributes in a landscape that may influence evolutionary processes will be determined on a case-by-case basis, and the determination of critical habitat will be heavily reliant on scientific knowledge. In the majority of cases, this criterion will apply in areas that have been previously investigated and that are already known or suspected to be associated with unique evolutionary processes. While systematic methods to measure and prioritize evolutionary processes in a landscape do exist, they are typically beyond a reasonable expectation of assessments conducted by the private sector." (GN6, Para. 83)

1.3 Antecedents

1.3.1 Critical Habitat Screening Report

A critical habitat screening assessment was conducted in relation to the BCIB project in 2020, during the feasibility stage, by a consultant engaged by ADB.[2] The screening process

[2] SC Environment, Ltd (SCE). 2020. Critical Habitat Screening, Nelex–Manila Bay Bridge. Report prepared for the Asian Development Bank. 7 May 2020.

required defined areas within which critical habitat could be assessed. Two areas of analysis (AoA) were subsequently created. The first included all of Manila Bay and a modest strip of land around the two ends of the BCIB project (the 'Bridge and Surrounding Area' AoA), while the second encompassed a solely terrestrial area covering the southern half of the Bataan peninsula, centered on Mt. Mariveles (the 'Bataan Province' AoA). A long list of 293 critically endangered (CR), endangered (EN) and vulnerable (VU) marine and terrestrial species was generated by a spatial search using the Integrated Biodiversity Assessment Tool (IBAT).[3] The long list included 13 CR species, 39 EN species, and 241 VU species. Two thirds (161) of the VU species listed were corals. The Bridge and Surrounding Area AoA was assessed for marine species only and the Bataan Province AoA was assessed for terrestrial species only.

The Bridge and Surrounding Area AoA was screened in relation to a list of 9 CR and 28 EN marine species drawn from the long list. The screening report concluded, based on an initial species-by-species evaluation, that 29 of the 37 marine species could be considered 'Potentially present, but unlikely to meet thresholds of Criteria 1–3'. In the case of the remaining eight species (all EN corals), it was concluded that there was insufficient information at hand to assess the probability of presence within the AoA, and that additional research should be carried out in relation to coral reef areas in support of any further critical habitat assessment.

The Bataan Province AoA was screened in relation to 4 CR and 10 EN terrestrial species extracted from the long list. It was concluded that none of the terrestrial species presented sufficient reason to suggest that a critical habitat determination would be triggered in relation to Criterion 1 or Criterion 2. The report suggested it was possible but not likely that two avian species could trigger a determination under Criterion 3, in the event that presence or suitable habitat were confirmed through field investigation. The conclusion of the report stated (p. 36) that "The data and information reviewed suggests that the Bataan Province AoA is not qualified as Critical Habitats as defined by ADB."

In addition to the IBAT-generated species lists, the screening report reviewed and discussed information and bird census data regarding the use of habitat areas within the Bridge and Surrounding Area AoA by migratory waterbirds. Manila Bay is recognized as a significant wintering and stopover site on the East Asian-Australasian Flyway, and the screening report drew on a 2018 report prepared for Wetlands International and IUCN, which indicated that numbers of 16 species typically present in the bay during winter may account for quite large proportions of their respective flyway populations.[4] The critical habitat screening indicated that the census numbers reported in the Wetlands International/IUCN report should be compared to global population data for the 16 species to determine if any exceed the 1% threshold of Criterion 3, as part of any subsequent critical habitat assessment. It was noted that although the greatest concentrations of migratory waterbirds are typically found using the foreshore, mud flats, mangroves and brackish waters at the head of the bay (40-50 km away from the BCIB project location), those habitats are within the AoA. It was also argued that extensive habitat loss and degradation (which are well documented) in those somewhat distant reaches of the bay might be expected to lead at least some species to use marginal

[3] The spatial parameters for the search, e.g., reference points and radii, were not indicated in the critical habitat screening report.
[4] Jensen, A.E. 2018. Internationally Important Waterbird Sites in Manila Bay, Philippines, October 2018. Technical Report. Wetlands International and IUCN National Committee of the Netherlands.

or less extensive habitat patches in other parts of the bay, including areas closer to the mouth.

With regards to Criterion 4, the screening report noted that Manila Bay has not yet been evaluated under the IUCN Red List of Ecosystems framework, and thus cannot be assessed in relation to Threshold (a) of Criterion 4. However, it was suggested that the Bridge and Surrounding Area AoA was likely, under more thoroughgoing consideration, to trigger Criterion 4 (b): *Other areas not yet assessed by IUCN but determined to be of high priority for conservation by regional or national systematic conservation planning*. The ongoing Manila Bay Sustainable Development Master Plan process was cited as possible evidence that the AoA, which is defined mostly by the boundaries of Manila Bay, had been identified as a high priority conservation target through systematic national or regional planning, and may appropriately qualify as critical habitat on that basis. Further investigation of conservation priorities developed in relation to Manila Bay by relevant governmental and NGO sector entities was therefore recommended.

The screening report concluded that Criterion 5 was not applicable to either of the two areas screened, as neither is recognized as a significant center of speciation or thought to represent any particular propensity for supporting heightened evolutionary activity.

1.3.2 Updated IBAT Screening Reports

In September of 2021, a new IBAT screening was carried out by ADB, for terrestrial and marine environments separately, based on the most recent alignment information for the BCIB project.[5] The terrestrial screening identified a list of 29 EN and CR terrestrial species, as well as 22 restricted range (RR) terrestrial species, within a 50-km radius of the project's centerline. The marine screening identified a list of 47 EN and CR marine species (and two RR marine species) within the same search radius. Fourteen terrestrial protected areas and six key biodiversity areas (KBAs) were identified within 50 km; two protected areas and one KBA were noted within 10 km of the project alignment. The updated IBAT screening reports, which are included in Appendix 1, are adopted as the basis for species evaluations in the present critical habitat assessment.

1.4 Purposes and Objectives

The overarching aim of this critical habitat assessment is to build upon the earlier critical habitat screening report to solidify a reasoned determination as to whether any known characteristics of the BCIB project's ecological setting should be considered to trigger critical habitat thresholds. If they do, they will set the stage for mitigation planning that adequately and appropriately meets the particular biodiversity conservation challenges posed by the project's development.

The key objectives supporting this aim are to (1) confirm and update the initial species-by-species evaluations carried out by SCE, Ltd. in relation to Criteria 1–3, including for the additional waterbird species discussed; (2) further develop the initial evaluation of conservation priorities, as articulated through national and regional systematic planning efforts, in relation to Criterion 4, Threshold (b); (3) scope the implications of any resulting

[5] (1) IBAT PS6 & ESS6 Report. Generated under licence 4846-21884 from the Integrated Biodiversity Assessment Tool on 13 September 2021 (GMT). www.ibat-alliance.org (Marine screening report); (2) IBAT PS6 & ESS6 Report. Generated under licence 4846-21885 from the Integrated Biodiversity Assessment Tool on 13 September 2021 (GMT). www.ibat-alliance.org (Terrestrial screening report)

critical habitat determinations for mitigation planning in relation to the BCIB project; and (4) identify future updates to the critical habitat assessment that may become possible following anticipated strengthening of baseline data on local presence, abundance and habitat use of individual species.

2 METHODOLOGY

2.1 Scope of Assessment

2.1.1 BCIB Area of Analysis

For the purposes of this assessment, the BCIB project area is defined as an envelope consisting of all land and sea areas within two kilometers of any part of the designed infrastructure footprint (see Exhibit 2). This is the Area of Influence (AoI). Thus, the marine portion of the AoI comprises a four-kilometer-wide strip across Manila Bay. Overall, the AoI comprises 150 km^2, of which 69% is sea area and 31% is land areas. The critical habitat assessment is not referenced in any direct or influential way to the location and character of the project infrastructure, expected project development activities, or anticipated impacts.

Exhibit 2: BCIB Project Area

2.1.2 Spatial Scope of Assessment

Typically for a critical habitat assessment a candidate long list of species is initially generated based on species that could potentially be present within a wider area of analysis

(AoA). The area of analysis (AoA) should be defined based on an understanding of the predominant biodiversity attributes in a project's broader setting and the ecological patterns and processes required to maintain them. As per GN6,

> The project should identify an ecologically appropriate area of analysis to determine the presence of critical habitat for each species with regular occurrence in the project's area of influence, or ecosystem, covered by Criteria 1–4. The client should define the boundaries of this area taking into account the distribution of species or ecosystems (within and sometimes extending beyond the project's area of influence) and the ecological patterns, processes, features, and functions that are necessary for maintaining them. These boundaries may include catchments, large rivers, or geological features. (GN6, Para. 59)

IFC PS6 then requires that for each biodiversity feature or species that regularly occurs in the Project AoI, and could potentially meet IFC PS6 criteria, an ecologically appropriate area of analysis (EAAA) is defined. The boundaries of the EAAAs should be defined based on the ecological patterns and processes that are necessary to maintain that species. The local population supported within the EAAA is what is used to determine if IFC PS6 critical habitat thresholds have been met.

At the time of writing, insufficient data was available to define species level EAAAs. As such an area of analysis (AoA) has been adopted and the spatial area for assessment. The original critical habitat screening report developed a case for the Bridge and Surrounding Area AoA as an appropriate spatial unit for the critical habitat screening. This AoA encompasses all of Manila Bay and a reasonable buffer of land area around the proposed BCIB project in Bataan and Cavite. This AoA, as shown in Exhibit 3 is subsequently evaluated against the five standard criteria of the IFC assessment framework. The AoA encompasses 2,000 km^2, of which approximately 93% is sea area, and 7% is land areas.

This approach is in line with the precautionary approach and as the project improves its biodiversity baseline over time the critical habitat assessment will be revisited and updated. In the interim a precautionary approach has been taken to the assessment.

In keeping with the conclusion of the screening report, the Bataan Province AoA, as introduced earlier, is considered to be of limited utility, and is not adopted for this assessment.

Source: SC Environment, Ltd (SCE). 2020. Critical Habitat Screening, Nelex–Manila Bay Bridge. Report prepared for the Asian Development Bank. 7 May 2020.

Exhibit 3 Area of Analysis for Critical Habitat Assessment

2.2 By-Species Evaluations

For each species listed in the terrestrial and marine IBAT output reports, desktop research was conducted to review habitat requirements, known range, estimated global population, reported local presence and other parameters, as the basis for determining whether the species could reasonably be considered to meet any of the thresholds under Criteria 1–3. Findings were corroborated as appropriate with preliminary results from field surveys conducted in the BCIB project area as part of baseline development for the ongoing EIA update.

As introduced earlier, the thresholds under Criteria 1–3 are numerical, and the core of each by-species evaluation is a comparison between the population of the species that can reasonably be anticipated within the AoA on the one hand, and the global population of the same species on the other. When there is no basis for estimation of either a local or global population—as is often the case—the relative sizes of the expected local area of occupancy (AOO) and the species' estimated global extent of occurrence (EOO) are called upon to reflect on the probability of the species being present in numbers sufficient to trigger one of the thresholds. The present critical habitat assessment adopted the assumption that the AoA (terrestrial or marine portion, depending on the species) was representative of the AOO, unless knowledge of habitat requirements and/or local presence provided a reason to define a smaller possible AOO (e.g., a marine species known to inhabit only very shallow inshore waters, or a terrestrial species never documented below a particular altitude).

The areas of the terrestrial and marine portions of the AoA were calculated using Google Earth, and smaller AOO estimates were derived from triangulation of these known areas with available baseline information regarding bathymetry, land cover and habitat types.

EOO was roughly gauged from range maps available online, gathered principally from species profiles presented on the IUCN Red List website (redlist.org); in some cases, numerical estimates of EOO were also available. Global population estimates were gathered from online sources, mainly redlist.org; population estimates were available only for the most studied species. Information on habitat preferences and constraints, as well as movement patterns and other behaviors, was gathered from species profiles available on redlist.org and other credible online sources.

It is acknowledged that by-species evaluation relative to the thresholds under Criteria 1–3 is an imprecise science requiring use of assumptions and preliminary, partial and tentative data. However, it is felt that by integrating multiple sources of information in a logical and consistent analytical process, the present critical habitat assessment has arrived at a reasoned, non-arbitrary probability assessment for each species in relation to the relevant thresholds.

2.3 Desktop Research in Relation to Criterion 4

A detailed review of policy initiatives, ecosystem assessment efforts, conservation planning processes and practical conservation actions pertaining to biodiversity in the Manila Bay area was conducted in order to assess the applicability of Criterion 4, Threshold (b) to the AoA. The analysis was oriented to illuminating the development of institutional interest and focus regarding threats facing ecosystem health and biodiversity in Manila Bay, and used an approach that is largely historical. The protected areas and key biodiversity areas (KBAs) identified in the IBAT screening report were among the conservation initiatives catalogued and discussed.

2.4 Consultations

As per PS6, consultation with knowledgeable stakeholders and experts in the broader project setting is considered a valuable and advisable component of a critical habitat assessment process. A list of consultation encounters undertaken in support of the critical habitat assessment— and scoping of related mitigation planning—for the BCIB project is presented in Appendix 2. Further consultative activity is anticipated in connection with additional ecological baseline surveys to be carried out during the project's pre-construction phase, as mandated under the EMP.

3 CRITICAL HABITAT DETERMINATION

3.1 Criterion 1: Critically Endangered and Endangered Species

3.1.1 Terrestrial Species

The terrestrial IBAT output report list included 23 CR and EN species.[6] Each species on the list was evaluated based on available information on habitat requirements, global EOO, global population numbers, and local conditions as appropriate to estimate the probability

[6] Two marine turtle species were also included, but these were considered with marine fauna.

that a population present within the AoA might meet Threshold (a) under Criterion 1.[7] The results of the by-species evaluation are summarized in Exhibit 4; range maps and sources consulted in relation to each species are collated in Appendix 3.

Exhibit 4: By-Species Evaluation in Relation to Criterion 1 (Terrestrial Species)

Species	Habitat and Range Notes[1]	Global population[2]	0.5% threshold	Probability of meeting Criterion 1 Threshold(a)
Acerodon jubatus Golden-Capped Fruit Bat (EN)	Endemic to the Philippines and widely distributed across most of the archipelago, this forest-dependent species' preferred feeding habitats are primary forest and high-quality secondary forest. This bat shares mixed-species roosts in locations inaccessible to humans, such as steep slopes, cliff edges and mangrove islands. The AoA has almost no sites that match these descriptors well, although there may be some minor mangrove islands near the head of the bay, and some suitable secondary forest within the AoA on the lower slopes of Mt. Mariveles. Terrestrial portions of the AoA, especially when narrowed by habitat type, comprise a tiny fraction of the global EOO for this species, making it very unlikely that any population present could comprise 0.5% of the Philippines-wide (i.e., global) population. This species was not recorded during faunal surveys of the BCIB project area in 2020 and 2021/2022.	10,000–20,000	50–100	Very low
Adelmeria dicranochila (EN)	A perennial herb new to science until 2019 and thought to be endemic to the Philippines, this species is known from only four sites, none of which are near the AoA and all of which are in primary and mossy forest between 1,000 and 2,100 masl. The species can be considered extremely unlikely to be found in the AoA. No specimens were recorded during vegetation surveys conducted in the BCIB project area in 2020 and 2021/2022.	Unknown	-	Zero
Cacatua haematuropygia Philippine Cockatoo (CR)	This species, endemic to the Philippines, is considered 'possibly extinct' over much of its former known range, including Luzon. The species favors primary lowland forest (of which there is none in the AoA), and was not recorded during faunal surveys of the BCIB project area in 2020 and 2021/2022. It can be considered very unlikely that this species would be found within the AoA.	430–750	3–4	Very low
Calidris tenuirostris Great Knot (EN)	Preferred wintering habitat for this migratory species is sheltered coastal habitats such as bays, estuaries and lagoons with large intertidal mud and sand flats, oceanic sandy beaches with nearby mudflats, sandy spits and muddy shorelines. Preferred wintering food is molluscs and crustaceans plucked from intertidal muds and sands. The global EOO is 331,000 km^2, of which the terrestrial portion of the AoA comprises less than 0.1%. Data from bird counts in areas of Manila Bay with preferred habitat from 2003–2018 indicate that no more than 500 individuals were ever documented across all count sites in any year. It can be considered improbable that this species would meet the 0.5% threshold consistently. The species was not recorded during faunal surveys of the BCIB project area in 2020 and 2021/2022.	292,000–295,000	1,460–1,475	Low

[7] Threshold (b) refers to VU species that might change status to CR and EN in the event of loss of the AoA population; as the IBAT output list included only CR and EN species, this threshold was not applied. Threshold (c) refers to nationally listed EN and CR species, where the national classification system follows the IUCN methodology; as this is not really the case with Philippines classifications of EN and CR species (made under various legal instruments), this threshold was not applied.

Species	Habitat and Range Notes[1]	Global population[2]	0.5% threshold	Probability of meeting Criterion 1 Threshold(a)
Calostoma insigne (EN)	This fungal species is associated with *Dipterocarp* trees and is found in tropical and subtropical lowland forests. The absence of significant lowland forest in the AoA suggests a very low probability of presence. Range maps indicate possible wide distribution across land areas of the Indo-Pacific, so it can be considered extremely unlikely that any populations present in the very limited lowland forest habitat left in the AoA could support as much as 0.5% of the global population.	Unknown	-	Extremely low
Camptostemon philippinense (EN)	This mangrove species has a very patchy distribution across much of the Philippines and part of Indonesia, and reportedly occurs in very small numbers where it is present. Range maps indicate that Manila Bay is just outside the known range, which includes the north coast of Batangas, but not coastline within the bay itself. In view of this, it can be considered improbable that any individuals of the species would be found in the AoA, and very unlikely that any specimens present would constitute as much as 0.5% of the global population. The species was not recorded during baseline surveys of coastal vegetation conducted in 2020 and 2021.	1,200	6	Very low
Cerberus microlepis Lake Buhi Bockadam (EN)	This freshwater snake species is known from a single lake in southeast Luzon, and can be considered extremely unlikely to be present in the AoA. It was not recorded during faunal surveys of the BCIB project area in 2020 and 2021/2022.	Unknown	-	Zero
Crocodylus mindorensis Philippine Crocodile (CR)	This species is considered extinct in central Luzon.	92–137	4–7	Zero
Cuora amboinensis Southeast Asian Box Turtle (EN)	This aquatic turtle species, of which there are four sub-species, is widely distributed from India to Indonesia. It is reportedly fairly common throughout the Philippines, though under threat from hunting for the pet trade, food and use in handicrafts. The species prefers warm, standing fresh water such as may be found in natural ponds and swamps, fish ponds and flooded rice paddies. This species is likely to be present in the AoA; however, since its distribution is very wide, it is highly unlikely that the population within the limited terrestrial portions of the AoA would approach 0.5% of the global population. The species was not recorded during faunal surveys of the BCIB project area in 2020 and 2021/2022, or in a river ecology survey conducted in 2021/2022.	Unknown	-	Extremely low
Dipterocarpus grandiflorus (EN)	This large forest tree species is usually found in primary lowland forest, often near the sea, and is known from one location within the AoA, in eastern Mariveles. The species was not recorded in the floral surveys carried out in the BCIB project area in 2020 and 2021/2022. *Dipterocarpus grandiflorus* has a scattered distribution across a very wide area (EOO over 6 million km^2) encompassing the northern Philippine Islands, Eastern Borneo, Sumatra, the Malay Peninsula, Vietnam, Laos, Myanmar and the Andaman Islands. Given this distribution, it is extremely unlikely that the population of a single known site in the AoA could account for anywhere close to 0.5% of the global population.	Unknown	-	Extremely low

Species	Habitat and Range Notes[1]	Global population[2]	0.5% threshold	Probability of meeting Criterion 1 Threshold(a)
Drepanosticta makilingia (CR)	This species of damselfly is known only from Mt. Makiling, on the south end of Laguna de Bay and some 45 km away from the AoA. It can be considered extremely unlikely to be present within the AoA.	Unknown	-	Extremely low
Drepanosticta trimaculata (CR)	This species is a forest-dependent damselfly documented from a single location south of Lake Taal, nearly 50 km away from the AoA. It can be considered extremely unlikely to be present within the AoA.	Unknown	-	Extremely low
Lonchura oryzivora Java Sparrow (EN)	There is a known population of this species, which is not native to the Philippines, within Metro Manila. The one available range map indicates that Metro Manila is the only place on Luzon where this bird lives, although this likely underestimates the local range quite significantly, since the species appears on extant species checklists for various forest areas both north and south of Manila Bay (e.g., Bataan Natural Park, Mariveles, Nasugbu, Taal) and was documented in the BCIB project area (Cavite portion) in 2021/2022 field surveys. Although the Java Sparrow is under severe threat from capture for the cagebird trade in its native central Java, it has been widely introduced elsewhere, and there are resident populations in Southeast Asia, East Asia and the Pacific, and as far away as Sri Lanka, Hawaii and Venezuela. Although the Java Sparrow can be considered likely in both land portions of the AoA, in view of the wide distribution of native and feral populations of the species, it is very unlikely that these limited land areas could account for as much as 0.5% of global population.	Unclear (1,500–3,750 estimated for native range)	-	Very low
Macromia negrito (EN)	This forest dragonfly species is known only from the area around Mt Makiling, 45 km away from the AoA. It is speculated that the species may be under-reported, perhaps drastically so, because of the difficulty in catching it. Regardless, there is no basis for concluding that this insect would have a significant presence in the AoA, particularly given the paucity of forest habitat in the Cavite portion.	Unknown	-	Extremely low
Nisaetus philippensis North Philippine Hawk-Eagle (EN)	A forest-dwelling lowland species, *Nisaetus philippensis* is mainly found on Luzon and Mindoro, and is suspected on Palawan. The Luzon population is thought to be concentrated primarily in the Sierra Madre Range, which runs up the east coast of the northern part of Luzon, to the west of the AoA. Although there is virtually no closed forest left in the AoA, the species is known to use somewhat modified forest as a marginal habitat, and to frequent open areas occasionally. Accordingly, presence within the AoA cannot be ruled out. However, it seems unlikely the modest land areas within the AoA, nonwell-endowed with forest land, could support more than 0.5% of the global population. Estimated EOO for this species is 233,000 km^2, while the terrestrial portion of the AoA is just 163 km^2. The species was not recorded during faunal surveys of the BCIB project area in 2020 and 2021/2022.	600–900	3–5	Low

Species	Habitat and Range Notes[1]	Global population[2]	0.5% threshold	Probability of meeting Criterion 1 Threshold(a)
Numenius madagascariensis Far Eastern Curlew (EN)	Preferred wintering habitat for this migratory species is estuaries, mangrove swamps, saltmarshes and intertidal flats, particularly those with extensive seagrass meadows; this kind of habitat is found around the northern and some eastern fringe portions of Manila Bay. Data from bird counts in areas of Manila Bay with preferred habitat from 2003–2018 indicate that no more than 68 individuals were ever documented across all count sites in any year, which suggests relatively low probability that the wintering population within the AoA would exceed 0.5% of the global population. The Far Eastern Curlew was not recorded during faunal surveys of the BCIB project area in 2020 and 2021/2022.	32,000	160	Low
Oriolus isabellae Isabela Oriole (CR)	This forest-dependent species is present in only a few localities in the northern Sierra Madre Mountains. It was formerly reported from southern Bataan, but is now considered likely to be extinct in this area, as it has not been seen there since 1947. The AoA contains very little preferred habitat (primary and secondary bamboo forest) for this species, and the very limited forest area within the Bataan portion (an estimated maximum area of 10 km^2 on the lower slopes of Mt. Mariveles) would constitute about 0.1% of the EOO for the species (8,900 km^2). The Isabella Oriole was not recorded during faunal surveys of the BCIB project area in 2020 and 2021/2022.	250	25	Very low
Pericnemis bonita (EN)	This species of damselfly lives in forest and wetland habitat and is known only from three areas of central and southern Luzon, the closest of which is the Mt. Makiling area about 45 km south of the AoA. Accordingly, the AoA can be assumed to have very little chance of meeting the 0.5% threshold for this species.	Unknown	-	Zero
Pericnemis incallida (EN)	Very little is known about this damselfly species, which was described from specimens collected at just five sites in central and northern Luzon, but it is thought to be forest-dependent and a phytotelmata breeder and have an altitudinal range of 50–600 masl. One of the specimens was collected in Ternate, Cavite, and the only range map available indicates Naic as part of the range, which seems dubious and may be a matter of low precision. The estimated EOO for this species is indicated as 32,913–45,577 km^2, whereas the terrestrial portion of the AoA in Cavite is 82 km^2 (0.25% of lower EOO estimate); based on this comparison, it may be reasonable to consider the AoA unlikely to support a population sufficient to meet the 0.5% threshold. The very reduced and disturbed state of forests in the part of Cavite included in the AoA, as well as the fact that the AoA within Cavite is virtually all lower than 50 masl, would tend to support this conclusion.	Unknown	-	Very low
Pithecophaga jefferyi Philippine Eagle (CR)	Range maps indicate that the Philippine Eagle is not extant west of the central Sierra Madre Range, which suggests the species would be unlikely to occur in the AoA; the AoA also lacks the rugged mountain terrain and primary forest typically frequented. The species was not recorded in faunal surveys of the BCIB project area in 2020 and 2021/2022. This species can safely be considered not to be a qualifying species for a critical habitat determination.	250–750	2–4	Extremely low

Species	Habitat and Range Notes[1]	Global population[2]	0.5% threshold	Probability of meeting Criterion 1 Threshold(a)
Prioniturus luconensis Green Racquet-Tail (EN)	Although range maps indicate likely presence throughout central and northern Luzon, this species, which is thought to be dependent on lowland primary forest, is now considered to be largely confined to the Subic Bay Forest Reserve and Northern Sierra Madre Natural Park. The EOO for this species is estimated at 147,000 km^2, which suggests that any population occurring in the terrestrial portion of the AoA in Bataan (75 km^2) would be quite unlikely to meet the 0.5% threshold. The Green Racquet-Tail was not recorded during faunal surveys of the BCIB project area in 2020 and 2021/2022.	1,500–3,800	8–19	Very low
Pterocarpus indicus Burmese Rosewood (EN)	Wild-grown specimens of this species are known from a large number of widely scattered sites spread across the Indo-Pacific. None of the sites indicated on range maps indicate a recorded presence within the AoA, and the altitudinal range for the species is 600–1,300 masl, likely putting wild populations well out of range for the AoA (highest elevation approximately 300 masl). It can be considered extremely unlikely that wild-grown specimens of this species would be found in the AoA in sufficient numbers to meet the 0.5% threshold. *Pterocarpus indicus* is commonly planted for living fences, and numerous instances of this were observed in the Bataan portion of the BCIB project area during field surveys; however, even when taking account of such plantings, the probability of the threshold being met can still safely be considered to be very low, given the species' wide distribution.	Unknown	-	Very low
Pterospermum cumingii (EN)	This small tree species is reported from only five sites, all of which are on Luzon and none of which are within the AoA. The species is considered endemic to ultramafic soils, which are not known to be present within the AoA. The species was not recorded during vegetation surveys of the BCIB project area in 2020 and 2021/2022.	Unknown	-	Zero

[1] Information for habitat and range notes is sourced primarily from species profiles on redlist.org, supplemented as needed from other online sources. Sources and range maps for each species are presented in Appendix 3.
[2] Global population estimates are sourced primarily from redlist.org, and other online sources where necessary.

The by-species evaluations presented in Exhibit 4 do not indicate that any terrestrial species can be considered likely to meet Threshold (a) under Criterion 1. However, special note is to be made of the Philippine Duck (*Anas luzonica*), a VU species which was considered in the present critical habitat assessment because it was identified in the aforementioned Wetlands International/IUCN report on waterbird numbers in Manila Bay as one of the extant species whose estimated Manila Bay populations appear to account for a large proportion of the estimated flyway or global population.[8] Under Threshold (b) of Criterion 1, an AoA that supports globally important concentrations of a VU species, the loss of which would result in a change of Red List status from VU to EN or CR and meet the Criterion 1 Threshold (a), may be considered a critical habitat.

Comparison of 2017-2018 *Anas luzonica* numbers documented by the Wetlands International/IUCN study conducted in the northern and eastern parts of Manila Bay (625 individuals) against the estimated global population of this species (5,000–10,000 individuals) indicates that the Manila Bay population may represent somewhere on the order

[8] Jensen, A.E. 2018. Internationally Important Waterbird Sites in Manila Bay, Philippines, October 2018. Technical Report. Wetlands International and IUCN National Committee of the Netherlands.

of 6.3% to 12.5% of the global population. This can reasonably be considered to constitute a globally important concentration of the species, although it is unclear whether the hypothetical loss of the Manila Bay population of *Anas luzonica* could be expected to trigger a change in IUCN conservation status from VU to EN; re-assignment is appropriately determined only through a detailed whole-population technical assessment by IUCN-designated experts. That said, the most recent (2016) IUCN assessment indicates that the species is thought to be on a substantial downward trend:

> A steep population decline was evident by the mid-1970s, with high numbers recorded at only a few sites in the following decade. Subsequent local extinctions and near-disappearances have occurred in several significant sites, owing to exceptionally high levels of hunting and trapping, conversion of natural wetlands, mangrove destruction and the recent extensive use of pesticides on rice-fields. This species' population is suspected to be undergoing a rapid and continuing decline in line with these impacts.[9]

This rather grim assessment suggests that *Anas luzonica* may be headed for EN status before very long, at which point the significant concentration of this species in the AoA would be certain to far exceed the 0.5% needed to meet Threshold (a) of Criterion 1. Further, the species was recorded in Cavite, within the AoI, albeit in small numbers, during the 2021 avian surveys. In light of this, it is proposed that the weight of evidence favors assignment of qualifying species status to *Anas luzonica*, in accordance with Criterion 1, Threshold (b).

3.1.2 Marine Species

The marine IBAT screening output list comprised 44 aquatic species.[10] Of these, 12 were CR, and 32 were EN. In addition to the species flagged by IBAT, two EN and one CR marine species were identified as being possibly present in the BCIB project area by local informants interviewed in October 2021 as part of field surveys supporting EIA updating work. Each species identified by IBAT or the interview data was evaluated in the same manner as described above for the terrestrial species. The results of the by-species evaluation are summarized in Exhibit 5; sources consulted and range maps for all species are presented in Appendix 3.

Exhibit 5: By-Species Evaluation in Relation to Criterion 1 (Marine Species)

Species	Habitat and Range Notes[1]	Global population[2]	0.5% threshold	Probability of meeting Criterion 1 Threshold(a)
Aetomylaeus vespertilio Ornate Eagle Ray (EN)	This species is found in muddy bays, over muddy banks and coral reefs, from the surface down to 110 m depth. It was reported as a locally extant species by locals in interviews conducted in the BCIB project area in 2021. Although little is known of the species' global population, its range is thought to include several large, dispersed nodes around the Indo-Pacific and the Indian Ocean, and the very small part of the global range contained within Manila Bay can be considered extremely unlikely to harbor as much as 0.5% of the global population.	Unknown	-	Extremely low

[9] BirdLife International. 2016. *Anas luzonica. The IUCN Red List of Threatened Species* 2016: e.T22680214A92849560. https://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T22680214A92849560.en. Accessed on 26 April 2022.

[10] Three waterbird species were also included, but these have been considered as part of the terrestrial fauna.

Species	Habitat and Range Notes[1]	Global population[2]	0.5% threshold	Probability of meeting Criterion 1 Threshold(a)
Alopias pelagicus Pelagic Thresher (EN)	Although the ecology of this species is not well understood, it is thought to be mainly an oceanic species that sometimes comes close to shore and enters lagoons around atolls. On this basis, the waters of Manila Bay seem unlikely to represent a significant habitat. The global population of this species is unknown, but distribution encompasses all of the Indian Ocean, Indo-Pacific region and most of the tropical and warm temperate Pacific, which suggests that the limited waters of Manila Bay would be extremely unlikely to support even a transient population representing as much as 0.5 of global population.	Unknown	-	Extremely low
Alveopora excelsa (EN)	This submassive coral species is typically found on exposed outer reef slopes as deep as 30 m, and may be considered relatively likely in the fringing reefs near the mouth of Manila Bay, where water quality conditions are known to favor more resilient massive, submassive and encrusting species. The species is distributed widely across the Coral Triangle and north to Taiwan and Japan, so it is highly unlikely that a population on the spatially limited, low-density reefs of Manila Bay would have any chance of meeting the 0.5% threshold.	Unknown	-	Extremely low
Alveopora minuta (EN)	A submassive coral species found on rocks exposed to currents, this species may be considered reasonably likely on some of the fringing reefs near the mouth of Manila Bay, particularly around Corregidor and Caballo Islands, where currents are strongest. If present on the limited area of low-density reefs within Manila Bay, it would certainly not meet the 0.5% threshold, as the species is widely distributed across the Coral Triangle.	Unknown	-	Extremely low
Anacropora spinosa (EN)	This branching coral species can be considered unlikely in Manila Bay, as the relatively high turbidity conditions that prevail there favor massive and encrusting coral species. If present on the limited area of low-density reefs within Manila Bay, it would certainly not meet the 0.5% threshold, as the species is widely distributed across the Coral Triangle.	Unknown	-	Zero
Balaenoptera borealis *Sei Whale* *(EN)*	Preferred habitat is in deeper waters far from the coastline, and there are no documented sightings of this species within Manila Bay. Even if the species were to be present as an occasional transient, there is no chance that individuals present would come anywhere close to meeting the 0.5% threshold.	50,000	250	Zero
Balaenoptera musculus *Blue Whale* *(EN)*	Blue whales are thought to be very uncommon in the Philippines, and there are no known sightings of this species within Manila Bay. All documented sightings in the Philippines since the late 19th century have come from the Bohol Sea. Even if the species were to be present as an occasional transient, there is no chance that individuals present would come anywhere close to meeting the 0.5% threshold.	5,000–15,000 mature individuals	25–75	Zero
Carcharhinus amblyrhynchos Grey Reef Shark (EN)	This shark is common around coral reefs, particularly near drop-offs and fringing reefs, and so may be considered a possible visitor to areas around the mouth of Manila Bay, and very unlikely to be found further in. It has a very wide, if patchy, distribution across the Indian and Pacific Ocean, with major concentration in the Indo-Pacific. It is extremely unlikely that any population around the mouth of Manila Bay would constitute anywhere close to 0.5% of the global population.	Unknown	-	Zero
Carcharhinus borneensis Borneo Shark CR	This species did not appear in the IBAT screening lists, but was identified by local informants in the BCIB project area in October 2021, with reference to a visual key. A small shark that frequents shallow inshore areas, the Borneo shark is	Unknown	-	Very low

Species	Habitat and Range Notes[1]	Global population[2]	0.5% threshold	Probability of meeting Criterion 1 Threshold(a)
	frequently taken in subsistence fisheries throughout its range, and is thought to have suffered steep population declines and shrinkage of its EOO. The species' range includes coastal areas mainly around the southern part of the South China Sea, but there are also records from as far north as the Taiwan Strait. Range maps indicate the present center of distribution is likely along the northwest coast of Borneo, southeast coast of Sumatra, and the southern Malay Peninsula. The species' presence in the Philippines is listed by most sources as 'uncertain' or 'questionable'. Based on the available information, there is no basis for concluding that a population in Manila Bay would be likely to exceed 0.5% of global population.			
Carcharhinus longimanus Oceanic whitetip shark (CR)	This very widespread pelagic shark species lives offshore in deep water, on the outer continental shelf, and around oceanic islands in deep water areas. Individuals may occasionally come near shore, but the waters of Manila Bay would not be expected to be preferred habitat for this species. There are no documented sightings of the species in Manila Bay.	Unknown	-	Zero
Carcharhinus plumbeus Sandbar Shark (EN)	This species did not appear in the IBAT screening lists but was identified by local informants in the BCIB project area in October 2021, with reference to a visual key. The species is typically found in shallow waters of bays, estuaries and harbors, and also on offshore oceanic banks to a depth of 280 m. The sandbar shark has a very wide distribution spanning the continental shelves and coastal areas of all tropical and warm temperate oceans. Accordingly, it is exceedingly unlikely that the Manila Bay population of the species could approach 0.5% of the global population.	Unknown	-	Extremely low
Cephaloscyllium fasciatum Reticulated Swellshark (CR)	The Reticulated Swellshark is a deep-water demersal species that lives on continental and insular shelf margins at depths between 200 and 400 m. Range maps indicate likely presence along the shelf edge off the west coast of Luzon, but this is well outside the relatively shallow waters of Manila Bay. This species would not be expected in the AoA.	Unknown	-	Zero
Chelonia mydas Green Turtle (EN)	This species has been reported to nest on beaches within Manila Bay, but available nesting data suggest that the Green Turtle is unlikely to be present in numbers sufficient to meet the 0.5% threshold; although annual nests on beaches within the bay may number in the hundreds on average, virtually all of these are reported to be the more common Olive Ridley Turtle.	85,000–95,000 nesting females	425–475 nesting females	Extremely low
Clupea manulensis - (CR)	*Clupea manulensis* is a small sardine species known only from the Manila Bay area but has not been recorded since its collection and classification in 1822. The species is considered possibly extinct. Very little is known of the biology of *Clupea manulensis*, but it is thought to be a wetland and riverine species, and the one available range map does not indicate presence in Manila Bay itself. The species did not turn up amongst sardine species documented in any of the several trawl surveys conducted in the bay over recent decades, which would tend not to support the probability of a significant marine stage in the life cycle. Based on the range map (which seems speculative at best), any population of this species that may be present in the limited inland aquatic habitat included in the AoA would seem unlikely to meet the 0.5% threshold, if indeed the species still exists.	Unknown	-	Low

Species	Habitat and Range Notes[1]	Global population[2]	0.5% threshold	Probability of meeting Criterion 1 Threshold(a)
Eretmochelys imbricata Hawksbill Turtle (CR)	This species is reported by research literature and locals to nest on beaches within Manila Bay, but this is apparently a relatively rare occurrence, compared to the nesting activity of the Olive Ridley Turtle (which accounts for all nests recorded by a municipal hatchery program in Mariveles, and virtually all nests recorded by a similar effort in Naic). The preferred diet of hawksbills is sponges that grow on coral reefs, which suggests that Manila Bay (with quite limited coral reef area) is not likely to support significant numbers of resident hawksbills. The available evidence does not strongly suggest that the number of hawksbills frequenting Manila Bay in any given year would meet the 0.5% threshold.	20,000–23,000 nesting females	100–115 nesting females	Low
Eusphyra blochii Winghead Shark (EN)	Although there are no records of this species being present in Manila Bay, the bay's waters would be expected to constitute preferred habitat for this species, which favors shallow nearshore and estuarine areas over sandy and muddy bottoms. The species is widely distributed in coastal areas throughout the Indo-Pacific and north Australia, and as far west as the Red Sea, which makes it very unlikely that a population within Manila Bay could constitute 0.5% of the global population.	Unknown	-	Very low
Gymnura zonura Zonetail Butterfly Ray (EN)	This ray's preferred habitat is inshore waters over soft substrates, up to 40 m in depth; Manila Bay can be considered to offer ample habitat. Global population size is unknown, but the species is widely distributed across the Indo-Pacific and all around the margins of the Indian Ocean, so it is extremely unlikely that even a robust population within Manila Bay would constitute 0.5% of the global population.	Unknown	-	Extremely low
Hemitriakis leucoperiptera Whitefin Topeshark (CR)	Very little is known about this shark, but it is thought to prefer shallow coastal habitat with sandy and muddy bottom, coral reefs and seagrass. The species is endemic to the Philippines. Range maps indicate Manila Bay is within its expected range and may account for perhaps 1-2% of overall EOO. This shark is thought to have suffered steep population declines in heavily fished areas (where it is taken primarily as bycatch). Based on the long-term intense fishing pressure in Manila Bay, the local population is likely to be well below the average density found across its full range, which suggests that a local population of 1–2% of global population, which might be inferred from the range mapping, is very likely to be a significant overestimate. This species is therefore considered likely to be present, but not in numbers sufficient to meet the 0.5% threshold. The species was not reported as a locally known species in interviews with locals (using an identification key) in the BCIB project area in 2021.	Unknown	-	Low
Himantura uarnak Reticulate Whipray (EN)	This species, which is also known as the Coach Whipray and Honeycomb Stingray, did not appear in the IBAT screening lists, but was identified by local informants in the BCIB project area in October 2021, with reference to a visual key. It is typically found in inshore areas, preferring shallow waters including estuaries, intertidal lagoons, reef flats and reef faces, and sometimes into accessible freshwater bodies. This species has a wide distribution in coastal areas throughout the Indo-Pacific and all around the fringes of the Indian Ocean, including the Red Sea. It is extremely unlikely that a population within Manila Bay could approach 0.5% of the global population.	Unknown	-	Extremely low

Species	Habitat and Range Notes[1]	Global population[2]	0.5% threshold	Probability of meeting Criterion 1 Threshold(a)
Holothuria lessoni Golden Sandfish (EN)	This sea cucumber species is found in sandy and muddy flats in water depths typically less than 10 m, primarily within lagoons and in association with seagrass. The species can be considered a possible resident of selected areas within Manila Bay. The global range of this species extends to shallow areas around the Indian Ocean, throughout the Indo-Pacific, and across much of Polynesia, so a population in Manila Bay would have extremely low probability of meeting the 0.5% threshold.	Unknown	-	Extremely low
Holothuria scabra Golden Sandfish (EN)	This sea cucumber species prefers sandy-silty bottoms in low-energy shallow-water locations such as coral lagoons and near mangroves. It is strongly associated with seagrass beds, which are favored nurseries for juveniles. This species can be considered likely within some shallow areas of Manila Bay, but not in numbers sufficient to account for as much as 0.5% of the global population, as the global EOO is very large, spreading across all of the Indo-Pacific, much of Polynesia, and all around the margins of the Indian Ocean.	Unknown	-	Extremely low
Holothuria whitmaei Black Teatfish (EN)	This sea cucumber is found on slopes and passes within coral reef environments, in waters up to 30 m in depth. Manila Bay is on the far western extremity of the species' range, which extends across all of the eastern portion of the Indo-Pacific, across Northern Australia and over much of Polynesia. Based on its large global EOO, it is highly unlikely that a population present on the few reef areas within Manila Bay would constitute anywhere near 0.5% of the global population.	Unknown	-	Extremely low
Isurus oxyrinchus Shortfin Mako (EN)	A pelagic shark with very wide distribution through tropical and warm temperate oceans. Preferred habitat for this species is open ocean, and it is very unlikely that any individuals would be found within Manila Bay. Given the very large EOO, it is extremely unlikely that any population in the deeper waters outside the mouth (but inside the AoA) would approach 0.5% of the global population.	Unknown	-	Extremely low
Isurus paucas Longfin Mako (EN)	A pelagic shark with very wide distribution through tropical and warm temperate oceans. Preferred habitat for this species is open ocean, although it is thought that females may travel closer in towards shore to give birth. Given the shark's habitat preference and very large range, it is highly unlikely that the limited and shallow waters of Manila Bay would support, even temporarily, numbers sufficient to meet the 0.5% threshold.	Unknown	-	Extremely low
Lobophyllia serratus (EN)	This coral species is generally considered rare, although distributed widely across the Coral Triangle. It is a massive species found on reef slopes between 4 and 15 m depth, which may increase the probability of presence on the fringing reefs found around the mouth of Manila Bay, where generally turbid conditions tend to favor massive and encrusting corals. Given the small area of reefs within Manila Bay and a large EOO, it is extremely unlikely that local specimens of this species would approach 0.5% of the global population.	Unknown	-	Extremely low
Maculabatis macrura Sharpnose Whipray (EN)	Preferred habitat for this inshore species is soft bottom in depths less than 60 m, and range maps indicate likely presence in Manila Bay. The species' range covers most of Southeast Asia, and it is highly unlikely that Manila Bay could harbor more than 0.5% of the global population, given its limited area.	Unknown	-	Very low

Species	Habitat and Range Notes[1]	Global population[2]	0.5% threshold	Probability of meeting Criterion 1 Threshold(a)
Mobula birostris Giant Manta Ray (EN)	Giant manta rays are known to favor waters around seamounts and continental shelf edges with prominent upwelling, but also spend time in shallow inshore waters, including estuaries, so Manila Bay cannot be ruled out as habitat for this species (although none have been reported in the scientific literature, or by interviews conducted in 2021 fisherfolk and others in the BCIB project area). The species has a very wide distribution throughout coastal and seamount-proximate zones of tropical and temperate oceans, so any population in Manila Bay would be extremely unlikely to meet the 0.5% threshold.	Unknown	-	Extremely low
Mobula kuhlii Shortfin Devilray (EN)	This species is widespread in coastal and near-coastal areas around the Indian Ocean and Southeast Asia, and around the Solomon Islands; it is suspected that current documentation may under-estimate the global EOO. Preferred habitat is inshore areas to 50 m, including around coral reefs. This species can be considered a possible resident of Manila Bay, although its wide global distribution suggests that a local population in the bay would be extremely unlikely to approach 0.5% of global population.	Unknown	-	Extremely low
Mobula mobular Spinetail Devilray (EN)	Also known as the Giant Devilray, this species was reported in interviews with locals in the BCIB project area in 2021. It is a pelagic species that spends most of its time in coastal waters less than 50 m deep and migrates seasonally according to prey abundance. The species has a patchy but very wide distribution across all tropical and warm temperate oceans, and it is extremely unlikely that the size of the population using Manila Bay (a tiny portion of the total EOO) in any given year would approach 0.5% of the global population.	Unknown	-	Extremely low
Mobula tarapacana Sicklefin Devilray (EN)	Primarily an oceanic species, which is occasionally seen in shallow waters, especially in areas with prominent upwelling, such as around seamounts. The species was reported by locals in interviews conducted in the BCIB project area in 2021. Given a circumglobal distribution, the modest amount of habitat available in Manila Bay would be extremely unlikely to harbor as much as 0.5% of the global population.	Unknown	-	Extremely low
Mobula thurstoni Bentfin Devilray (EN)	Thought likely to be globally distributed in tropical and warm temperate seas, this species has a planktivorous diet and frequents areas with robust upwelling such as seamounts, continental shelf edges and insular coasts. The West Philippine Sea (South China Sea) is within its confirmed range. The Bentfin Devil Ray can be considered possibly present in Manila Bay, but given its global distribution, this relatively small area of marginal habitat is extremely unlikely to support a population approaching 0.5% of the global population.	Unknown	-	Extremely low
Montipora setosa (EN)	This digitate coral species is found on reef slopes as deep as 20 m, and can be considered unlikely in Manila Bay, as the relatively high turbidity conditions that prevail there favor massive and encrusting coral species. If present on the limited area of low-density reefs within Manila Bay, it would certainly not meet the 0.5% threshold, as the species is widely distributed across the Coral Triangle.	Unknown	-	Extremely low

Species	Habitat and Range Notes[1]	Global population[2]	0.5% threshold	Probability of meeting Criterion 1 Threshold(a)
Pectinia maxima (EN)	This laminar coral species is known to favor somewhat turbid conditions. It occurs in shallow, sheltered locations protected from wave action, and thus may have limited habitat around the relatively exposed reef areas near the mouth of Manila Bay. The species is distributed across the Coral Triangle and the Solomon Islands; any small population that might exist in Manila Bay would be extremely unlikely to approach 0.5% of the global population.	Unknown	-	Extremely low
Porites eridani (EN)	This laminar and sometimes partially digitate coral species can be considered relatively unlikely in Manila Bay, as the relatively high turbidity conditions that prevail there favor massive and encrusting coral species. If present on the limited area of low-density reefs within Manila Bay, it would certainly not meet the 0.5% threshold, as the species is widely distributed across the entire Coral Triangle.	Unknown	-	Extremely low
Porites ornata (EN)	This branching coral species can be considered unlikely in Manila Bay, as the relatively high turbidity conditions that prevail there favor massive and encrusting coral species. If present on the limited area of low-density reefs within Manila Bay, it would certainly not meet the 0.5% threshold, as the species is widely distributed across the Coral Triangle.	Unknown	-	Extremely low
Pristis pristis Largetooth Sawfish (CR)	Range maps indicate that the presence of this shallow-water estuary-favoring species is uncertain throughout the Philippines, due to long-term overfishing. Based on this, it can be considered very unlikely that Manila Bay would sustain a substantial population, despite offering suitable habitat. With more viable populations in other parts of the world, it is extremely unlikely that a tiny remnant population in Manila would approach the 0.5% threshold.	Unknown	-	Extremely low
Pristis zijsron Green Sawfish (CR)	Range maps for the Green Sawfish indicate that most of the Philippine archipelago, including western Luzon, is a 'presence uncertain' zone. However, interviews with local informants in the BCIB project area in 2021 revealed that the species is locally known. Estuaries are preferred habitat for the species. Given that the Green Sawfish has known distribution across large areas along the North Australian coast and southern New Guinea, as well as all around Borneo, Java, Sumatra and the Malay Peninsula, the likely small population in Manila Bay can be considered very unlikely to constitute as much as 0.5% of the global population.	Unknown	-	Very low
Rhina ancylostoma Bowmouth Guitarfish (CR)	Manila Bay offers favorable habitat for this species, which lives in shallow waters from very near shore to 70 m depth, and feeds on sandy and muddy substrates and around rocky and coral reefs. The species is widely distributed in shallow areas across the Indo-Pacific, from Korea to Australia, and around the northern and western Indian Ocean all the way to Madagascar. Thus, even a thriving population in Manila Bay would be very unlikely to constitute as much as 0.5% of the global population.	Unknown	-	Extremely low
Rhincodon typus Whale Shark (EN)	The Whale Shark is known to frequent both open oceanic and coastal waters, and aggregate on an opportunistic basis in areas of high planktonic production. Whale Sharks have been documented within Manila Bay. Given the estimated global population size, it can be considered inconceivable that individuals using Manila Bay habitat in any given year would do so in numbers sufficient to meet the 0.5% threshold.	119,000–238,000	595–1,190	Zero

Species	Habitat and Range Notes[1]	Global population[2]	0.5% threshold	Probability of meeting Criterion 1 Threshold(a)
Rhinoptera javanica Javanese Cownose Ray (EN)	Preferred habitats for this species include open seas, shallow seas, subtidal aquatic beds, coral reefs, estuarine waters, and coastal saline lagoons, in depths from 0–50 m. Manila Bay offers such conditions, and the species is likely to be present; however, the species has a wide distribution in shallow coastal waters throughout the Indo-Pacific, from Japan to the Red Sea and as far south as Indonesia and possibly northern Australia, and any population in Manila Bay would be extremely unlikely to approach 0.5% of the global population.	Unknown	-	Extremely low
Rhynchobatus australiae Bottlenose wedgefish (CR)	Preferred habitat for this species is soft substrate in shallow coastal waters to 60 m depth, and it is also sometimes found over coral reefs. Manila Bay can be considered to offer such habitat in abundance. Distribution for this species is widespread across shallow coastal waters throughout the Indo-Pacific and Indian Ocean, so a population in Manila Bay, while probable, is highly unlikely to approach 0.5% of the global population.	Unknown	-	Extremely low
Rhynchobatus springeri Broadnose wedgefish (CR)	Range maps for this species indicate patchy distribution in the Philippines but show Manila Bay as one of the more substantial areas of probable extent in the country. The species is considered a probable estuarine habitat specialist. Much larger portions of the species' EOO are to be found in northern Borneo, western Sumatra, the Malay Peninsula and Gulf of Thailand, suggesting that a population in Manila Bay would be quite unlikely to approach the 0.5% threshold	Unknown	-	Very low
Sphyrna lewini Scalloped Hammerhead (CR)	This coastal and semi-oceanic pelagic shark frequents continental and insular shelves and nearby deep water. In inshore locations, it is found over sandy, sand-mud and muddy bottoms. Based on habitat requirements, the species is likely in and around Manila Bay. However, the species is very widely distributed in nearshore areas around the world, in all tropical and warm temperate seas, so it is extremely unlikely that a population the limited area of Manila Bay would approach 0.5% of the global population.	Unknown	-	Extremely low
Sphyrna mokarran Great Hammerhead (CR)	A coastal and semi-oceanic shark species that is found both close inshore and well offshore and is reported to enter enclosed bays and estuaries, the Great Hammerhead would be considered likely to use habitat within and around Manila Bay. However, as the species has a circumglobal distribution in almost all tropical and warm temperate seas, it is extremely unlikely that any population using Manila Bay would constitute as much as 0.5% of the global population.	Unknown	-	Extremely low
Stegostoma tigrinum Zebra Shark (EN)	This inshore shark species is typically found on sand, rubble or coral bottoms on continental shelves and around islands, and sometimes also ventures into freshwater systems. The species has a wide distribution in nearshore areas all around the Indian Ocean, throughout Southeast Asia and as far east as Tonga. Manila Bay can be considered likely habitat for this species but is very unlikely to harbor more than 0.5% of the global population, given the species' large global range.	Unknown	-	Extremely low

Species	Habitat and Range Notes[1]	Global population[2]	0.5% threshold	Probability of meeting Criterion 1 Threshold(a)
Thelenota ananas Prickly Redfish (EN)	This sea cucumber is known to favor shallow coral reef areas, particularly patchy reef slopes with rubble and coral patches interspersed with sandy passes; the reefs around the mouth of Manila Bay fit this description and are likely to be good habitat. As the species is widely distributed on reefs across Polynesia and the Indo-Pacific, and around the Indian Ocean and Red Sea, a population existing on the few reefs in Manila Bay would be extremely unlikely to meet the 0.5% threshold.	Unknown	-	Extremely low
[1] Information for habitat and range notes is sourced primarily from species profiles on redlist.org, supplemented as needed from other online sources. [2] Global population estimates are sourced primarily from redlist.org, and other online sources where necessary.				

The by-species evaluations presented in Exhibit 5 indicate that none of the EN and CR species identified in the marine IBAT screening can be considered likely to meet Threshold (a) under Criterion 1. This conclusion has been made using the AoA and will be reassessed and updated as appropriate when sufficient data to enable application of EAAAs are available for all relevant terrestrial and marine species. Assessment of VU and National and Regional Red List species data will also be integrated at that time, and adjustments made to the same conclusion if needed.

3.2 Criterion 2: Restricted Range and Endemic Species

3.2.1 Terrestrial Species

The IBAT data identified 22 terrestrial species considered to have a spatially limited EOO, a characteristic which may indicate special vulnerability to certain threats, most particularly habitat loss. Such species are evaluated in the context of critical habitat assessment regardless of their present IUCN-assigned conservation status. Findings from evaluation of the restricted range species list are summarized in Exhibit 6. Range maps and sources consulted for each species are presented in Appendix 3.

Exhibit 6: By-Species Evaluation in Relation to Criterion 2 (Terrestrial Species)

Species	Habitat and Range Notes[1]	Global population[2]	10% threshold	Probability of meeting Criterion 2 threshold
Abditomys latidens Luzon Broad-Toothed Rat (DD)	Very little is known of this species, which is only known from two specimens collected in a lowland rice field in Laguna Province and on Mt. Data in the Central Cordillera Range, respectively. There is no basis for concluding that any populations of this species that might be found in the AoA could constitute anywhere near 10% of the global population. This species was not recorded during faunal surveys of the BCIB project area in 2020 and 2021/2022.	Unknown	-	Extremely low

Species	Habitat and Range Notes[1]	Global population[2]	10% threshold	Probability of meeting Criterion 2 threshold
Apomys sacobianus Long-Nosed Luzon Forest Mouse (LC)	Also known as the Pinatubo Volcano Mouse, this small forest-dwelling rodent species is only known from forest above 365 masl in the area around Mt. Pinatubo. The nearest portion of the species' mapped range is about 30 km from the AoA. This species can be considered extremely unlikely to be present within the AoA. This species was not recorded during faunal surveys of the BCIB project area in 2020 and 2021/2022.	<10,000	1,000	Zero
Apomys zambalensis Zambales Forest Mouse (LC)	This species is known mainly from the Zambales Mountains, including Mt. Natib and Mt. Pinatubo, within the range of 365–1,690 masl. It is also considered to be possibly present on Mt. Mariveles. The small portion of the AoA around the southern base of Mt. Mariveles (which lies below the lower end of the known altitudinal range) would be extremely unlikely to support more than a tiny percentage of the global population. This species was not recorded during faunal surveys of the BCIB project area in 2020 and 2021/2022.	Unknown	-	Zero
Dasylophus superciliosus Red-Crested Malkoha (LC)	This species is found mainly in the Sierra Madre Range along the east side of Luzon, although range mapping indicates presence as a resident on Mt. Mariveles. The species was not found during field surveys in the BCIB project area in 2020 and 2021/2022. The EOO for this species is estimated at 144,000 km^2, which suggests that the terrestrial portion of the AoA in Bataan (about 75 km^2) would not be expected to support more than a tiny fraction of the global population.	Unknown	-	Extremely low
Erythropitta kochi Whiskered Pitta (NT)	Range maps for this upland forest species indicate likely presence around Mt. Mariveles in Bataan, and around Mts. Palay-Palay Mataas na Gulod and the Taal volcano in Cavite. The lower end of the bird's reported altitudinal range is 360 masl, which suggests that it is unlikely to be present within the AoA, whose highest point (in Bataan) would be about 300 masl. A lack of forest habitat within the AoA would also tend to rule out this species' presence.	10,000–19,999	1,000–2,000	Extremely low
Ficedula disposita Furtive Flycatcher (NT)	This species, which prefers dense lowland secondary forest, is known to occur across the entire Bataan peninsula, and on Corregidor Island. It was recorded during faunal surveys of the BCIB project area in 2020 and 2021/2022. However, the terrestrial portion of the AoA (less than 80 km^2) contains a tiny portion of the known EOO (60,000 km^2), which also covers other zones of north and central Luzon. Accordingly, it is very unlikely that the AoA would support as much as 10% of the global population.	<10,000	1,000	Extremely low
Fregata minor Great Frigatebird (LC)	This species has an enormous EOO, estimated at 126,000,000 km^2, and is not a restricted range species. Nesting colonies are found on small, isolated oceanic islands lacking predators, and dispersal outside of breeding season is very wide but generally focused on high-productivity ocean areas with upwelling, divergences and convergences. It is possible that individuals of the species may make their way to the outer reaches of Manila Bay to feed, but certainly not in numbers approaching the 12,000 individuals needed to meet the 10% threshold. This species was not recorded during faunal surveys of the BCIB project area in 2020 and 2021/2022.	120,000 mature individuals	12,000 mature individuals	Zero

Species	Habitat and Range Notes[1]	Global population[2]	10% threshold	Probability of meeting Criterion 2 threshold
Lepidogrammus cumingi Scale-Feathered Malkoha (LC)	Most of this species' mapped range is in the Sierra Madre Range along the eastern side of Luzon, but it is reported from Mt. Mariveles. The species was not found during field surveys in the BCIB project area in 2020 and 2021/2022. The EOO for this species is estimated at 168,000 km^2, which suggests that the terrestrial portion of the AoA in Bataan (about 75 km^2) would not be expected to support anywhere near 10% of the global population.	Unknown	-	Extremely low
Oriolus albiloris White-Lored Oriole (LC)	Occurrence of this species is restricted to parts of northern Luzon, including Mt. Mariveles. The species prefers forest but is known to use highly disturbed areas as marginal habitat. It was not observed in field surveys in the BCIB project area in 2020 and 2021/2022. The estimated EOO for this species is 85,100 km^2, which suggests that any individuals that may be found within the Bataan terrestrial portion of the AoA (75 km^2) would be extremely unlikely to comprise anywhere near 10% of the global population.	Unknown	-	Extremely low
Oriolus isabellae Isabela Oriole (CR)	This forest-dependent species is present in only a few localities in the northern Sierra Madre Mountains. It was formerly reported from southern Bataan but is now considered likely to be extinct in this area, as it has not been seen there since 1947. The AoA contains very little preferred habitat (primary and secondary bamboo forest) for this species, and the very limited forest area within the Bataan portion (an estimated maximum area of 10 km^2 on the lower slopes of Mt. Mariveles) would constitute about 0.1% of the EOO for the species (8,900 km^2). Even if still present in this part of Bataan, local population numbers would be extremely unlikely to meet the 10% threshold. The Isabella Oriole was not recorded during faunal surveys of the BCIB project area in 2020 and 2021/2022.	250	25	Extremely low
Phoenicurus bicolor Luzon Water-Redstart (NT)	This bird's main range is in mountainous areas of northern Luzon (Sierra Madre Range and Central Cordillera). It is considered possibly extant in the Zambales Mountains, about 100 km north of the AoA. Given this, it can be considered highly improbable that the AoA could contain anywhere near 10% of the global population.	<10,000	1,000	Zero
Phylloscopus ijimae Ijama's Leaf-Warbler (VU)	The AoA is within the known range of this species, which is found all over Luzon, Taiwan and a number of islands in Japan. Based on the size of the terrestrial portions of the AoA with suitable habitat (forest and scrubland) as compared to the extensive global EOO (133,000 km^2), it can be considered very unlikely that anywhere near 10% of the global population would be found in the AoA. This species was not recorded during faunal surveys of the BCIB project area in 2020 and 2021/2022.	3,750–14,999	375–1,500	Extremely low
Platymantis luzonensis (NT)	Range maps for this frog species indicate that the AoA is some distance from known areas of occurrence, the nearest of which is 40 km away, south of Laguna de Bay. It is very unlikely that this species would be present at all in the AoA. It was not recorded during faunal surveys of the BCIB project area in 2020 and 2021/2022.	<10,000	1,000	Zero

Species	Habitat and Range Notes[1]	Global population[2]	10% threshold	Probability of meeting Criterion 2 threshold
Platymantis mimulus Diminutive Forest Frog (LC)	This frog species has a scattered distribution across parts of Luzon and is also reported from Marinduque. One node of the mapped EOO extends into the far southwest portion of the AoA, in the hills along the border of Cavite and Batangas. The species is thought to have a narrow altitudinal range in the vicinity of 400 masl, which would tend to rule out all of the AoA. The estimated EOO for this species is 38,800 km^2, while the terrestrial portion of the AoA is just 163 km^2, which suggests that any populations within the AoA would be extremely unlikely to approach 10% of the global population. This species was not recorded during faunal surveys of the BCIB project area in 2020 and 2021/2022.	Unknown	-	Extremely low
Platymantis montanus (VU)	This frog species is confirmed present only in three mountainous areas of central and southern Luzon, putting the Manila Bay area outside the EOO. The lower end of the altitudinal range of the species is 800 masl, more than 500 m higher than the highest point in the AoA. The species has a very low probability of being present. It was not recorded during faunal surveys of the BCIB project area in 2020 and 2021/2022.	<10,000	1,000	Zero
Rhabdornis grandis Grand Rhabdornis (LC)	A forest species, this bird is thought to be 'possibly extant' on Mt. Mariveles but can be considered unlikely in the disturbed habitat that predominates in the nearby AoA. Estimated EOO for this species is 41,600 km^2, which suggests extremely low probability that any individuals present in the Bataan portion of the AoA would constitute more than a tiny percentage of global population. This species was not recorded during faunal surveys of the BCIB project area in 2020 and 2021/2022.	Unknown	-	Zero
Robsonius sorsogonensis Bicol Ground-Warbler (NT)	Range maps indicate this species is confined to the central and southern Sierra Madre Range and the southern Bicol Peninsula and would therefore be very unlikely to be present in the AoA. In view of this, it can be considered highly improbable that the AoA could contain anywhere near 10% of the global population. The species can be found around limestone outcroppings and moss-covered boulders in broadleaf evergreen forest, habitat characteristics not represented within the AoA. This species was not recorded during faunal surveys of the BCIB project area in 2020 and 2021/2022.	<10,000	1,000	Zero
Scolopax bukidnonensis Bukidnon Woodcock (LC)	A ground bird that lives in clearings in montane forest at elevations of 700–2760 masl, this species is not known to be present anywhere near the AoA, according to available range maps. The nearest known portion of the species' range is around Mt. Natib, some 25 km to the north. This species was not recorded during faunal surveys of the BCIB project area in 2020 and 2021/2022.	Unknown	-	Zero
Sterrhoptilus nigrocapitatus Black-Crowned Babbler (LC)	Range maps for this forest species indicate likely presence around Mt. Mariveles and in the forested hills along the Cavite-Batangas border, both on the margins of the AoA. The species was not observed in surveys in the BCIB project area in 2020 and 2021/2022. The estimated EOO for this species is 174,000 km^2, which suggests extremely low probability that individuals found within the limited marginal-habitat areas of the AoA could approach 10% of global population.	Unknown	-	Extremely low

Species	Habitat and Range Notes[1]	Global population[2]	10% threshold	Probability of meeting Criterion 2 threshold
Tryphornys adustus Luzon Short-Nosed Rat DD	This generalist species is thought to prefer wet lowland habitats such as rice fields and other lowland agricultural lands but has also been recorded in secondary forest habitat up to 2,500 masl. It is only known from three areas of Luzon, the closest of which to the AoA is Mt. Makiling in Laguna Province. The species was not observed in field surveys in the BCIB project area in 2020 and 2021/2022. There is no basis for concluding that any populations of this species that might be found in the AoA could constitute anywhere near 10% of the global population.	Unknown	-	Zero
Zosterornis striatus Luzon Striped Babbler (NT)	This forest-dependent bird's main range is in the Sierra Madre Mountains, although occurrence is also indicated on Mt. Mariveles, which suggests possible overlap with the AoA. Given this, it can be considered possible that the species could be found within the AoA, but as the applicable portion of the AoA comprises at most 15 km^2 and the EOO for the species is estimated at 58,000 km^2, it is highly improbable that the AoA could contain anywhere near 10% of the global population. This species was not recorded during faunal surveys of the BCIB project area in 2020 and 2021/2022.	<10,000	1,000	Extremely low
Zosterornis whiteheadi Chestnut-Faced Babbler (LC)	This forest and scrubland species is considered 'possibly extant' across all of northern and central Luzon, but its typical altitudinal range of 800–2,600 masl makes it quite unlikely to be found within the AoA. It was not observed during field surveys in the BCIB project area in 2020 and 2021/2022. The species has an estimated EOO of 138,000 km^2, which indicates that any individuals that may use parts of the AoA's limited terrestrial areas would have no chance of constituting a significant percentage of the global population.	Unknown	-	Zero

[1] Information for habitat and range notes is sourced primarily from species profiles on redlist.org. Sources and range maps for each species are presented in Appendix 3.
[2] Global population estimates are sourced from redlist. org.

The findings presented in Exhibit 6 indicate that no terrestrial species are likely to meet the threshold necessary to be considered qualifying species for a critical habitat determination under Criterion 2. This conclusion has been made using the AoA and will be reassessed when data availability permits definition and evaluation of EAAAs for all relevant terrestrial species.

3.2.2 Marine Species

Only one of the CR and EN aquatic species identified in the marine IBAT screening can be considered a restricted range species: *Clupea manulensis*. Although it seems quite doubtful that this species still exists, any population present in the limited inland aquatic habitat contained within the AoA would be unlikely to exceed 10% of the global population. It is therefore determined that the AoA is not appropriately designated as critical habitat for any marine species in relation to Criterion 2.

3.3 Criterion 3: Migratory and Congregatory Species

3.3.1 Terrestrial Species

Of the 19 EN and CR animal species listed in the terrestrial IBAT data, two are known migrants and also congregatory: the Far Eastern Curlew (*Numenius madagascariensis*) and Great Knot (*Calidris tenuirostris*). A third species, the Golden-Capped Fruit Bat (*Acerodon jubatus*) is congregatory but not migratory. Based on review of global population and global EOO data, together with consideration of probable local occupancy, it is concluded that none of these species would have a strong probability of exceeding either of the thresholds under Criterion 3. The spatial extent of the AoA's terrestrial portions is extremely small relative to the global range of all of these species, and there is no evidence that any of them actually exist in significant numbers in the AoA. Exhibit 7 illustrates the factors contributing to the low probability that each species would be a qualifying species for a critical habitat determination under Criterion 3, Threshold (a). The Manila Bay ecosystem is not known as a concentrator site for individuals of any of these species during times of special environmental stress, so Threshold (b) is deemed not to apply.

Exhibit 7: By-Species Evaluations in Relation to Criterion 3 (Terrestrial Species)

Species	Habitat and Range Notes[1]	Global population[2]	1% threshold	Probability of meeting Criterion 3 Threshold(a)
Acerodon jubatus Golden-Capped Fruit Bat (EN)	Endemic to the Philippines and widely distributed across most of the archipelago, this forest-dependent species' preferred feeding habitats are primary forest and high-quality secondary forest. This bat shares mixed-species roosts in locations inaccessible to humans, such as steep slopes, cliff edges and mangrove islands. The AoA has almost no sites that match these descriptors well, although there may be some minor mangrove islands near the head of the bay, and some suitable secondary forest within the AoA on the lower slopes of Mt. Mariveles. Terrestrial portions of the AoA, especially when narrowed by habitat type, comprise a tiny fraction of the global EOO for this species, making it very unlikely that any population present could comprise as much as 1% of the Philippines-wide (i.e., global) population. This species was not recorded during faunal surveys of the BCIB project area in 2020 and 2021/2022.	10,000–20,000	100–200	Very low
Calidris tenuirostris Great Knot (EN)	Preferred wintering habitat for this migratory species is sheltered coastal habitats such as bays, estuaries and lagoons with large intertidal mud and sand flats, oceanic sandy beaches with nearby mudflats, sandy spits and muddy shorelines. Preferred wintering food is molluscs and crustaceans plucked from intertidal muds and sands. The global EOO is 331,000 km^2, of which the terrestrial portion of the AoA comprises less than 0.1%. Data from bird counts in areas of Manila Bay with preferred habitat from 2003–2018 indicate that no more than 500 individuals were ever documented across all count sites in any year. It can be considered very improbable that this species would meet the 1% threshold consistently. The species was not recorded during faunal surveys of the BCIB project area in 2020 and 2021/2022.	292,000–295,000	2,920–2,950	Low

Species	Habitat and Range Notes[1]	Global population[2]	1% threshold	Probability of meeting Criterion 3 Threshold(a)
Numenius madagascariensis Far Eastern Curlew (EN)	Preferred wintering habitat for this migratory species is estuaries, mangrove swamps, saltmarshes and intertidal flats, particularly those with extensive seagrass meadows; this kind of habitat is found around the northern and some eastern fringe portions of Manila Bay. Data from bird counts in areas of Manila Bay with preferred habitat from 2003–2018 indicate that no more than 68 individuals were ever documented across all count sites in any year, which suggests very low probability that the wintering population within the AoA would exceed 1% of the global population. The Far Eastern Curlew was not recorded during faunal surveys of the BCIB project area in 2020 and 2021/2022.	32,000	320	Low

[1] Information for habitat and range notes is sourced primarily from species profiles on redlist.org. Sources and range maps for each species are presented in Appendix 3.
[2] Global population estimates are sourced from redlist. org.

As noted in the critical habitat screening report by SCE, Ltd., 16 waterbird species documented in the northern part of the AoA were highlighted by a 2018 report of Wetlands International and IUCN as having local winter populations in excess of 1% of the population thought to use the East Asian-Australasian Flyway.[11] This raised the possibility that some or all of these species (none of which are CR or EN species) might also exceed the Threshold (a) value (1% of global population), and perhaps even the Threshold (b) 10% level. For the present critical habitat assessment, the 2017-2018 bird count data for these 16 species were compared to global population estimates gathered from the IUCN Red List species profiles. The results of the comparison are presented in Exhibit 8. It will be noted that global population data are typically presented as a range, so the percentage calculations also generated a ranged output.

The data presented in Exhibit 8 indicate that six migratory waterbird species exceed the Threshold (a) value of 1% of global population, and are thus considered qualifying species for a critical habitat determination for the AoA. These six species are the Red-Necked Stint (*Calidris ruficollis*), Long-Toed Stint (*Calidris subminuta*), Kentish Plover (*Charadrius alexandrinus*), Whiskered Tern (*Chlidonius hybrida*), Black-Winged Stilt (*Himantopus himantopus*) and Pacific Golden Plover (*Pluvialis fulva*).

It can also be seen from Exhibit 8 that the 2017-2018 survey populations of two of the waterbird species evaluated (*Chlidonius hybrida* and *Pluvialis fulva*) represent especially high percentages of the respective global populations; the upper end of the ranged proportions are in excess of 10%, and mid-range percentages are in the vicinity of 10% (*Chlidonius hybrida* = 10.7%; *Pluvialis fulva* = 8.9%). These numbers approach or slightly exceed the 10% threshold that pertains to Threshold (b), but there is no indication that the concentrations observed are related to a time of special environmental stress, nor is Manila Bay known to predictably serve as an important refuge for these or any other species during times of stress. Accordingly, these species are not considered to trigger a critical habitat determination in relation to Threshold (b). It is noteworthy, however, that the Manila Bay

[11] Jensen, A.E. 2018. Internationally Important Waterbird Sites in Manila Bay, Philippines, October 2018. Technical Report. Wetlands International and IUCN National Committee of the Netherlands.

ecosystem appears to be of heightened importance for these two species, one of which (*Chlidonius hybrida*) was recently documented feeding in the BCIB project area.

Exhibit 8: Populations of Selected Waterbirds in Manila Bay (2017-2018 Census) as Percentage of Global Population

Species name	Common name	IUCN status	Counted in Manila Bay 2017-2018[1]	Global Population (low)[2]	Global Population (high)[2]	% in Manila Bay 2017-2018 (low)	% in Manila Bay 2017-2018 (high)	Criterion 3 Threshold(a) (>1%)
Ardea alba	Great Egret	LC	4,664	590,000	2,200,000	0.2	0.8	NO
Calidris ruficollis	Red-Necked Stint	NT	4,741	315,000	315,000	1.5	1.5	**YES**
Calidris subminuta	Long-Toed Stint	LC	553	25,000	25,000	2.2	2.2	**YES**
Charadrius alexandrinus	Kentish Plover	LC	5,246	100,000	499,999	1.0	5.2	**YES**
Charadrius dubius	Little Ringed Plover	LC	280	280,000	530,000	0.1	0.1	NO
Charadrius leschenaultii	Greater Sand Plover	LC	769	150,000	340,000	0.2	0.5	NO
Charadrius mongolus	Lesser Sand Plover	LC	831	310,000	390,000	0.2	0.3	NO
Chlidonias hybrida	Whiskered Tern	LC	53,647	300,000	1,500,000	3.6	17.9	**YES**
Chroicocephalus ridibundus	Black-Headed Gull	LC	27,779	4,800,000	8,900,000	0.3	0.6	NO
Egretta eulophotes	Chinese Egret	VU	35	3,800	15,000	0.2	0.9	NO
Egretta intermedia	Intermediate Egret	LC	363	unknown	unknown	<1.0[3]	<1.0[3]	NO
Himantopus himantopus	Black-winged Stilt	LC	6,854	450,000	780,000	0.9	1.5	**YES**
Pluvialis fulva	Pacific Golden Plover	LC	19,164	190,000	250,000	7.7	10.1	**YES**
Tringa nebularia	Common Greenshank	LC	1,850	440,000	1,500,000	0.1	0.4	NO
Tringa totanus	Common Redshank	LC	1,629	1,300,000	3,100,000	0.1	0.1	NO

Notes
[1] As reported in Jensen, A.E. 2018. Internationally Important Waterbird Sites in Manila Bay, Philippines, October 2018. Technical Report. Wetlands International and IUCN National Committee of the Netherlands.
[2] Low and high global population estimates were collected from redlist.org (accessed 20 April 2022).
3 Global population estimates for *Egretta intermedia* are very uncertain due to recent taxonomic changes, but Wetlands International suggests the 1% level would be at least 1,000 observed individuals (see Delaney, S. and D. Scott, eds. 2006. Waterbird Population Estimates, 4th edition. Wageningen, The Netherlands: Wetlands International).

3.3.2 Marine Species

Of the 44 EN and CR aquatic species listed in the marine IBAT output report, 35 are mobile marine animals. Of these, 10 are known migrants, and five are thought to be significantly congregatory (see Exhibit 9). All of these species have been evaluated above in relation to Criterion 1, and none were found likely to be present in the AoA in numbers sufficient to exceed 0.5% of global population. Accordingly, none would meet the significantly higher threshold values under Criterion 3, i.e., 1% of global population for Threshold (a), and 10% of global population for Threshold (b). Therefore, the AoA is determined not to qualify as critical habitat in relation to migratory marine and congregatory species.

Exhibit 9 Migratory and Congregatory Marine Species From IBAT Screening (EN and CR)

Species	IUCN Status	Migratory	Congregatory
Eretmochelys imbricata Hawksbill Turtle	CR	YES	YES
Balaenoptera borealis Sei Whale	EN	YES	YES
Balaenoptera musculus Blue Whale	EN	YES	YES
Chelonia mydas Green Turtle	EN	YES	NO
Rhincodon typus Whale Shark	EN	YES	NO
Isurus oxyrinchus Shortfin Mako	EN	YES	NO
Stegostoma tigrinum Zebra shark	EN	YES	NO
Mobula tarapacana Sicklefin Devilray	EN	YES	YES
Mobula thurstoni Bentfin Devilray	EN	NO	YES
Mobula birostris Giant Manta Ray	EN	YES	NO
Mobula mobular Spinetail Devilray	EN	YES	NO

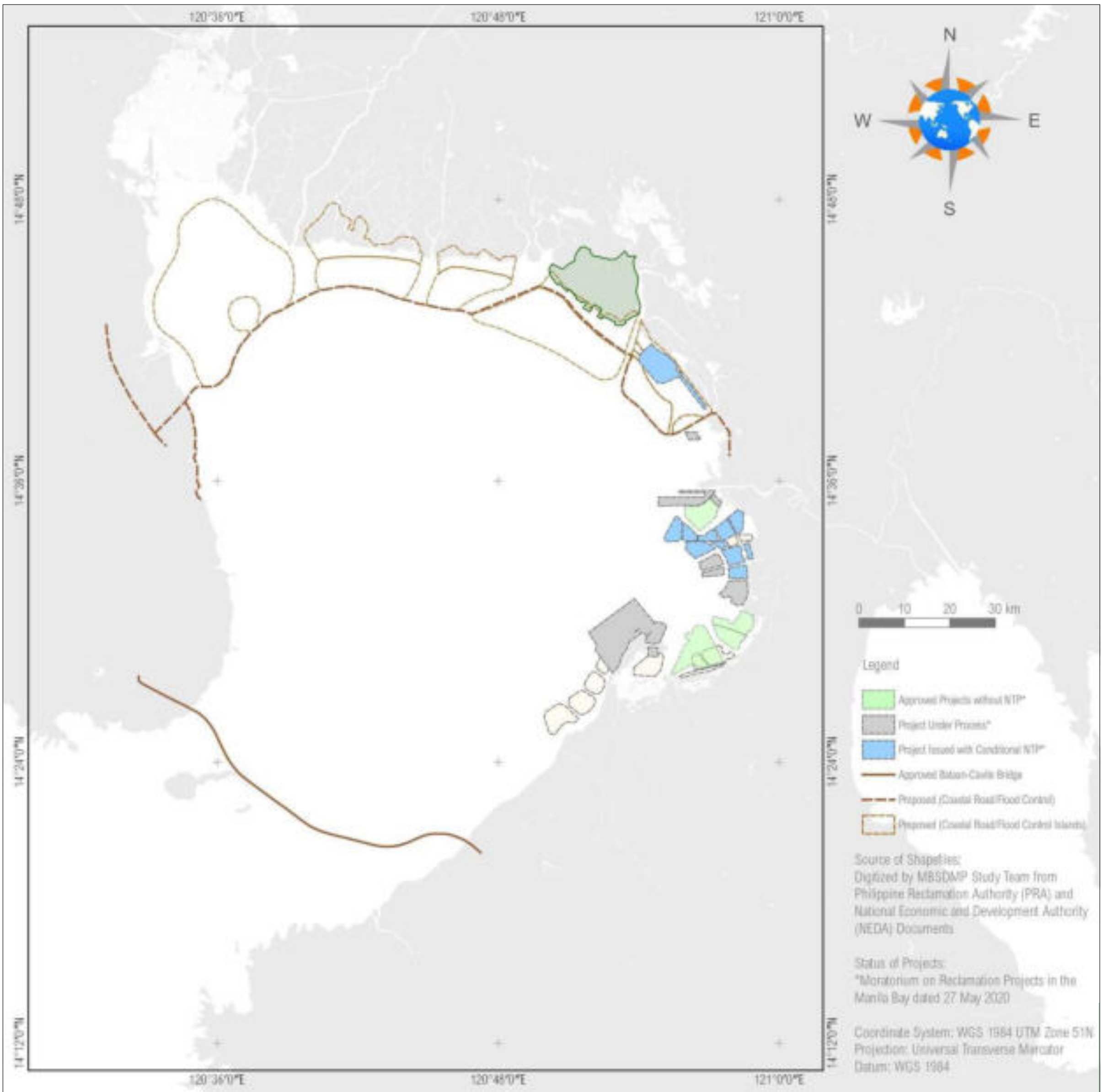
3.4 Criterion 4: Highly Threatened or Unique Ecosystems

The 2020 critical habitat screening report by SCE Ltd. suggested that Manila Bay may meet the requirements to be considered critical habitat based on Criterion 4, Threshold (b): *Other areas not yet assessed by IUCN but determined to be of high priority for conservation by regional or national systematic conservation planning*. The rationale for this suggestion points to the presence of coral reefs, which are widely acknowledged as a globally threatened ecosystem type, and the presence of a migratory bird concentration of global importance, as well as the evident interest at the local, regional and national level in reversing the decades-long decline of the Manila Bay ecosystem, as manifest in the Manila Bay Sustainable Development Master Plan process. As noted earlier, the Manila Bay ecosystem has not been evaluated under the IUCN Red List of Ecosystems framework, so Threshold (a) is not applicable.

3.4.1 Threats to the Manila Bay Ecosystem

There can be little doubt that Manila Bay is, in general, a significantly threatened ecosystem, with many active stressors and worsening conditions in relation to many indicators. The Manila Bay ecosystem is host to a megacity and a busy major port, and receives large quantities of untreated human waste, industrial effluents, urban stormwater and agricultural runoff from surrounding land areas. Rivers flowing into the bay from all directions are widely acknowledged not to meet national freshwater quality standards, and national marine water quality standards are sometimes not fully met over substantial portions of the bay, most particularly near river mouths and more heavily populated and industrialized portions of the shoreline. Hypoxic conditions develop in parts of the bay during certain times of the year. Much of the formerly vast area of mud flats, mangroves and brackish backwaters across the head of the bay has been converted to salt pans and aquaculture ponds, the latter of which are a major source of nutrients that contribute to hypoxia, harmful algal blooms and elevated turbidity. Fishing is a historical mainstay of coastal communities around the bay, but fisheries resources have been over-exploited and declining for decades. These and other problems have been documented and scrutinized in numerous academic works conducted across several scientific disciplines, as well as major comprehensive assessments such as those carried out under the auspices of the Manila Bay Environmental Management Project in the early 2000s and the more recent Manila Bay Sustainable Development Master Plan process (both are discussed below).

The factors mentioned above have contributed to declines in the health of the marine environment of Manila Bay over many decades. With regards to emerging threats to marine life, two significant concerns stand out: land reclamation and seabed mining. Metro Manila and surrounding areas continue to grow in population, density and spatial extent, and there is an ever-expanding list of development projects that would impinge upon the marine environment, including artificial islands, wharfs, jetties, shipping terminals, airports, coastal roads and flood control works. This is not a new problem, as shoreline development has long reshaped the coastal zone in the bay, especially in the vicinity of Metro Manila. However, the collective magnitude of currently proposed reclamation schemes represents something of a quantum leap in the threat level. The map in Exhibit 10 shows a partial accounting of reclamation proposals, and conveys a sense of the scope of projects that threaten to rework the coastal zone if approved and financed.



Source: NEDA. 2020. Manila Bay Sustainable Development Master Plan – Final Master Plan, Action Plan and Investment Report. Annex 3: Manila Bay Atlas.

Exhibit 10: Proposed Reclamation Works Around Manila Bay

Linked in part to the aforementioned surge in land reclamation proposals, commercial and governmental interest in seabed mining poses a direct physical threat to water quality, benthic habitat and fisheries across nearly the entirety of Manila Bay. Most of the bay's area has been staked out as seabed mining tenements under the permitting process administered by the Department of Environment and Natural Resources – Mines and Geosciences Bureau (see Exhibit 11). The areas shown are at varying stages of the exploration and development process, but each is a potential mining zone, in which wholesale removal of seafloor habitat would take place, and from which vast quantities of suspended sediment could be released. As of early 2022, dredging activity is ongoing in two of the areas subject to approved extraction permits, both around the San Nicolas Shoals off Cavite.

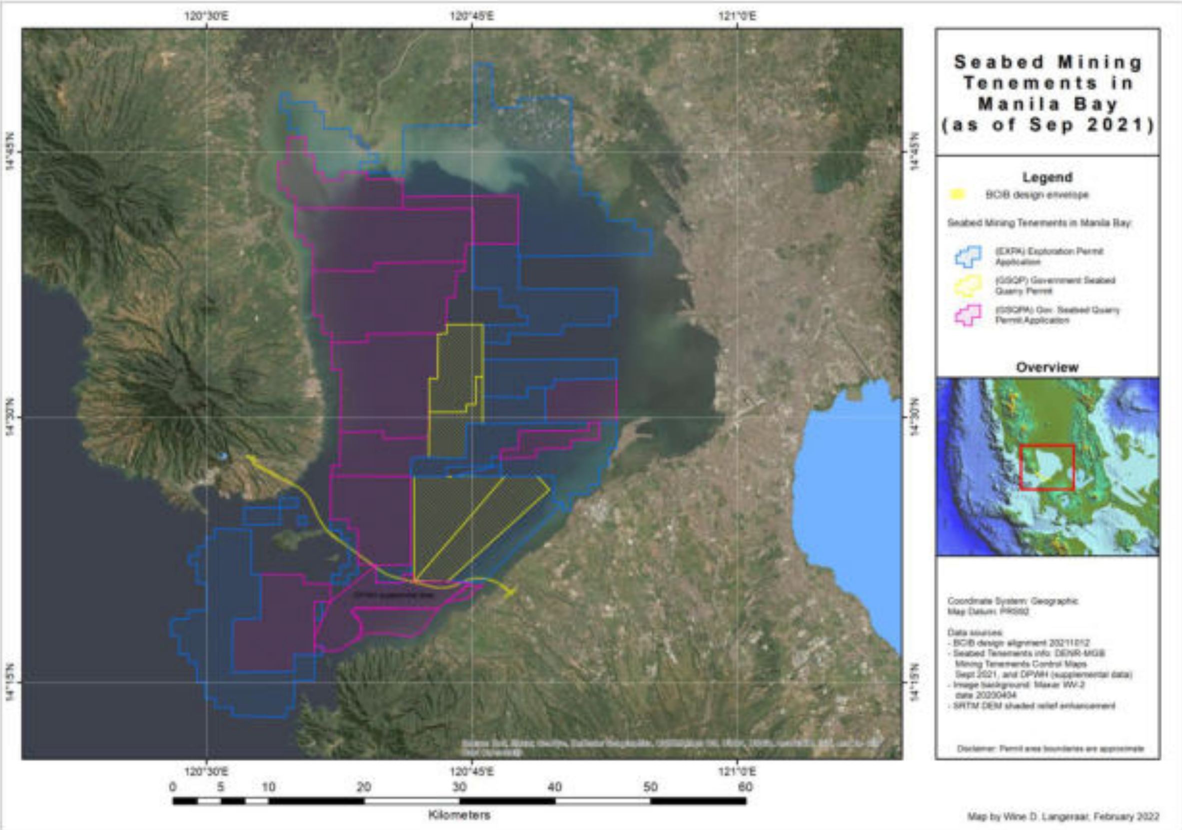


Exhibit 11: Mining Tenements in Manila Bay

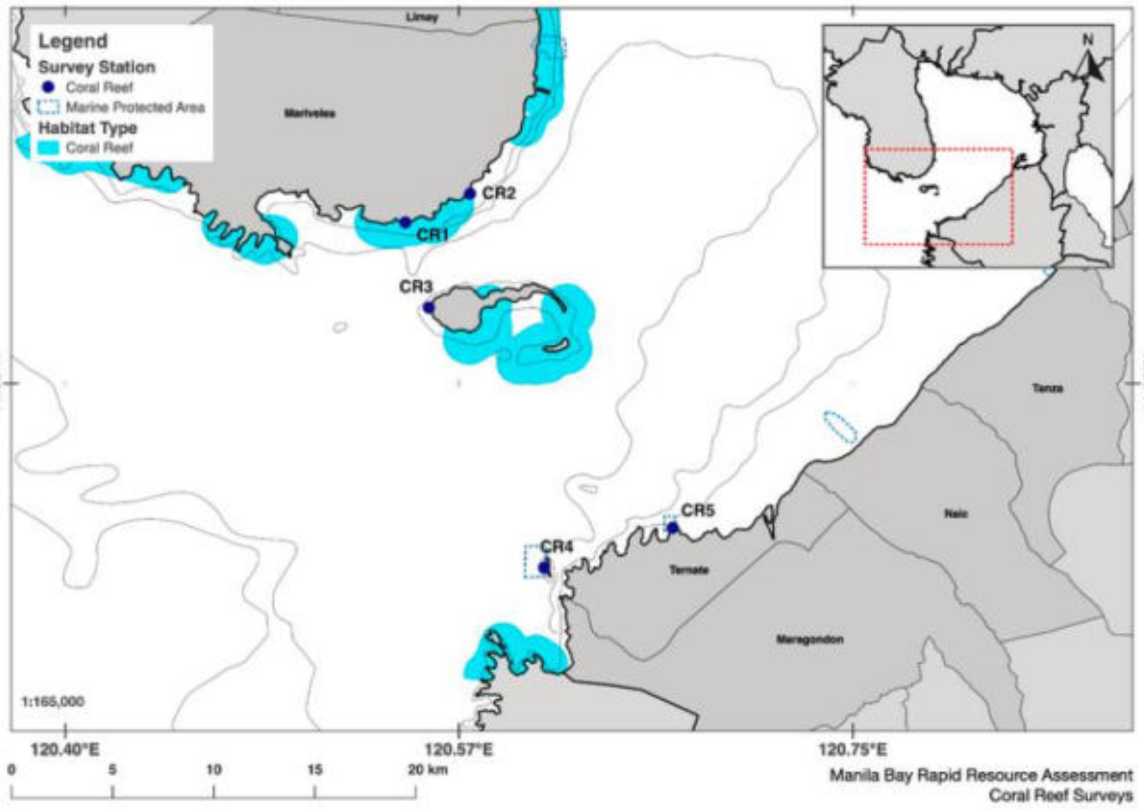
3.4.2 Threatened Ecosystem Components

With regards to specific biodiversity elements and values, Manila Bay contains locally significant remnants of ecosystem types that are under threat worldwide, including coral reefs, mudflats, mangroves and seagrass meadows. These habitats are known to play vital roles in supporting fisheries and bird life and their progressive loss and degradation are understood in the local context as a constraint on the development of sustainable fishing livelihoods, and as a threat to globally significant concentrations of migratory waterbirds that use Manila Bay as a stopover or wintering ground.

3.4.2.1 Coral reefs

Coral reefs in Manila Bay are thought to have been in decline for decades, threatened by overfishing, use of destructive fishing practices (particularly dynamite), increased sedimentation, and declines in water quality. It is probable that the reefs in Manila Bay, in common with reefs around the world, are also feeling the effects of climate change (i.e., warming and acidification), although this has not been documented. Coral reefs are not considered to have occupied large portions of Manila Bay historically, as a paucity of hard substrate for colonization, a dynamic sediment transport regime and naturally elevated turbidity pose basic biophysical constraints on reef establishment, but it is probable that the decline in this ecosystem has involved both a loss of overall reef area and a substantial reduction in the remaining reefs' biodiversity and habitat values. Corals are found mostly in fringing reefs around the rocky shores of Corregidor and Caballo Islands, southern

Mariveles, and far western Cavite and northern Batangas, all near the bay's mouth.[12] Loss and decline in coral reef habitats is understood to limit fish biomass available for harvest, as well as ecotourism potential. One representation of the distribution of coral reefs in Manila Bay is shown in Exhibit 12.



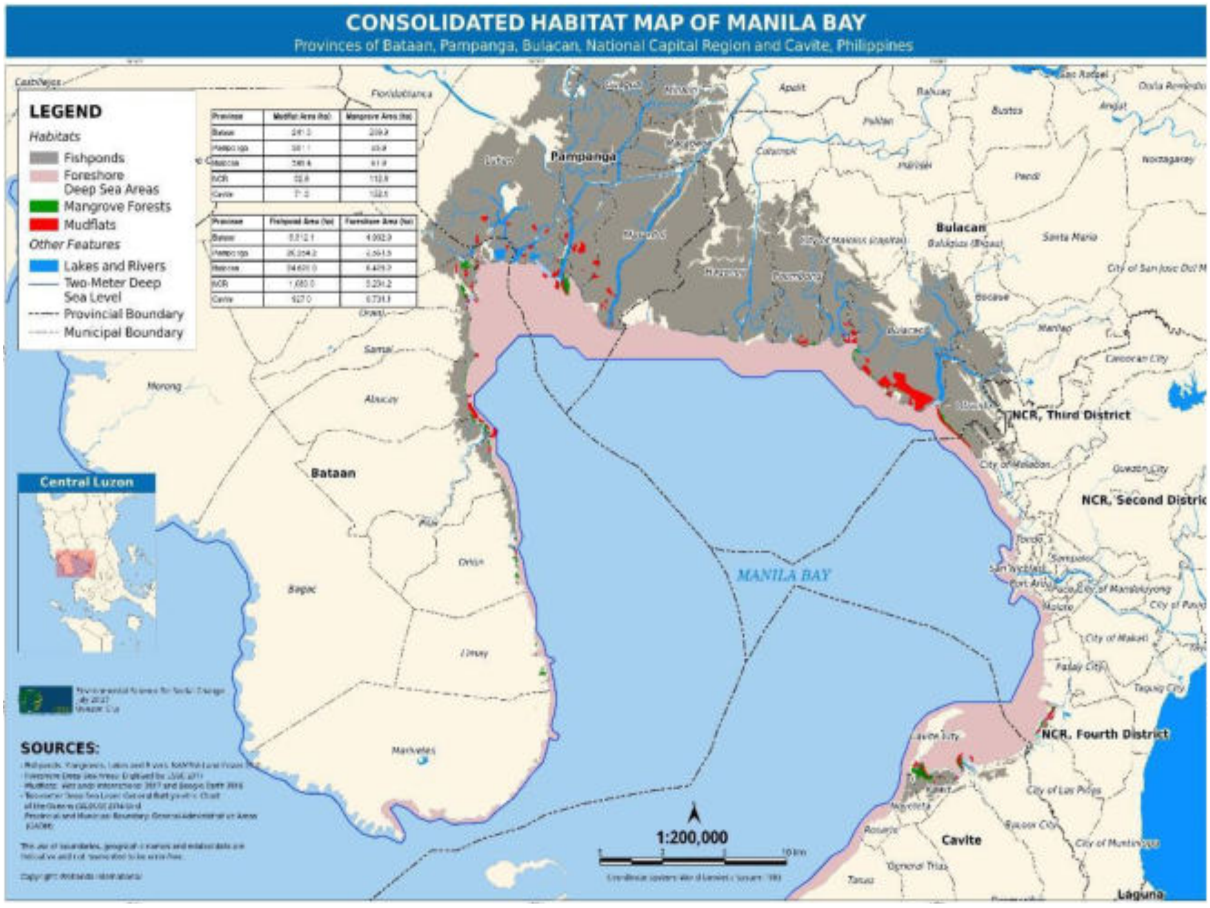
Source: NEDA. 2020. Manila Bay Sustainable Development Master Plan – Final Master Plan, Action Plan and Investment Report. Annex 9: Rapid Resource Inventory. December 2020.

Exhibit 12: Distribution of Coral Reefs in Manila Bay

3.4.2.2 Mudflats

Mudflats are thought to have occupied a much larger area historically than they do today, with major expanses in the Pampanga River floodplain and near the mouths of other rivers, particularly around the northern and eastern fringes of Manila Bay. Declines in mudflat area are tied principally to conversion for aquaculture and salt pans, with encroachment and reclamation also taking their toll. Mudflats are prime habitat for invertebrates and the birds and fish that feed on them, and the loss of the remaining mudflat areas would be a significant blow to the value of Manila Bay as a wintering and stopover site for migratory waterbirds, which it has been historically.[13] The distribution of mudflats in Manila Bay can be seen on the map in Exhibit 13.

[12] NEDA. 2018. Manila Bay Sustainable Development Master Plan – Situation Analysis. Focal Theme Report, Environmental Protection. December 2018.
[13] Ibid.

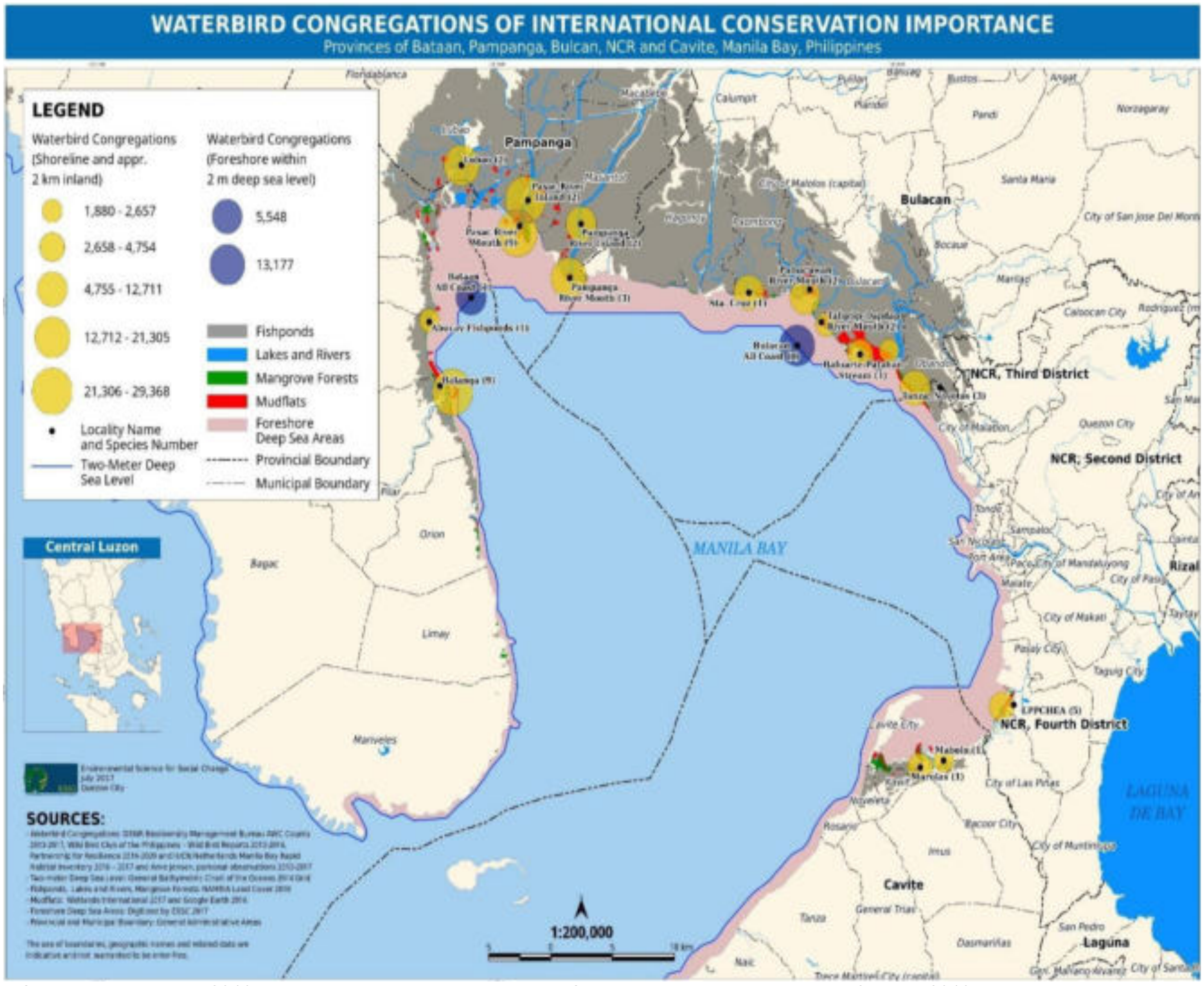


Source: Jensen, A.E. 2018. Internationally Important Waterbird Sites in Manila Bay, Philippines, October 2018. Technical Report. Wetlands International and IUCN National Committee of the Netherlands.

Exhibit 13: Distribution of Key Habitat Types, Including Mudflats

The role of mudflats and associated foreshore areas in supporting avian life is of heightened significance in Manila Bay, which is recognized as having both national and global importance for waterbirds. Manila Bay hosts the most significant concentration of waterbirds in the Philippines, and accounts for very high proportions of the country's overall populations of several species. The bay is also a major node in the eastern branch of the East Asian-Australasian Flyway, providing habitat to numerous migratory waterbird species, including transient populations that may approach 10% of global population for a handful of species (see Section 3.3.1 above). Mudflats are considered the most important habitat type for the waterbirds extant in Manila Bay.[14] The map in Exhibit 14 illustrates the strong spatial affinity between mudflat distribution and waterbird concentrations in Manila Bay.

[14] Jensen, A.E. 2018. Internationally Important Waterbird Sites in Manila Bay, Philippines, October 2018. Technical Report. Wetlands International and IUCN National Committee of the Netherlands.



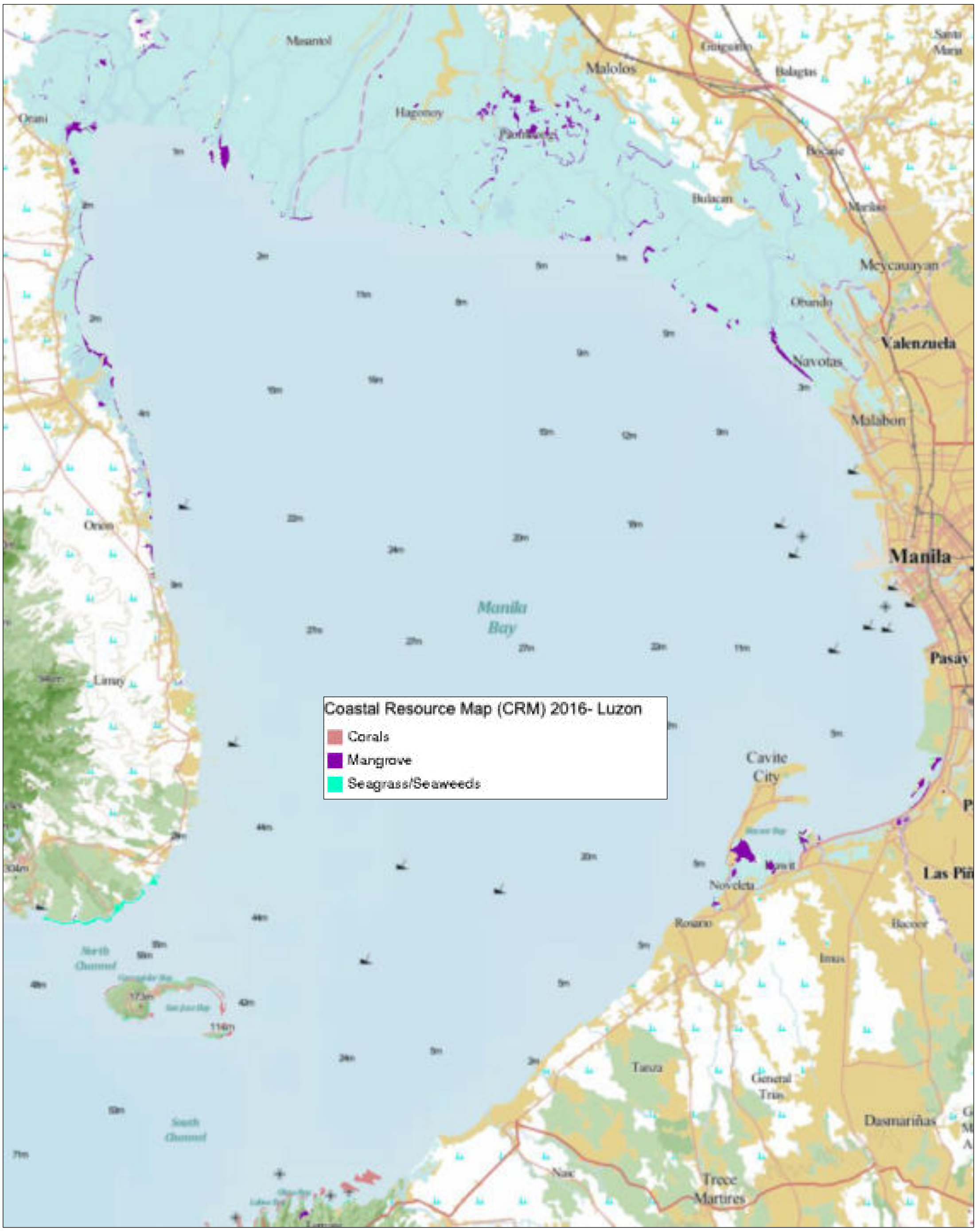
Source: Jensen, A.E. 2018. Internationally Important Waterbird Sites in Manila Bay, Philippines, October 2018. Technical Report. Wetlands International and IUCN National Committee of the Netherlands.

Exhibit 14: Distribution of Waterbirds in Numbers of Global Importance in Manila Bay

3.4.2.3 Mangroves

Mangrove forests around the fringes of Manila Bay are very much reduced from historical levels, due to conversion for aquaculture, salt pans and settlements, as well as over-exploitation for lumber and fuelwood, effects of water pollution, and natural factors such as insect infestations and suffocation by lahar flows. It is estimated that mangroves covered about 54,000 ha around Manila Bay at the beginning of the 20th century, but only 1–4% of that area remains today.[15] As mangroves play such an important role in the life cycles of many marine species (as breeding grounds and nurseries) and also provide roosting sites for numerous bird and bat species, loss of the remaining mangrove areas would have knock-on effects on the sustainability of fisheries and wildlife. Restoration efforts (mainly plantations) have resulted in an overall increase in mangrove area across the Manila Bay area in recent years, but mangrove habitat remains under threat in many places.[16] The distribution of mangroves around Manila Bay is shown in Exhibit 15.

[15] NEDA. 2018. Manila Bay Sustainable Development Master Plan – Situation Analysis. Focal Theme Report, Environmental Protection. December 2018.
[16] Ibid.



Source: NAMRIA. 2015. Coastal Resource Map 2016 – Luzon. geoportal.gov.ph.

Exhibit 15: Distribution of Mangroves Around Manila Bay

3.4.2.4 Seagrass

Seagrass meadows are thought to have occupied substantial portions of the seabed in the shallower fringes of Manila Bay at one time. These sensitive habitats support grazers such as dugongs and some marine turtles, and the modern absence of dugongs within the bay can likely be attributed principally to the loss of seagrass. Seagrass meadows also offer shelter to numerous invertebrates and fish, and are increasingly recognized as having major potential to capture and store carbon, thereby helping to mitigate climate change. Historical seagrass extent in Manila Bay is not well understood, but the prevailing scientific consensus is that this habitat type has experienced heavy losses due to increased sedimentation from land-based activity; elevated turbidity; coastal eutrophication; conversion for aquaculture, salt production and development; bottom trawling and dredging.[17] The present state of knowledge regarding seagrass distribution in Manila is very weak, but the clear water conditions necessary for seagrass to thrive are most likely near the mouth of the bay. As there are relatively few locations near the mouth of the bay that also have favorable sandy or muddy substrate at shallow depths, distribution is expected to be quite narrow. A seagrass distribution map generated from satellite imagery by the Allen Coral Atlas (see Exhibit 16) shows the entire predicted distribution for Manila Bay, all of it around Corregidor and Caballo Islands, as well as the south shore of Mariveles.

Image credit: Allen Coral Atlas

Exhibit 16: Predicted Seagrass Distribution in Manila Bay

3.4.2.5 Summary

In view of the foregoing, Manila Bay can reasonably be considered to qualify as a highly threatened ecosystem, both in relation to specific remnant areas of globally threatened ecosystem types, and as a whole integral ecosystem in its own right. As such, the AoA is appropriately evaluated in relation to Criterion 4. It remains, then, to establish whether the Manila Bay ecosystem has been 'determined to be of high priority for conservation by regional or national systematic conservation planning', as per Threshold (b).

3.4.3 Prioritization of Manila Bay Ecosystem Components as Conservation Targets

Governmental and multi-sectoral attempts to reverse declining water quality in Manila Bay go back to at least 1973, when the Pasig River Development Council was created with a mandate to clean up the Pasig River, which discharges to Manila Bay at the present South

[17] Ibid.

Harbor of the Port of Manila.[18] It was in the late 1990s and early 2000s that concerted institutional attention really began to focus in a more comprehensive and integrated way on the ecological health of Manila Bay as a whole. A major catalyst was the identification, by the Global Environment Facility, United Nations Development Program and International Maritime Organization, through their joint Program on Building Partnerships in Environmental Management for the Seas of East Asia (PEMSEA), of Manila Bay as one of three subregional marine pollution hotspots in the region. The Manila Bay Environmental Management Project (MBEMP) was launched under the auspices of PEMSEA in 2000. One of the major outputs of the MBEMP was a comprehensive Manila Bay Coastal Strategy, which was formulated in late 2001.

Around the same time, the Protected Areas and Wildlife Bureau of the Department of Environment and Natural Resources (since renamed as the Biodiversity Management Bureau) was engaged, in collaboration with Conservation International–Philippines and the University of the Philippines, in a systematic effort to take stock of biodiversity resources, as a prelude to shaping of national commitments in the context of the Convention on Biological Diversity. Numerous locations around Manila Bay were identified as potential conservation targets in that assessment, which was put forward as the second iteration of the National Biodiversity Strategy and Action Plan in 2002.

Another major catalyst for attention and effort focused on the ecological health of Manila Bay during the early 2000s was the so-called Mandamus Writ, a directive issued in 2008 by the Supreme Court following a lengthy legal process that had originated in a 1999 complaint filed in a Regional Trial Court in Cavite by a group of concerned citizens, accusing multiple agencies of the national government of neglecting their statutory responsibilities for preventing environmental degradation affecting Manila Bay. The Mandamus Writ ordered 13 government agencies with mandates related in some way to water quality to develop and implement plans for cleaning up, rehabilitating and protecting Manila Bay. Although defined primarily in relation to water quality (the agencies are required to keep giving implementation progress reports on their Court-approved plans until such time as the bay's waters are found to meet the national SB water quality standards), the effect of the directive has been to focus significant purposive governmental attention on not just preventing further degradation of Manila Bay, but on restoring the integrity of a range of natural attributes, ecosystem functions and ecosystem services on land and in riverine, estuarine and marine environments.

More recently, in what can in many ways be understood as a direct follow-up to the MBEMP, work got underway on a Manila Bay Sustainable Development Master Plan in 2018. Under the leadership of the National Economic and Development Authority (NEDA) and with the support of the Government of the Netherlands, the master planning process brought renewed focus to conservation of the natural features and ecosystem services of Manila Bay, within a comprehensive approach that recognizes the interdependencies of natural and human systems in the region.

The major systematic assessment and planning efforts mentioned above are discussed in more detail below. Marine habitat protection efforts promoted by coastal municipalities, principally marine protected areas of various types, are also outlined.

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[18] Vallejo. B.M. Jr., AB. Aloy, M. Ocampo, J. Conejar-Espedido, and L.M. Manubag. 2019. Manila Bay Ecology and Associated Invasive Species. Pp. 145–169 in C. Makowski and W. Finkl, eds. Impacts of Invasive Species on Coastal Environments. Coastal Research Library 29, https://doi.org/10.1007/978-3-319-91382-7_5.

3.4.3.1 Manila Bay Coastal Strategy

A key early output of the MBEMP was the 2001 formulation, in consultation with a broad array of institutional stakeholders, of a Manila Bay Coastal Strategy (MBCS). The release of the MBCS was marked by the signing of a Manila Bay Declaration affirming dedication to the strategy's implementation by over 100 representatives of key stakeholders implicated in the strategy.[19] A significant research and information compilation effort was developed under the MBEMP, including a risk assessment study and environmental atlas that examined Manila Bay as a single unit from ecological, social and economic vantage points. An Operational Plan for the Manila Bay Coastal Strategy was formulated in 2005 and updated periodically, with the most recent version covering the 2017–2022 period.

The MBCS articulated an environmental problematic with eight major dimensions:

1. Water pollution;
2. Solid waste;
3. Overexploitation of resources (including overfishing, deforestation, overextraction of groundwater, and uncontrolled mining activity);
4. Siltation and sedimentation;
5. Habitat degradation;
6. Natural hazards;
7. Sea level rise; and
8. Conflicts between resource uses.

Five general strategies were formulated to address the challenges identified, including Protect, Mitigate, Develop, Communicate and Direct. The most directly applicable to habitat and biodiversity conservation is the 'Protect' strategy, which has two key objectives: (1) Improvement of the health and well-being of the coastal and non-coastal communities in Manila Bay; and (2) Protection of natural features, and cultural, historical and religious sites. Supporting these objectives is a broad array of 'action programs' collectively seeking simultaneous and linked improvement in environmental quality; engagement and empowerment of communities in natural resource stewardship; rationalized and holistic resource management in agricultural, forestry and fisheries sectors; integrated coastal zone planning; and establishment and competent management of various types of terrestrial and marine protected areas to conserve and protect priority habitats and species. Action Program 3 (Protect and Conserve Biological Diversity) calls for:

1. Establishing sanctuaries for fish, birds, etc. in selected areas;
2. Establishing protected areas for critical habitats, and providing buffer zones around these areas;
3. Organizing community-based management of coastal habitats of Bay-wide significance; and
4. Developing legal, economic and financial mechanisms to ensure the maintenance of sanctuaries and protected areas.

[19] Manila Bay Environmental Management Project. 2001. Manila Bay Coastal Strategy.

3.4.3.2 Philippines Biodiversity Strategy and Action Plan

The Second Iteration of the Philippines Biodiversity Strategy and Action Plan, issued in 2002, identified over 400 locations and features around the country as Conservation Priority Areas (CPAs) in relation to particular classes of species or positioning within regional corridors.[20] Six sites in the Manila Bay area were included in the CPA list, as follows:

1. Bataan Natural Park and Subic Bay Forest Reserve (CPA 28), shown on a map as covering the entire Bataan peninsula, and identified as 'very high' priority in relation to terrestrial mammals;

2. Mariveles Mountains (CPA 29), listed as being of 'very high' priority for conservation of birds;

3. Manila Bay (CPA 30), around the head of the bay and identified as being of 'extremely high/critical' priority for birds;

4. Mts. Palay-Palay-Mataas na Gulod National Park (CPA 41), considered a 'very high' priority for birds;

5. Zambales Coast and Offshore (CPA 286), shown on a map as extending around the southern tip of the Bataan peninsula and partway into Manila Bay west of Corregidor Island, and identified as being of importance for conservation of marine turtles; and

6. Manila Bay (CPA 288), covering the entire bay and listed as a priority for conservation of reef fishes.

A follow-up effort by Conservation International, the Haribon Foundation and DENR's Protected Areas and Wildlife Bureau in 2006 combined the CPA list with a list of 177 Important Bird Areas (IBAs) developed by BirdLife International and the Haribon Foundation to formulate recommendations for designation of KBAs. The resulting list included 128 recommended KBAs and 51 areas identified as having the potential to be recommended as KBAs after further study (candidate KBAs).[21] Of the Manila Bay-area CPAs listed above, the first four were substantially reflected in KBA designations; this can be seen in the map in Exhibit 17.

Two of the recommended KBAs (Mariveles Mountains KBA and Manila Bay KBA) overlap slightly with the AoA as defined for this critical habitat assessment. Four other KBAs (Mts. Palay-Palay Mataas na Gulod National Park KBA; Bataan National Park and Subic Bay Forest Reserve KBA; Mt. Makiling Forest Reserve KBA; and Taal Volcano Protected Landscape KBA) also appeared in the IBAT screening report for the BCIB project, but these are all outside the AoA.

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[20] Ong, P.S., L.E. Afuang and R.G. Rosell-Ambal (eds.) 2002. Philippine Biodiversity Conservation Priorities: A Second Iteration of the National Biodiversity Strategy and Action Plan. Department of Environment and Natural Resources–Protected Areas and Wildlife Bureau, Conservation International Philippines, Biodiversity Conservation Program–University of the Philippines Center for Integrative and Development Studies, and Foundation for the Philippine Environment, Quezon City, Philippines.

[21] Conservation International/Haribon Foundation/DENR–PAWB. 2006. Priority Sites for Conservation in the Philippines: Key Biodiversity Areas.

Neither of the last two CPAs listed above, both marine areas, was accorded KBA status; however, as will be discussed below, sea areas of the Manila Bay ecosystem remain of significant interest in relation to establishment of marine protected areas.

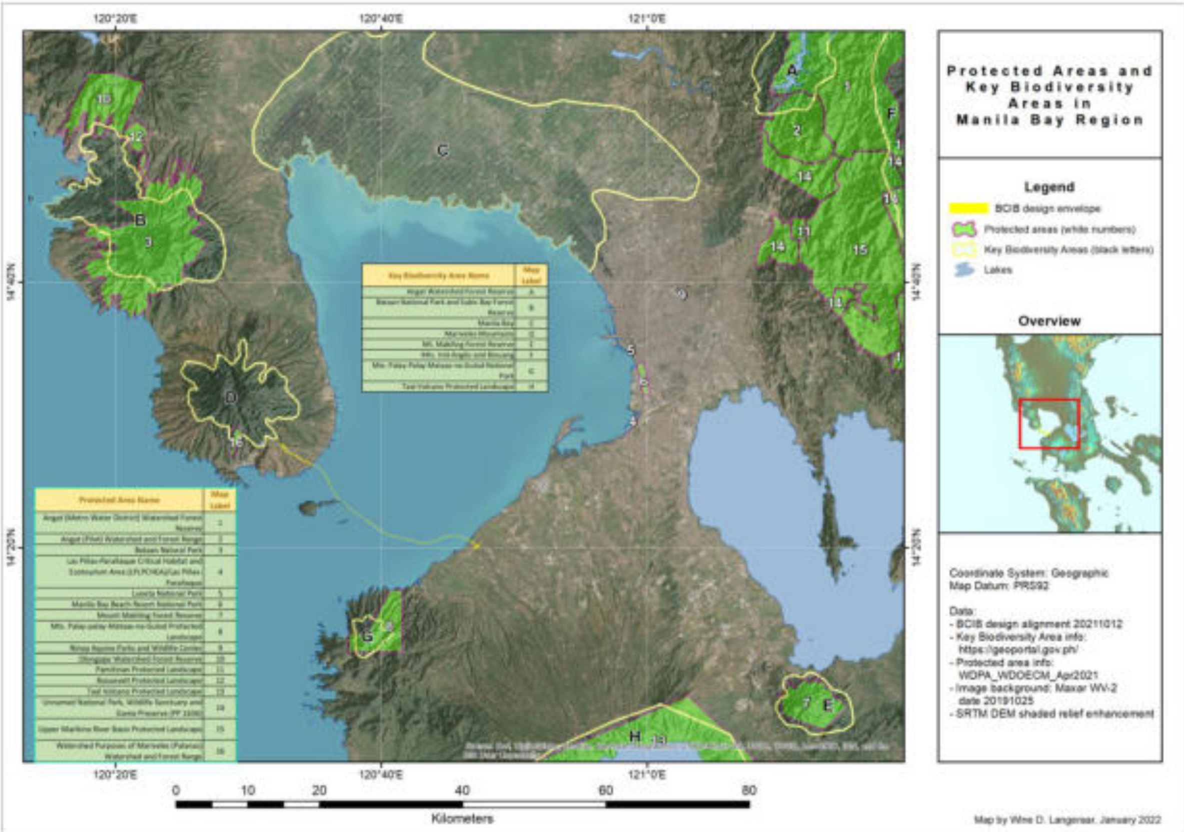


Exhibit 17: Terrestrial Protected Areas and Key Biodiversity Areas in Central Luzon

3.4.3.3 Expanded Integrated National Protected Areas System (E-NIPAS)

The IBAT screening reports identified 14 terrestrial protected areas within 50 km of the BCIB project alignment; two protected areas were noted within 10 km of the project alignment; all are listed as permanent or initial components of the Expanded Integrated National Protected Areas System (ENIPAS).

The first National Integrated Protected Areas System (NIPAS) came into being in 1992 via RA 7586, and represented an attempt to secure a coordinated direction for the assortment of protected areas of different types and objectives that had grown up over the decades as a result of presidential decrees, executive orders and acts of congress. The ENIPAS (established through RA 11038 in 2018) is an extension and further refinement and rationalization of the NIPAS, and places greater emphasis on biodiversity conservation as a focal goal of natural protected areas. Neither the ENIPAS nor the NIPAS is founded on a systematic targeting process like the one described above in relation to KBAs. However, the existence of component protected areas in the Manila Bay area is substantially linked to public and governmental perceptions over the decades with respect to patches of wild nature deemed worthy of permanent protection.

The practical relevance of particular protected areas in the context of the critical habitat assessment depends to a great extent on their location relative to the AoA, the extent to which they actually represent significant biodiversity resources, and the centrality of in-situ biodiversity conservation to management objectives. Exhibit 18 outlines the findings of desktop research on the areas listed in the IBAT screening reports. The protected areas discussed can be located on the map in Exhibit 17.

Exhibit 18: Protected Areas Identified in IBAT Screening Report

Listed site	Distance from BCIB footprint	Within AoA	Relevance to In-Situ Biodiversity Conservation in AoA
Mts. Palay-Palay Mataas-na-Gulod Protected Landscape	12 km	Partially	The northern portion of this protected area extends to the Cavite coast, and thus into the AoA. The strict preservation zone, which is considered a site of some importance for forest-associated birds among other things, and is the last remaining tract of lowland tropical rainforest in Cavite, covers the forested hills in its southwest portion and is outside the AoA. The small portion of the protected landscape near the coast that is within the AoA is significantly disturbed by roads, resorts and a golf course; a recent land cover study indicated that perennial crops, sparse vegetation and built-up areas are the predominant land cover types in this area, with dense forest being absent. The protected landscape may nevertheless be considered a potentially significant biodiversity resource in the context of the critical habitat assessment.
Watershed Purposes of Mariveles (Palanas) Watershed and Forest Range	5.8 km	No	Also known as Mariveles Watershed Forest Preserve, this 347-ha protected area was first designated over a century ago; its name suggests that protecting a water supply for Mariveles town was its principal originating rationale. The preserve retains significant forest cover in higher-elevation portions, which are within the Mariveles Mountains KBA and can be assumed to have significant biodiversity values. The preserve is outside the AoA.
Bataan Natural Park	28 km	No	This mostly forested protected area is centered on Mt. Natib. The park has significant biodiversity values, but has no direct relevance to biodiversity conservation in the AoA, given its distant location.
Las Piñas-Parañaque Critical Habitat and Ecotourism Area	27 km	Yes	This 181-ha protected area comprises two artificial islands created off the shore of Metro Manila as an offshoot of a coastal highway development project in the 1980s, which subsequently became forested with diverse mangrove species and acquired significant value as wildlife habitat, together with the surrounding brackish wetlands and mudflats. Designated as a Ramsar site, this protected area is well known as a refuge for migratory and resident waterbirds. It is within the AoA, and can be considered to have very significant biodiversity values.
Luneta National Park	45 km	No	This is an urban park with no significance for biodiversity conservation.
Manila Bay Beach Resort National Park	46 km	No	Officially gazetted in 1954 but not implemented, this park still exists on paper but has been completely urbanized, and has no biodiversity values.
Mount Makiling Forest Reserve and ASEAN Heritage Park	47 km	No	A mostly forested mountain area south of Laguna de Bay, this protected area is known to harbor numerous endemic species. The reserve is recognized as a center of plant diversity in the Philippines. Although the reserve has very high biodiversity values, it is well outside the AoA, and has little direct relevance in the context of the critical habitat assessment.
Ninoy Aquino Parks and Wildlife Center	54 km	No	This is an urban park with a botanical garden and significant values as a venue for environmental education, but no significance for in-situ biodiversity conservation in the AoA.
Olongapo Naval Base Perimeter National Park	56 km	No	Located near Subic Bay, this park is a tiny adjunct to the adjacent Olongapo Watershed Forest Reserve (see next).
Olongapo Watershed Forest Reserve	56 km	No	Located outside Subic Bay and apparently created largely to protect the water supply, this 6,300-ha park is mostly forest and natural grassland and likely has significant biodiversity values, but is far from the AoA and has no relevance for the critical habitat assessment.

Listed site	Distance from BCIB footprint	Within AoA	Relevance to In-Situ Biodiversity Conservation in AoA
Roosevelt Protected Landscape	55 km	No	A 768-ha park on the outskirts of Subic Bay that is known to offer habitat for numerous threatened species. Given its distance from the AoA, this protected area has no direct relevance for the critical habitat assessment.
Taal Volcano Protected Landscape	32 km	No	This large protected landscape has significant biodiversity values, including rare endemic species known to have evolved as a response to the area's volcanic dynamism. It is well outside the AoA, however, and has no direct relevance to biodiversity conservation in Manila Bay.

The findings presented in Exhibit 17 indicate that only two of the 12 protected areas identified in the IBAT screening overlap with the AoA. Both of these protected areas (Mts. Palay-Palay Mataas na Gulod Protected Landscape, and Las Piñas-Parañaque Critical Habitat and Ecotourism Area) represent significant biodiversity resources and are subject to biodiversity-driven management objectives. They are indicative of historical and still-ongoing conservation interest on the part of the national government and regional and local stakeholders in the Manila Bay ecosystem.

3.4.3.4 Manila Bay Sustainable Development Master Plan

Like the MBCS, the Manila Bay Sustainable Development Master Plan (MBSDMP) takes a broad approach, conceptualizing conservation issues and actions within a framework explicitly linking human prosperity and social life with environmental quality and ecosystem services. Within this overall sustainable development framework, biodiversity and natural habitats are targeted for protection and restoration for both their intrinsic and utilitarian values:

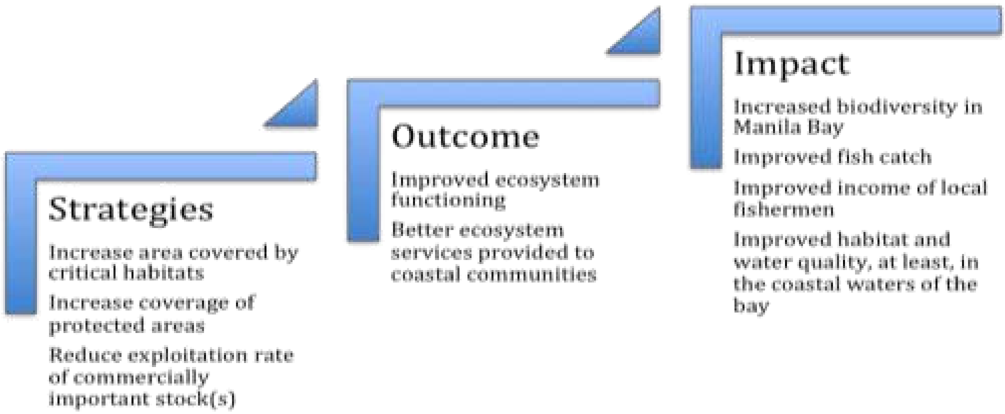
> Improved management of Natural Protected areas contributes to the overall productivity and resilience of Manila Bay by providing habitats to a diverse community of species, enhancing ecosystem productivity and biodiversity, and increasing the capacity of the system to assimilate pollution.[22]

This linked conception is evident in the results chain presented in relation to ecosystem protection within the rubric of the MBSDMP, as shown in Exhibit 19.

One of the six major thematic areas of the MBSDMP is 'Restore Natural Habitat', and the principal mechanism designated for protection and restoration is the marine protected area (MPA). The MBSDMP establishes targets for both establishment of new MPAs and improving protection and management of existing ones. The rationale is explained as follows:

> Protected areas established in Manila Bay comprise less than 1% of its total area. This is not sufficient to sustain not only the biodiversity of the bay, but also the ecological services they provide. Furthermore, protection and management of some of these existing MPAs remain weak and ineffective. Hence, increasing well-managed protected areas is a critical undertaking to ensure the sustainability of Manila Bay.[23]

[22] NEDA. 2020. Manila Bay 2040 – Final Master Plan. September 2020. (p. 35)
[23] NEDA. 2020. Manila Bay Sustainable Development Master Plan – Final Master Plan, Action Plan + Investment Report. Annex 6: PAPs Profiles. December 2020.



Source: NEDA. 2018. Manila Bay Sustainable Development Master Plan – Situational Analysis Report: Ecosystem Protection. December 2018.

Exhibit 19: Ecosystem Conservation Results Chain of MBSDMP

The MBSDMP proposals for increasing MPA coverage and enhancing MPA management take advantage of existing institutional configurations for MPA establishment and administration, as provided for under the Philippine Fisheries Code of 1986 (RA 8550). This law and its supporting regulations, which are implemented by the Bureau of Fisheries and Aquatic Resources (BFAR) under the Department of Agriculture, delegate responsibility for MPAs to the Local Government Units (LGUs) in whose municipal waters they are established.[24] The Locally Managed Marine Protected Area (LMMPA) is thus the predominant instrument for marine habitat protection and biodiversity conservation in the Manila Bay context. It may be noted that LMMPAs are also central to another major thrust of the MBSDMP, which is 'Increase Fish Biomass'. As articulated in the MBSDMP, LMMPAs are assumed to serve as nodes of fish biomass production due to their protection of benthic habitat supportive of feeding, reproduction, refuge and juvenile development:

> Restoration of natural habitats by increasing the number of marine protected areas and fish sanctuaries in Manila Bay will eventually affect fish biomass in the bay. The increase in restored marine habitats and the maintenance of existing protected critical habitats is expected to increase fish biomass and other marine life in Manila Bay.[25]

It will be noted in the passage reproduced above that the concept of 'critical habitat' is used to define targets for conservation; although the term is not formally defined in any of the MBSDMP documents, it appears from target-related discussions that it includes coral reefs, mudflats, mangroves, and seagrass. Use of the term reflects a sense that these ecosystem components are vital to the overall ecosystem, including the fishing economy, and thus deserve priority in conservation. This usage is not equivalent to the IFC conceptualization of critical habitat. A situational analysis report focused on ecosystem protection proposes eight indicators, of which four are defined by these marine 'critical habitat' categories, for measuring progress in the context of the MBSDMP, as follows:[26]

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[24] Philippines Fisheries Code of 1986 (R.A. 8550).
[25] NEDA. 2020. Manila Bay Sustainable Development Master Plan – Final Master Plan, Action Plan + Investment Report. Annex 6: PAPs Profiles. December 2020. (p.85)
[26] NEDA. 2018. Manila Bay Sustainable Development Master Plan – Situational Analysis Report: Ecosystem Protection. December 2018.

1. Mudflat cover;
2. Mangrove cover;
3. Seagrass cover;
4. Coral cover;
5. Forest cover;
6. Number of migratory waterbirds of international importance residing in Manila Bay;
7. Exploitation rate of fish stocks; and
8. Number of marine protected areas in Manila Bay.

One of the key action items being pursued under the auspices of the MBSDMP is the Locally Managed Marine Protected Area Project, which is composed of a series of sub-projects aimed at increasing the number and size of MPAs in Manila Bay by (1) assisting LGUs towards establishing LMMPAs; (2) increasing local capabilities through training and learning-by-doing though pilot projects; and (3) increasing capacities through participation and engagement of communities in managing marine protected areas in their jurisdictions. Collectively, the sub-projects formulated to date aim to establish 22,515 ha of new LMMPAs in the municipal waters of 30 coastal municipalities (see Exhibit 20). The proposed new LMMPAs are understood as pilots. Tools and best practices in establishing, institutionalization and management of LMMPAs under the pilot initiative are to be documented and made available to inform future expansion of the seafloor area under protection across Manila Bay.[27]

Exhibit 20: Targets for New Marine Protected Areas in Manila Bay Under MBSDMP

Province/Region	LGU	Target for New MPAs in Pilot Phase (ha)
Bataan	Abucay	294
	Balanga	9
	Limay	1,615
	Mariveles	1,732
	Orion	1,369
	Pilar	457
	Samal	214
Bulacan	Bulacan	877
	Hagonoy	1,529
	Malolos	409
	Obando	231
	Paombong	540
Cavite	Bacoor	100
	Cavite City	4,283
	Kawit	58
	Maragondon	1,184
	Naic	691
	Noveleta	417
	Rosario	722

[27] NEDA. 2020. Manila Bay Sustainable Development Master Plan – Final Master Plan, Action Plan + Investment Report. Annex 6: PAPs Profiles. December 2020.

Province/Region	LGU	Target for New MPAs in Pilot Phase (ha)
	Tanza	1,157
	Ternate	1,163
Metro Manila	Las Piñas	52
	Manila	1,558
	Navotas	531
	Parañaque	166
	Pasay City	76
Pampanga	Labao	71
	Macabebe	800
	Sasmuan	210
	Total	**22,515 ha**

Source: NEDA. 2020. Manila Bay Sustainable Development Master Plan – Final Master Plan, Action Plan + Investment Report. Annex 6: PAPs Profiles. December 2020.

3.4.3.5 Existing Municipal Marine Protected Areas

As has been noted above, the marine protected areas initiative developed under the auspices of the MBSDMP intends not only to establish new LMMPAs, but also to strengthen management of existing LMMPAs. A number of MPAs of various types have been established over the last three decades by coastal municipalities within Manila Bay, reflecting substantial interest in protecting marine habitat. Most early designations were conceived of as fish sanctuaries and fishery reserves, and are referenced to the typology indicated in the Philippine Fisheries Code RA 8550.[28] Consistent with a country-wide trend, establishment and management of such MPAs has been increasingly understood as an integral element of integrated coastal management (ICM), and implemented through the institutional supports available for ICM.[29] Establishment of MPAs by municipalities is encouraged as a coastal management best practice by the DENR's Biodiversity Management Bureau (DENR-BMB).[30] Municipal governments in both Bataan and Cavite, as well as Bulacan, are actively working on identifying further areas for protection, including both nearshore open water zones and coastal mangrove areas.[31] Existing MPAs exhibit various states of implementation status, institutional and financial support, management effort and effectiveness. Exhibit 21 lists the known LMMPAs established within Manila Bay as of the time of writing.

Exhibit 21: Municipal Marine Protected Areas in Manila Bay

MPA Name	Year established	Area (ha)	Municipality	Distance from BCIB (km)
Orion Kent Fish Sanctuary	1994	25	Orion (Bataan)	~23*
PNOC Fishery Reserve Area	2001	25	Mariveles (Bataan)	10
Naic Fish Sanctuary	2003	59	Naic (Cavite)	0.8
Tanza Fish Sanctuary	2009	45	Tanza (Cavite)	10
Bulaklakin Reef Fish Sanctuary	2005	13	Ternate (Cavite)	7
Limay Fish Sanctuary	2005	8	Limay (Bataan)	~16*

[28] R.A. 8550 – Philippine Fisheries Code of 1998, as Amended by R.A. 10654 (2013).
[29] See White, A.T., R. Eisma-Osorio and S.J. Green. 2005. Integrated Coastal Management and Marine Protected Areas: Complementarity in the Philippines. Ocean & Coastal Management 48()11-12): 948–971.
[30] DENR-BMB Technical Bulletin NO. 2017-14 – Guidelines on the Application of Integrated Coastal Management (ICM) as a Strategy in the Implementation of the Coastal and Marine Ecosystems Management Program (CMEMP).
[31] (1) Provincial Government of Cavite. 2017. State of the Coasts of Cavite Province.; (2) Provincial Government of Bataan. 2017. State of the Coasts of Bataan Province.

Rosario Marine Protected Area	2013	nd	Rosario (Cavite)	~15*
Carabao Island Fish Sanctuary	2015	57	Maragondon (Cavite)	12
Ternate Marine Park	2019	614	Ternate (Cavite)	5
Corregidor Islands Marine Park	2021	508	Cavite City (Cavite)	overlapping
Abucay Fish Sanctuary	nd	500	Abucay (Bataan)	~31*
Bulakan Mangrove Reserve Area	nd	23	Bulakan (Bulacan)	~45*

* Distance is approximated, as no mapping of this MPA was available

Sources

(1) MPA Support Network. Marine Protected Areas List. https://database.mpasupportnetwork.com/#mpa-list. Accessed 12 November 2021; (2) Provincial Government of Cavite. 2017. State of the Coasts of Cavite Province.; (3) Provincial Government of Bataan. 2017. State of the Coasts of Bataan Province.; (3) Provincial profiles of progress in integrated coastal management compiled by Sea Knowledge Bank. https://seaknowledgebank.net/content/bulacan. Accessed 1 December 2021.

In recent years, the more comprehensive MPA concept of the multi-use marine park has risen to prominence in the Manila Bay context, as reflected in the establishment of the Ternate Marine Park (2019) and Corregidor Islands Marine Park (2021). These are more substantial and ambitious conservation undertakings than the small sanctuaries and reserves that had been prevalent, and have a biodiversity conservation mandate that goes beyond the linkage between protection of benthic habitat and increased (or at least stable) fish biomass available to support fisherfolk livelihoods that underpins earlier MPAs. The management plans for both the Ternate Marine Park and Corregidor Islands Marine Park use a zoning approach that recognizes a range of biodiversity values, including intrinsic existence value, enablement of scientific research, fisheries productivity enhancement, eco-touristic potential, and sustainable extraction.[32] This is illustrated in the map of Corregidor Islands Marine Park shown in Exhibit 22.

3.4.4 Summary Evaluation of the Manila Bay AoA Against Criterion 4

Based on the foregoing consideration of (1) the threats facing the Manila Bay ecosystem; and (2) the extent to which key elements of the Manila Bay ecosystem have been identified as targets for conservation, it is clear that the AoA used in the present critical habitat assessment meets the definition as per Criterion 4, Threshold (b): *Other areas not yet assessed by IUCN but determined to be of high priority for conservation by regional or national systematic conservation planning*.

Key habitats in Manila Bay are both highly threatened and subject to long-standing and progressively developing systematic efforts to ensure their conservation. A determination as critical habitat is therefore appropriate in relation to Criterion 4. The determination is applicable to those components of the Manila Bay ecosystem that are prioritized by existing conservation initiatives, including coral reefs, mangroves, mudflats and seagrass, as well as areas designated as marine protected areas and other sites within the AoA that are recognized as targets for in-situ biodiversity conservation, i.e., the southern margin of the Mariveles Mountains KBA, the northern coastal tip of the Mts. Palay-Palay Mataas na Gulod Protected Landscape, the seaward fringe of the Manila Bay KBA, and the Las Piñas-Parañaque Critical Habitat and Ecotourism Area.

[32] (1) DENR-PENRO Cavite. 2020. Ternate Marine Park Management Plan CY 2020–2022.; (2) Cavite City LGU. 2021. Corregidor Islands Marine Park Management Plan 2021–2025.

Exhibit 22: Multi-Use Zonation of Corregidor Islands Marine Park

3.5 Criterion 5: Key Evolutionary Processes

As concluded in SCE Ltd.'s screening report, Manila Bay is not considered to have any features that would indicate particular importance to sustaining or exhibiting key evolutionary processes. Accordingly, Criterion 5 is not considered relevant to this critical habitat assessment.

4 CONCLUSIONS AND NEXT STEPS

4.1 Summary of Critical Habitat Determinations

This critical habitat assessment has found that one avian species meets Threshold (b) specified under Criterion 1, and six avian species meet Threshold (a) under Criterion 3, thus leading to a finding that the AoA should be considered critical habitat for these species. In addition, the Manila Bay ecosystem has been found to meet Threshold (b) under Criterion 4, due to the presence of exemplars of globally threatened ecosystem types targeted as a high priority by systematic regional or national conservation planning. A generalized critical habitat determination is made for those elements of the AoA that have been identified as priorities for in-situ biodiversity conservation; this includes:

1. all areas of coral habitat, mudflats, mangroves and seagrass in the bay;

2. all marine protected areas;

3. the southern margin of the Mariveles Mountains KBA;
4. the northern near-coastal portion of the Mts. Palay-Palay Mataas na Gulod Protected Landscape;
5. the seaward fringe of the Manila Bay KBA; and the Las Piñas-Parañaque Critical Habitat and Ecotourism Area.

4.2 Implications of Critical Habitat Determinations for Project Development

As specified in PS6, a critical habitat determination for the habitat areas within which a project is proposed requires that a number of conditions are applied to the project's further consideration and implementation. If a project is proposed for implementation in critical habitat, the proponent must demonstrate all of the following:

1. No other viable alternatives within the region exist for development of the project on modified or natural habitats that are not critical;
2. The project does not lead to measurable adverse impacts on those biodiversity values for which the critical habitat was designated, and on the ecological processes supporting those biodiversity values;
3. The project does not lead to a net reduction in the global and/or national/regional population in any Critically Endangered or Endangered Species over a reasonable period of time; and
4. Robust, appropriately designed, and long-term biodiversity monitoring and evaluation program is integrated into the proponent's management program.

With regards to the first requirement, it is difficult to foresee a viable alternative for developing the project—whose core purpose is to meet an identified need for a cross-bay road transport link between Bataan and Cavite, and one of whose objectives is to enable an eventual road link to Corregidor Island—that would not impinge on or otherwise affect critical habitat. Virtually all of the nearshore slope in southern Mariveles, and all-around Corregidor Island, is thought to have at least some coral habitat, and even if the project footprint could be designed to avoid direct impingement upon coral reefs, water quality and other potentially far-reaching impacts derived from construction and operation of the infrastructure would still extend the project's area of influence into these habitats. A bored tunnel crossing, which could avoid impacts on benthic habitat altogether, was not considered amongst the alternatives for the BCIB project, for technical and cost reasons. So practically speaking, there is no viable alternative for development of the BCIB project that completely avoids critical habitat.

Meeting the second and third requirements is, in the case of the BCIB, very likely to require implementation of carefully formulated mitigation to prevent and minimize impacts on critical habitat areas and EN and CR species known to frequent the project area. It is inevitable that some of the biodiversity values relevant to the critical habitat finding will be degraded by construction activity, and to a lesser extent by long-term operations, even with aggressive mitigation, so compensatory measures to offset lost or degraded biodiversity values will be needed to ensure that the project can, on balance, meet the second and third requirements. In view of the already existing, demonstrated interest amongst institutional stakeholders in protection and restoration of marine habitat, there is ample scope for the

BCIB project to tie into, support and advance ecosystem restoration efforts that should significantly enhance biodiversity values in the project area.

The fourth requirement, for a robust long-term biodiversity monitoring and management program, can be met by the BCIB project, provided the appropriate resources are allocated for establishing supporting institutional arrangements and for long-term funding of the monitoring program. A Biodiversity Action Plan will be developed to provide clarity and guidance on how the project will achieve a net gain for each receptor that triggers critical habitat.

It is relevant to note here that PS6 also stipulates conditions for projects proposed for implementation in protected areas, which typically represent or contain significant biodiversity values, and whose continued or enhanced protection may strongly support mitigation of losses to biodiversity values at the landscape scale. The BCIB project will directly impinge upon the Corregidor Islands Marine Park (CIMP), traversing approximately 1,950 m of the park's Artificial Reef Area management zone.

In accordance with PS6, proponents of projects proposed within legally recognized protected areas must:

1. Demonstrate that the proposed development in such areas is legally permitted.
2. Act in a manner consistent with any government recognized management plans for such areas;
3. Consult protected area sponsors and managers, Affected Communities, Indigenous Peoples and other stakeholders on the proposed project, as appropriate; and
4. Implement additional programs, as appropriate, to promote and enhance the conservation aims and effective management of the area.

With respect to the first of these requirements for projects in protected areas, it is surmised that the BCIB project can legally be developed within the CIMP. The Cavite City LGU, which has jurisdiction over Corregidor Island and the surrounding waters and the legal prerogative to establish marine protected areas in its municipal waters, issued a formal endorsement of the BCIB project in October of 2019, prior to establishing the CIMP through enactment of a Sangguniang Panlungsod ordinance. The selection of the BCIB alignment (early 2019) and the project's application for an ECC (application January 2021, granted April 2021) appear to pre-date the formal establishment of the park.[33] The CIMP is not a part of the Expanded National Integrated Protected Area System (ENIPAS).

Regarding the second condition, the Cavite City LGU and other stakeholders in the CIMP management team are aware of the BCIB's planned impingement upon the Artificial Reef Area management zone of the CIMP, and the CIMP's management plan is to be updated to reflect the planned presence of the BCIB infrastructure and allow for its operation.[34] As of October 2022, the updated management plan had not yet been issued.

The CIMP's multi-stakeholder management board has been consulted twice to date regarding the overlap between the BCIB project and the CIMP: first in October 2021, and

[33] At the time of writing, the actual date of the passing of the ordinance remains subject to confirmation.
[34] This was indicated by a representative of the Cavite City planning department during a consultation meeting held with institutional stakeholders in the CIMP's management, March 30, 2022, at the Cavite provincial capitol building, Trece Martires.

again in March 2022. In both instances, consultation took the form of a meeting between representatives of the project proponent (including members of the team updating the EIA) and representatives of multiple entities with a place on the management board. In the March 2022 meeting (actually two meetings held on consecutive days to accommodate schedule constraints of the member entities), discussion centered on the anticipated impacts of the project on marine life within and in the vicinity of the CIMP, and some initial informal scoping of possible mitigation and habitat offset options was also undertaken. Further engagement is anticipated as mitigation planning proceeds.

With respect to the last condition, there is substantial scope and potential for the implementation of additional programs to promote and enhance the biodiversity conservation aims of the CIMP. In particular, compensatory measures may be configured to expand and strengthen initiatives already indicated in the CIMP management plan, including surveillance and enforcement activity, shoreline cleanup work, a marine turtle hatchery program, inventory of park resources and other research, installation and maintenance of artificial reefs, long-term monitoring, and environmental education for fisherfolk and park visitors.

4.3 Implications of Critical Habitat Determinations for Mitigation Planning

As indicated above, the second essential requirement of the proponent of a project in critical habitat is 'The project does not lead to measurable adverse impacts on those biodiversity values for which the critical habitat was designated, and on the ecological processes supporting those biodiversity values'. According to GN6, this should be interpreted as emphasizing the importance of considering biodiversity values across a broader scale, and therefore, the requirement "means that project-related direct and indirect impacts will not jeopardize the long-term persistence of the biodiversity value(s) for which the critical habitat was designated, considering the range of mitigation measures implemented by the client throughout the life of the project and in alignment with the mitigation hierarchy." GN6 (Para. 86).

Importantly, it can be noted here that the shift from critical habitat assessment to mitigation planning necessarily entails a spatial sharpening of focus from the broader AoA used in critical habitat determination to the narrower AoI, in which impacts on qualifying species and habitat types have the potential to be realized. In the case of the BCIB, the AoI (150 km^2) is much smaller than the AoA (2,000 km^2), and contains a limited subset of the critical habitat elements identified in relation to the Criterion 4 determination, i.e., coral reefs, mangroves, mudflats, seagrass, protected areas and KBAs. It is anticipated that some of the biodiversity values implicated in the critical habitat assessment will be found, upon further consideration during site-specific impact assessment, to be very unlikely to be affected by project impacts, and thus may not be subject to mitigative action.

As per PS6, for projects proposed in critical habitat (and where it has been established that the proponent can meet all conditions), the proponent's mitigation strategy as it relates to biodiversity shall be formulated in a Biodiversity Action Plan (BAP), which shall be designed to achieve net gains in relation to those biodiversity values for which the critical habitat was designated, and which may be affected by project activities. For the purposes of the BAP, net gains are to be understood as additional positive conservation outcomes over and above maintenance of existing values, or 'no net loss-plus'. The BAP is to be formulated and implemented as a stand-alone plan, but should be cross-referenced to and integrated as appropriate with the project's Environmental Management Plan (EMP). A long-term biodiversity monitoring program is required to ensure that net gains are achieved and maintained.

4.3.1 Critical Habitat Determinations Under Criteria 1 and 3

The critical habitat determinations made in relation to Criterion 1 and Criterion 3 pertain to individual species; these species (all birds) thus assume the role of 'biodiversity values for which the critical habitat was designated' and will be subject to compensatory or additional efforts designed to ensure net gain. Net gains for individual qualifying species will have to be achieved by means of additional conservation actions, which may include direct habitat restoration and habitat protection, or indirect action through financial, in-kind, logistical or institutional support for existing programs that do these things. Such measures will be scoped and formulated in consultation with relevant stakeholders, most particularly those people and entities who may play a role in their implementation and monitoring.

4.3.2 Critical Habitat Determination Under Criterion 4

The critical habitat determination made under Criterion 4 is generalized to the Manila Bay ecosystem, but is focused on a specific set of critical ecosystem components. Accordingly, the BAP should develop measures to ensure that the BCIB project's implementation will result in a measurable net gain in the functional habitat value of such habitats found within the project's AoI. Functional habitat value may be measured in terms of both habitat area and habitat quality, and success in achieving net gains will have to be verified through time by means of a long-term biodiversity monitoring program. Such a monitoring program needs to be specified and funded under the auspices of the BAP.

Efforts to ensure net gain of biodiversity values in relation to affected critical habitat elements may involve direct action (i.e., implemented by the Proponent) or indirect action (implemented by other parties with support from the Proponent). As has been illustrated above, there is no shortage of existing marine habitat conservation efforts in Manila Bay, including within and nearby the BCIB project area. There should thus be ample opportunity to shape the BAP to complement and support existing programs, and this should be the favored approach unless specific circumstances make it reasonable to expect a greater probability of measurable success and cost-effectiveness from direct implementation of habitat restoration by the Proponent. The entities involved in the multi-stakeholder management of the CIMP are likely to be essential partners in the formulation and implementation of the BAP, as the CIMP will be directly and substantially affected by project impacts, and also because the park's management agenda already includes multiple nascent programs that may offer significant potential vehicles for biodiversity offsets. Set asides and offsets contemplated for terrestrial areas may fruitfully be pursued in partnership with municipal and provincial environment agencies in particular.

4.4 Next Steps

This critical habitat assessment has developed the project's understanding of critical habitat and introduces potential critical habitat triggers. At the time of writing however, insufficient data was available to define species-level EAAAs, and as such, a wider and more generalized AOA was used to determine the presence of critical habitat. This live assessment must therefore continue to be updated and reassessed as pre-construction field surveys and more advanced consultation provide better and more robust data, and improved understanding of the ecological receptors relevant. This assessment must therefore be updated using EAAAs for any relevant receptors before the BAP is finalized.

APPENDIX 1
IBAT SCREENING REPORTS

Integrated Biodiversity Assessment Tool
World Bank Group Biodiversity Risk Screen

BCIB CENTERLINE

- **Country:** Philippines
- **Location:** [14.4, 120.7]
- **IUCN Red List Biomes:** Marine
- **Created by:** Bing Rufo

Overlaps with:

Protected Areas	1 km: **0**	10 km: **2**	50 km: **12**	**14**
World Heritage (WH)	1 km: **0**	10 km: **0**	50 km: **0**	**0**

Key Biodiversity Areas	1 km: **0**	10 km: **1**	50 km: **5**	**6**
Alliance for Zero Extinction (AZE)	1 km: **0**	10 km: **0**	50 km: **0**	**0**

IUCN Red List	47

Critical Habitat	Likely

Displaying project location and buffers: 1 km, 10 km, 50 km

WORLD BANK GROUP

This report is based on IFC Performance Standard 6 (PS6) but applies to World Bank Environmental and Social Standard 6 (ESS6)

About this report

The recommendations stated alongside any Protected Areas and Key Biodiversity Areas identified in this report are determined by the following:

Protected Areas:

- 'Highest risk. Seek expert help' is stated if the report identifies a designation that includes either 'natural' or 'mixed world heritage site'.
- 'Assess for Critical Habitat' is stated if the report identifies a Strict Nature Reserve, Wilderness Area or National Park as coded by IUCN protected area categories Ia, Ib and II.
- 'Assess for biodiversity risk' is stated if the report identifies any other type of protected area.

Key Biodiversity Areas:

- 'Highest risk. Seek expert help' is stated if the report identifies an Alliance for Zero Extinction site.
- 'Assess for Critical Habitat' is stated if the report identifies Critically Endangered or Endangered species OR species with restricted ranges OR congregatory species as coded in the IUCN Red List of Threatened Species.
- 'Assess for biodiversity risk' is stated if the report identifies any other type of Key Biodiversity Area.

IBAT provides initial screening for Critical Habitat values. Performance Standard 6 (PS6) defines these values for Critical Habitat (PS6: para. 16) and legally protected and internationally recognized areas (PS6: para. 20). PS6 will be triggered when IFC client activities are located in modified habitats containing "significant biodiversity value," natural habitats, Critical Habitats, legally protected areas, or areas that are internationally recognized for biodiversity. References to PS6 and Guidance Note 6 (GN6) are provided to guide further assessment and detailed definitions where necessary. Please see https://www.ifc.org/ps6 for full details on PS6 and GN6.

The report screens for known risks within a standard 50km buffer of the coordinates used for analysis. This buffer is not intended to indicate the area of impact. The report can be used to:

- Scope risks to include within an assessment of risks and impacts
- Identify gaps within an existing assessment of risks and impacts
- Prioritize between sites in a portfolio for further assessment of risks and impacts
- Inform a preliminary determination of Critical Habitat
- Assess the need for engaging a biodiversity specialist
- Identify additional conservation experts or organizations to inform further assessment or planning

WARNING: IBAT aims to provide the most up-to-date and accurate information available at the time of analysis. There is however a possibility of incomplete, incorrect or out-of-date information. All findings in this report must be supported by further desktop review, consultation with experts and/or on-the-ground field assessment as described in PS6 and GN6. Please consult IBAT for any additional disclaimers or recommendations applicable to the information used to generate this report.

Please note, sensitive species data are currently not included in IBAT reports in line with the Sensitive Data Access Restrictions Policy for the IUCN Red List. This relates to sensitive Threatened species and KBAs triggered by sensitive species.

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Priority Species

Habitat of significant importance to priority species will trigger Critical Habitat status (See PS6: para 16). IBAT provides a preliminary list of priority species that could occur within the 50km buffer. This list is drawn from the IUCN Red List of Threatened Species (IUCN RL). This list should be used to guide any further assessment, with the aim of confirming knownor likely occurrence of these species within the project area. It is also possible that further assessment may confirm occurrence of additional priority species not listed here. It is strongly encouraged that any new species information collected by the project be shared with species experts and/or IUCN wherever possible in order to improve IUCN datasets.

IUCN Red List of Threatened Species - CR & EN

The following species are potentially found within 50km of the area of interest.
For the full IUCN Red List please refer to the associated csv in the report folder.

Species Name	Common Name	Taxonomic Group	IUCN Category	Population Trend	Biome
Eretmochelys imbricata	Hawksbill Turtle	REPTILIA	CR	Decreasing	Terrestrial, Marine
Hemitriakis leucoperiptera	Whitefin Topeshark	CHONDRICHTHYES	CR	Unknown	Marine
Carcharhinus longimanus	Oceanic Whitetip Shark	CHONDRICHTHYES	CR	Decreasing	Marine
Sphyrna lewini	Scalloped Hammerhead	CHONDRICHTHYES	CR	Decreasing	Marine
Sphyrna mokarran	Great Hammerhead	CHONDRICHTHYES	CR	Decreasing	Marine
Pristis zijsron	Green Sawfish	CHONDRICHTHYES	CR	Decreasing	Marine
Rhina ancylostoma	Bowmouth Guitarfish	CHONDRICHTHYES	CR	Decreasing	Marine
Rhynchobatus australiae	Bottlenose Wedgefish	CHONDRICHTHYES	CR	Decreasing	Marine

Species Name	Common Name	Taxonomic Group	IUCN Category	Population Trend	Biome
Rhynchobatus springeri	Broadnose Wedgefish	CHONDRICHTHYES	CR	Decreasing	Marine
Pristis pristis	Largetooth Sawfish	CHONDRICHTHYES	CR	Decreasing	Marine, Freshwater
Clupea manulensis		ACTINOPTERYGII	CR	Unknown	Marine, Freshwater
Cephaloscyllium fasciatum	Reticulated Swellshark	CHONDRICHTHYES	CR	Decreasing	Marine
Balaenoptera borealis	Sei Whale	MAMMALIA	EN	Increasing	Marine
Balaenoptera musculus	Blue Whale	MAMMALIA	EN	Increasing	Marine
Chelonia mydas	Green Turtle	REPTILIA	EN	Decreasing	Terrestrial, Marine
Rhincodon typus	Whale Shark	CHONDRICHTHYES	EN	Decreasing	Marine
Isurus oxyrinchus	Shortfin Mako	CHONDRICHTHYES	EN	Decreasing	Marine
Carcharhinus amblyrhynchos	Grey Reef Shark	CHONDRICHTHYES	EN	Decreasing	Marine
Eusphyra blochii	Winghead Shark	CHONDRICHTHYES	EN	Decreasing	Marine
Stegostoma tigrinum	Zebra Shark	CHONDRICHTHYES	EN	Decreasing	Marine
Gymnura zonura	Zonetail Butterfly Ray	CHONDRICHTHYES	EN	Decreasing	Marine
Aetomylaeus vespertilio	Ornate Eagle Ray	CHONDRICHTHYES	EN	Decreasing	Marine

Species Name	Common Name	Taxonomic Group	IUCN Category	Population Trend	Biome
Rhinoptera javanica	Javanese Cownose Ray	CHONDRICHTHYES	EN	Unknown	Marine
Mobula tarapacana	Sicklefin Devilray	CHONDRICHTHYES	EN	Decreasing	Marine
Mobula thurstoni	Bentfin Devilray	CHONDRICHTHYES	EN	Decreasing	Marine
Isurus paucus	Longfin Mako	CHONDRICHTHYES	EN	Decreasing	Marine
Porites eridani		ANTHOZOA	EN	Unknown	Marine
Anacropora spinosa		ANTHOZOA	EN	Decreasing	Marine
Lobophyllia serratus		ANTHOZOA	EN	Unknown	Marine
Porites ornata		ANTHOZOA	EN	Unknown	Marine
Montipora setosa		ANTHOZOA	EN	Decreasing	Marine
Alveopora excelsa		ANTHOZOA	EN	Unknown	Marine
Alveopora minuta		ANTHOZOA	EN	Unknown	Marine
Pectinia maxima		ANTHOZOA	EN	Unknown	Marine
Mobula kuhlii	Shortfin Devilray	CHONDRICHTHYES	EN	Decreasing	Marine
Alopias pelagicus	Pelagic Thresher	CHONDRICHTHYES	EN	Decreasing	Marine
Camptostemon philippinense		MAGNOLIOPSIDA	EN	Decreasing	Terrestrial, Marine

Species Name	Common Name	Taxonomic Group	IUCN Category	Population Trend	Biome
Holothuria scabra	Golden Sandfish	HOLOTHUROIDEA	EN	Decreasing	Marine
Holothuria lessoni	Golden Sandfish	HOLOTHUROIDEA	EN	Decreasing	Marine
Holothuria whitmaei	Black Teatfish	HOLOTHUROIDEA	EN		Marine
Thelenota ananas	Prickly Redfish	HOLOTHUROIDEA	EN	Decreasing	Marine
Mobula birostris	Giant Manta Ray	CHONDRICHTHYES	EN	Decreasing	Marine
Numenius madagascariensis	Far Eastern Curlew	AVES	EN	Decreasing	Terrestrial, Marine, Freshwater
Calidris tenuirostris	Great Knot	AVES	EN	Decreasing	Terrestrial, Marine
Platalea minor	Black-faced Spoonbill	AVES	EN	Increasing	Marine, Freshwater
Maculabatis macrura	Sharpnose Whipray	CHONDRICHTHYES	EN	Decreasing	Marine
Mobula mobular	Spinetail Devil Ray	CHONDRICHTHYES	EN	Decreasing	Marine

Restricted Range Species

Species Name	Common Name	Taxonomic Group	IUCN Category	Population Trend	Biome
Platalea minor	Black-faced Spoonbill	AVES	EN	Increasing	Marine, Freshwater

Species Name	Common Name	Taxonomic Group	IUCN Category	Population Trend	Biome
Fregata minor	Great Frigatebird	AVES	LC OR LR/LC	Decreasing	Terrestrial, Marine

Biodiversity features which are likely to trigger Critical Habitat

Protected Areas

The following protected areas are found within 1 km and 10 km and 50 km of the area of interest.
For further details please refer to the associated csv file in the report folder.

Area name	Distance	IUCN Category	Status	Designation	Recommendation
Mts. Palay-palay-Mataas-na-Gulod Protected Landscape	10 km	V	Designated	Protected Landscape	Assess for biodiversity risk
Watershed Purposes of Mariveles (Palanas) Watershed and Forest Range	10 km	Not Assigned	Designated	Watershed and Forest Range	Assess for biodiversity risk
Bataan Natural Park	50 km	II	Designated	Natural Park	Assess for critical habitat
Las Piñas-Parañaque Critical Habitat and Ecotourism Area	50 km	Not Reported	Designated	Ramsar Site, Wetland of International Importance	Assess for biodiversity risk
Las Piñas-Parañaque Critical Habitat and Ecotourism Area (LPLPCHEA)/Las Piñas-Parañaque	50 km	IV	Designated	Wetland Park	Assess for biodiversity risk
Luneta National Park	50 km	Not Assigned	Designated	National Park	Assess for biodiversity risk
Manila Bay Beach Resort National Park	50 km	Not Assigned	Designated	National Park	Assess for biodiversity risk

Area name	Distance	IUCN Category	Status	Designation	Recommendation
Mount Makiling Forest Reserve	50 km	Not Assigned	Designated	ASEAN Heritage Park	Assess for biodiversity risk
Mount Makiling Forest Reserve	50 km	Not Assigned	Designated	Forest Reserve	Assess for biodiversity risk
Ninoy Aquino Parks and Wildlife Center	50 km	Not Assigned	Designated	Parks and Wildlife Center	Assess for biodiversity risk
Olongapo Naval Base Perimeter National Park	50 km	Not Assigned	Designated	National Park	Assess for biodiversity risk
Olongapo Watershed Forest Reserve	50 km	Not Assigned	Designated	Watershed Forest Reserve	Assess for biodiversity risk
Roosevelt Protected Landscape	50 km	V	Designated	Protected Landscape	Assess for biodiversity risk
Taal Volcano Protected Landscape	50 km	V	Designated	Protected Landscape	Assess for biodiversity risk

Key Biodiversity Areas

The following key biodiversity areas are found within 1 km and 10 km and 50 km of the area of interest.
For further details please refer to the associated csv file in the report folder.

Area name	Distance	IBA	AZE	Recommendation

Area name	Distance	IBA	AZE	Recommendation
Mariveles mountains	10 km	Yes	No	Assess for critical habitat
Bataan Natural Park and Subic Bay Forest Reserve	50 km	Yes	No	Assess for critical habitat
Manila Bay	50 km	Yes	No	Assess for critical habitat
Mount Makiling	50 km	Yes	No	Assess for critical habitat
Mounts Palay-Palay-Mataas Na Gulod National Park	50 km	Yes	No	Assess for critical habitat
Taal Volcano Protected Landscape	50 km	No	No	Assess for biodiversity risk

Species with potential to occur

Area Taxonomic group	Total assessed species	Total (CR, EN & VU)	CR	EN	VU	NT	LC	DD
REPTILIA	19	5	1	1	3	1	13	0
CHONDRICHTHYES	85	56	10	16	30	12	15	2
ACTINOPTERYGII	1891	20	1	0	19	9	1746	116
MAMMALIA	22	4	0	2	2	2	15	1
ANTHOZOA	564	168	0	8	160	147	200	49

Area Taxonomic group	Total assessed species	Total (CR, EN & VU)	CR	EN	VU	NT	LC	DD
MAGNOLIOPSIDA	33	2	0	1	1	2	27	2
HOLOTHUROIDEA	73	9	0	4	5	0	25	39
AVES	104	6	0	3	3	14	84	0
HYDROZOA	7	1	0	0	1	1	5	0
LILIOPSIDA	13	1	0	0	1	0	12	0
GASTROPODA	190	0	0	0	0	0	179	11
BIVALVIA	10	0	0	0	0	0	4	6
MALACOSTRACA	42	0	0	0	0	0	37	5
POLYPODIOPSIDA	1	0	0	0	0	0	1	0
MYXINI	1	0	0	0	0	0	0	1

Recommended citation

IBAT PS6 & ESS6 Report. Generated under licence 4846-21884 from the Integrated Biodiversity Assessment Tool on 13 September 2021 (GMT). www.ibat-alliance.org

Recommended Experts and Organizations

For projects located in Critical Habitat, clients must ensure that external experts with regional expertise are involved in further assessment (GN6: GN22). Clients are encouraged to develop partnerships with recognized and credible conservation organizations and/or academic institutes, especially with respect to potential developments in natural or Critical Habitat (GN6: GN23). Where Critical Habitats are triggered by priority species, species specialists must be involved. IBAT provides data originally collected by a large network of national partners, while species information is sourced via the IUCN Red List and affiliated Species Specialist Groups. These experts and organizations are listed below. **Please note that this is not intended as a comprehensive list of organizations and experts. These organizations and experts are under no obligation to support any further assessment and do so entirely at their discretion and under their terms. Any views expressed or recommendations made by these stakeholders should not be attributed to the IFC or IBAT for IFC partners.**

Birdlife Partners

URL: https://www.birdlife.org/worldwide/partnership/birdlife-partners

Directory for Species Survival Commission (SSC) Specialist Groups and Red List Authorities

URL: https://www.iucn.org/commissions/ssc-groups

APPENDIX 2

CONSULTATIONS

Date and location	Event type	Entities/Individuals Consulted	Key Topics of Discussion Relevant to Assessment
21 October 2021	Group consultation (online)	Corregidor Islands Marine Park Technical Committee (multi-stakeholder entity)	• Proximity of proposed BCIB alignment to Corregidor Islands Marine Park management zones
22 March 2022	Group consultation	Municipal Environment and Natural Resources Office, Mariveles	• Active coastal conservation programs, including marine turtle hatchery • Potential long-term effects of BCIB project on forests of Mt. Mariveles
22 March 2022	Group consultation	Alas-Asin Fisherfolk Barangay Alas-Asin	• Locations of fishing activity around Mariveles shore and Corregidor Island • Scoping of possible benthic restoration in context of environmental mitigation related to the BCIB project
28 March 2022	Individual interview	Corregidor Foundation, Inc. (Mr. Jerry Rollin, Consultant)	• Ecology of Corregidor Island and surrounding waters • Existing threats to marine ecosystem around Corregidor Island • Planned environmental management activities for Corregidor Islands Marine Park
29 March 2022	Group consultation	Provincial Environment and Natural Resources Office, Cavite	• Proximity of proposed BCIB alignment to Corregidor Islands Marine Park management zones • Threats to marine ecology of BCIB project area • Scoping of possible benthic restoration in context of environmental mitigation related to the BCIB project
29 March 2022	Group consultation	Municipal Environment and Natural Resources Office, Naic Municipal Agriculture Office, Naic	• Active coastal conservation programs, including marine turtle hatchery • Naic Fish Sanctuary
30 March 2022	Group consultation	Corregidor Islands Marine Park Technical Committee	• Proximity of proposed BCIB alignment to Corregidor Islands Marine Park management zones • Threats to marine ecology of BCIB project area • Scoping of possible benthic restoration in context of environmental mitigation related to the BCIB project
12 May 2022	Small-group interview	Ms. Eva Pangilinan Municipal Environment and Natural Resources Office, Naic Mr. John Nepomuceno, Dean Cavite State University	• Naic marine turtle hatchery program • History and management of Naic Fish Sanctuary
May 2022	Individual interview	Dr. Lemuel Arragones Institute of Environmental Science and Meteorology, University of the Philippines	• State of knowledge regarding presence, distribution and abundance of cetaceans in Manila Bay
May 2022	Individual interview	Dr. Yaptinchay, Executive Director Marine Wildlife Watch of the Philippines	• State of knowledge regarding presence, distribution and abundance of marine wildlife in Manila Bay

Date and location	Event type	Entities/Individuals Consulted	Key Topics of Discussion Relevant to Assessment
May 2022	Individual interview	Kester Yu, Marine conservationist and previous officer of National Environmental Protection Council of the Philippines	• State of knowledge regarding presence, distribution and abundance of marine wildlife in Manila Bay
May 2022	Individual interview	Oceana (Diovanie de Jesus, Campaign and Science Specialist)	• State of knowledge regarding presence, distribution and abundance of marine wildlife in Manila Bay

APPENDIX 3

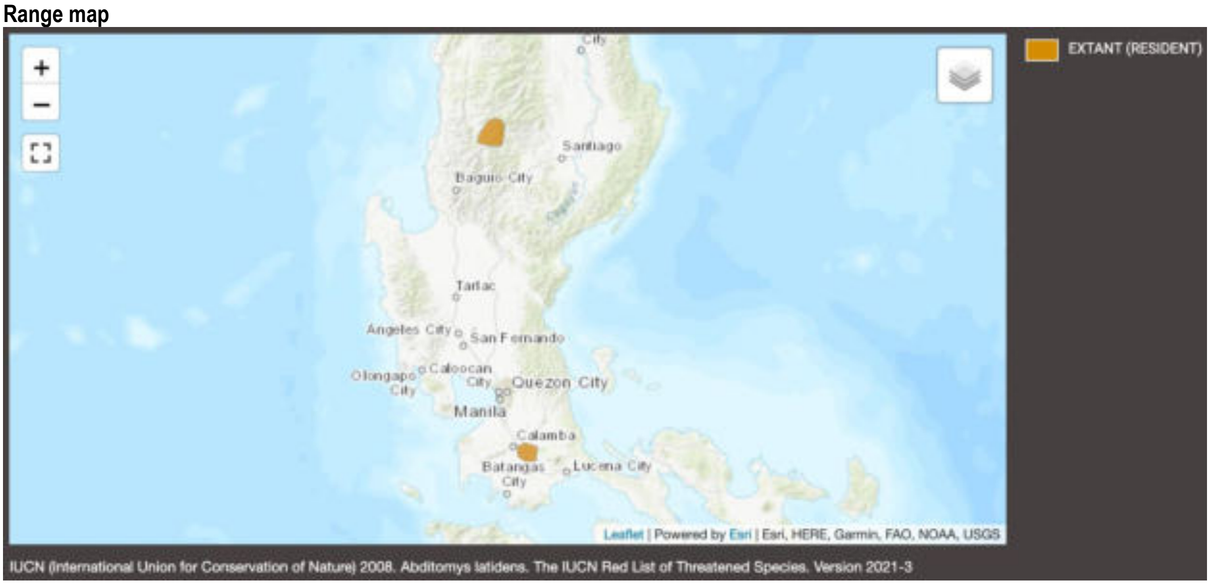
INFORMATION SOURCES AND RANGE MAPS FOR BY-SPECIES EVALUATIONS

Abditomys latidens
Luzon Broad-Toothed Rat
(DD)

Sources consulted

(1) Gerrie, R. & Kennerley, R. 2016. *Abditomys latidens* (errata version published in 2017). *The IUCN Red List of Threatened Species* 2016: e.T42641A115198627. https://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T42641A22454309.en. Accessed on 17 June 2022.
(2) Heaney, L.R., Balete, D.S. and Rickart, E.A. 2016. The Mammals of Luzon Island: Biogeography and Natural History of a Philippine Fauna. Johns Hopkins University Press, Baltimore, USA.

Range map



Source: Gerrie, R. & Kennerley, R. 2016. *Abditomys latidens* (errata version published in 2017). *The IUCN Red List of Threatened Species* 2016: e.T42641A115198627. https://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T42641A22454309.en. Accessed on 17 June 2022.

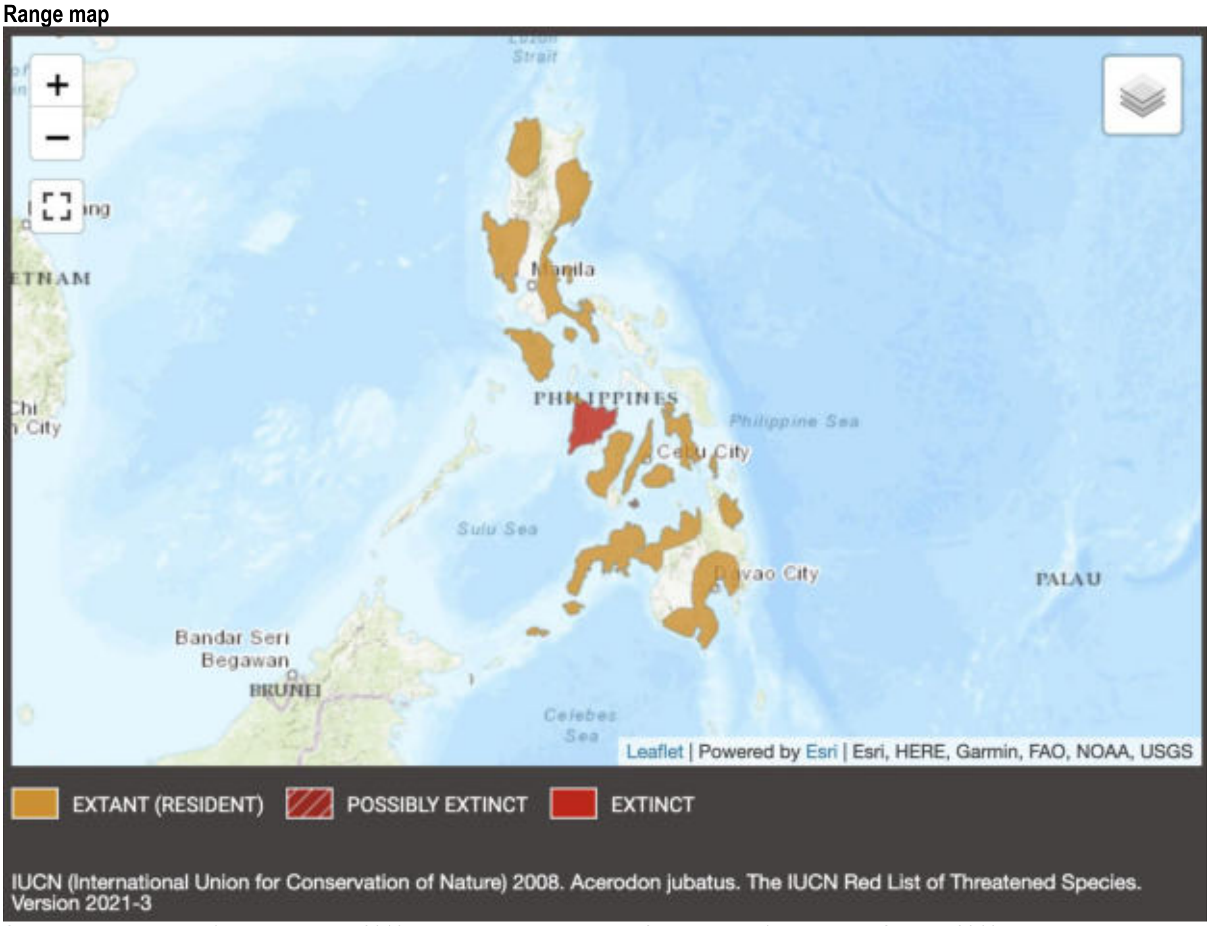
Acerodon jubatus
Golden-Capped Fruit Bat
(EN)

Sources consulted

(1) Mildenstein, T. & Paguntalan, L. 2016. *Acerodon jubatus*. *The IUCN Red List of Threatened Species* 2016: e.T139A21988328. https://dx.doi.org/10.2305/IUCN.UK.2016-2.RLTS.T139A21988328.en. Accessed on 17 June 2022.

(2) Heinen, V. 2009. "Acerodon jubatus" (On-line), Animal Diversity Web. Accessed June 17, 2022 at https://animaldiversity.org/accounts/Acerodon_jubatus/

Range map



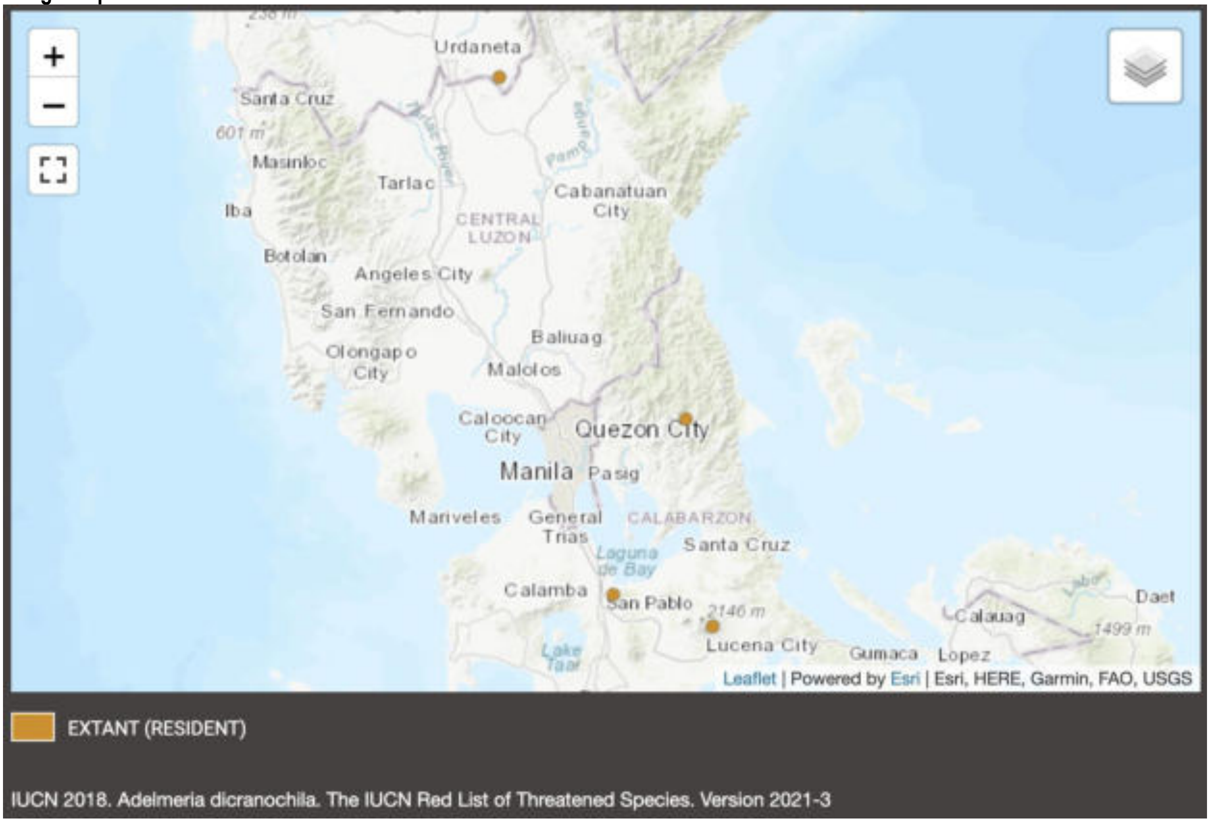
Source: Mildenstein, T. & Paguntalan, L. 2016. *Acerodon jubatus*. *The IUCN Red List of Threatened Species* 2016: e.T139A21988328. https://dx.doi.org/10.2305/IUCN.UK.2016-2.RLTS.T139A21988328.en. Accessed on 17 June 2022.

Adelmeria dicranochila
(EN)

Sources consulted

(1) Docot, R.V.A. 2020. *Adelmeria dicranochila*. *The IUCN Red List of Threatened Species* 2020: e.T132925112A132925153. https://dx.doi.org/10.2305/IUCN.UK.2020-1.RLTS.T132925112A132925153.en. Accessed on 20 June 2022.

Range map



Source: Docot, R.V.A. 2020. *Adelmeria dicranochila*. *The IUCN Red List of Threatened Species* 2020: e.T132925112A132925153. https://dx.doi.org/10.2305/IUCN.UK.2020-1.RLTS.T132925112A132925153.en. Accessed on 20 June 2022.

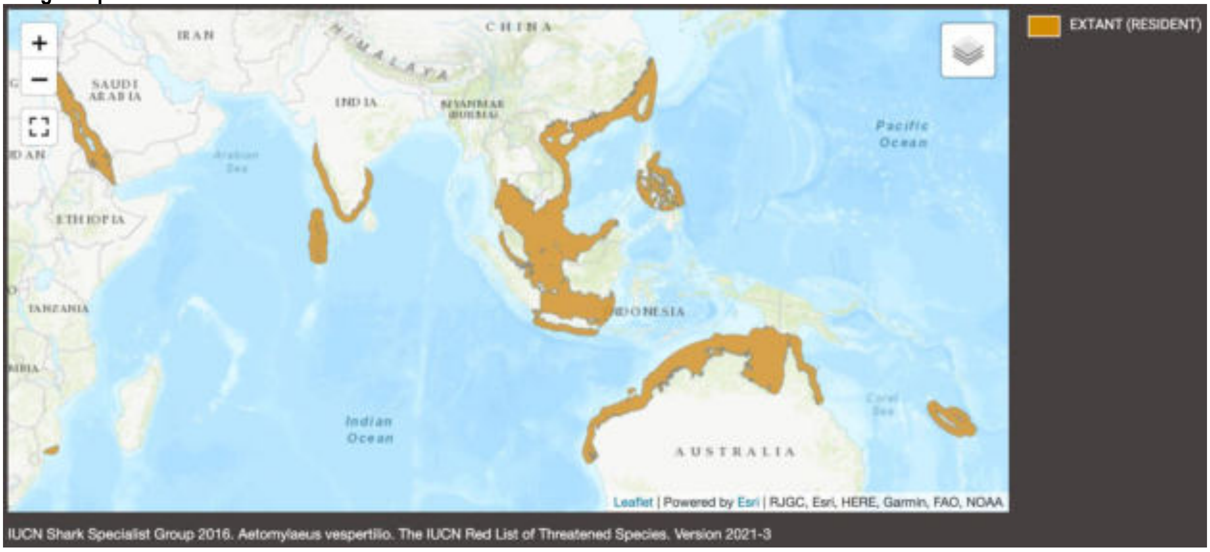
Aetomylaeus vespertilio
Ornate Eagle Ray
(EN)

Sources consulted

(1) White, W.T. & Kyne, P.M. 2016. *Aetomylaeus vespertilio*. *The IUCN Red List of Threatened Species* 2016: e.T60121A68607665. https://dx.doi.org/10.2305/IUCN.UK.2016-1.RLTS.T60121A68607665.en. Accessed on 17 June 2022.

(2) Froese, R. and D. Pauly. Editors. 2022.FishBase. World Wide Web electronic publication. www.fishbase.org. Accessed 17 May 2022.

Range map



Source: White, W.T. & Kyne, P.M. 2016. *Aetomylaeus vespertilio. The IUCN Red List of Threatened Species* 2016: e.T60121A68607665. https://dx.doi.org/10.2305/IUCN.UK.2016-1.RLTS.T60121A68607665.en. Accessed on 17 June 2022.

Alopias pelagicus
Pelagic Thresher
(EN)

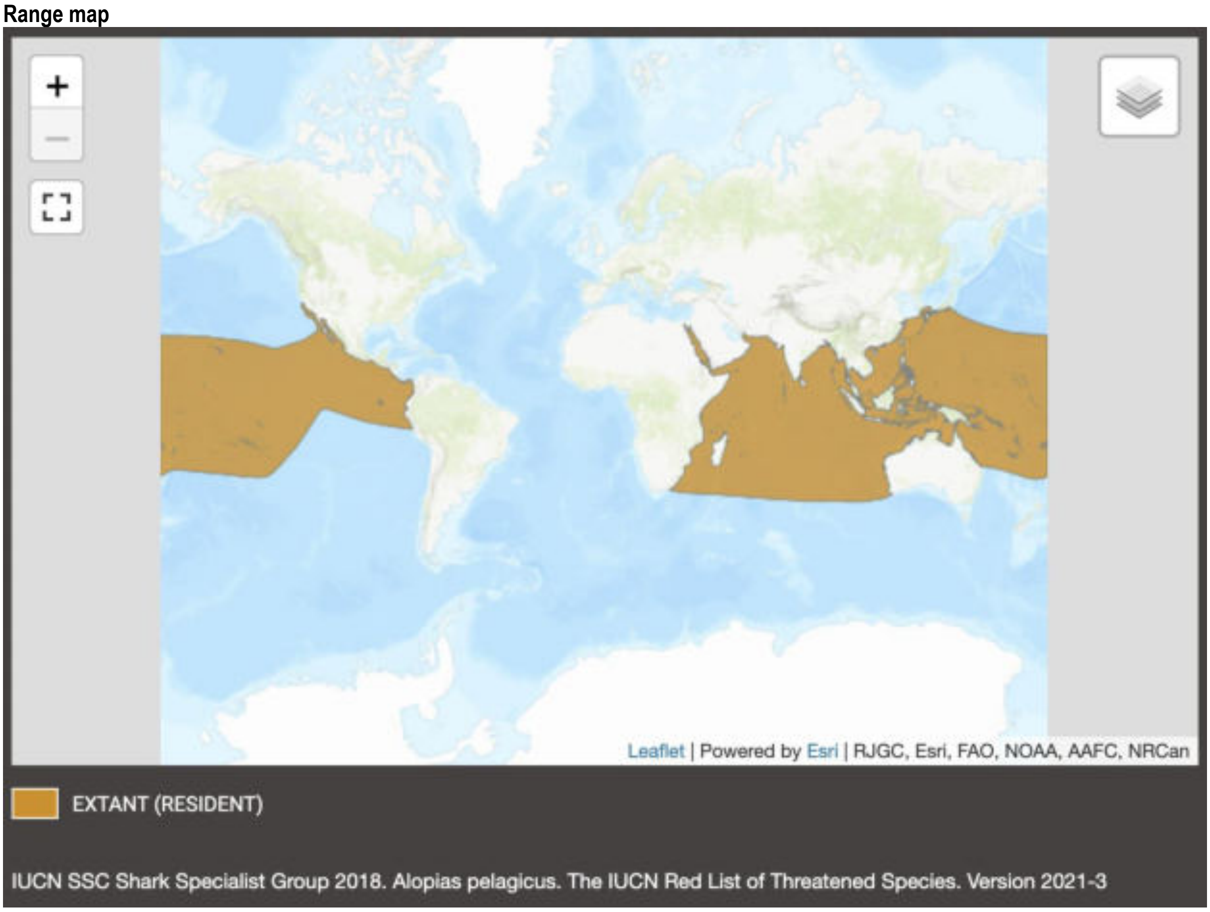
Sources consulted

(1) Rigby, C.L., Barreto, R., Carlson, J., Fernando, D., Fordham, S., Francis, M.P., Herman, K., Jabado, R.W., Liu, K.M., Marshall, A., Pacoureau, N., Romanov, E., Sherley, R.B. & Winker, H. 2019. *Alopias pelagicus*. *The IUCN Red List of Threatened Species* 2019: e.T161597A68607857. https://dx.doi.org/10.2305/IUCN.UK.2019-3.RLTS.T161597A68607857.en. Accessed on 17 June 2022.

(2) ReefQuest Center for Shark Research. Undated. Biology of the Pelagic Thresher(*Alopias pelagicus*). http://www.elasmo-research.org/education/shark_profiles/a_pelagicus.htm. Accessed 17 May 2022.

(3) Froese, R. and D. Pauly. Editors. 2022.FishBase. World Wide Web electronic publication. www.fishbase.org. Accessed 17 May 2022.

Range map



Source: Rigby, C.L., Barreto, R., Carlson, J., Fernando, D., Fordham, S., Francis, M.P., Herman, K., Jabado, R.W., Liu, K.M., Marshall, A., Pacoureau, N., Romanov, E., Sherley, R.B. & Winker, H. 2019. *Alopias pelagicus*. *The IUCN Red List of Threatened Species* 2019: e.T161597A68607857. https://dx.doi.org/10.2305/IUCN.UK.2019-3.RLTS.T161597A68607857.en. Accessed on 17 June 2022.

Alveopora excelsa
(EN)

Sources consulted

(1) Sheppard, A., Fenner, D., Edwards, A., Abrar, M. & Ochavillo, D. 2008. *Alveopora excelsa. The IUCN Red List of Threatened Species* 2008: e.T133464A3758346. https://dx.doi.org/10.2305/IUCN.UK.2008.RLTS.T133464A3758346.en. Accessed on 17 June 2022.
(2) Corals of the World. Factsheet – Alveopora excelsa. http://www.coralsoftheworld.org/species_factsheets/species_factsheet_summary/alveopora-excelsa/. Accessed 15 May 2022.
(3) Coral Trait Database. 2022. *Alveopora excelsa*. https://coraltraits.org/species/212?search=alveopora+excelsa. Accessed 28 June 2022.

Range map

Source: Sheppard, A., Fenner, D., Edwards, A., Abrar, M. & Ochavillo, D. 2008. *Alveopora excelsa*. *The IUCN Red List of Threatened Species* 2008: e.T133464A3758346. https://dx.doi.org/10.2305/IUCN.UK.2008.RLTS.T133464A3758346.en. Accessed on 17 June 2022.

Alveopora minuta
(EN)

Sources consulted

(1) Sheppard, A., Fenner, D., Edwards, A., Abrar, M. & Ochavillo, D. 2008. *Alveopora minuta. The IUCN Red List of Threatened Species* 2008: e.T133467A3759369. https://dx.doi.org/10.2305/IUCN.UK.2008.RLTS.T133467A3759369.en. Accessed on 17 June 2022.
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(3) Coral Trait Database. 2022. *Alveopora minuta*. https://coraltraits.org/species/217?search=alveopora+minuta. Accessed 28 June 2022.

Range map

Source: Sheppard, A., Fenner, D., Edwards, A., Abrar, M. & Ochavillo, D. 2008. *Alveopora minuta. The IUCN Red List of Threatened Species* 2008: e.T133467A3759369. https://dx.doi.org/10.2305/IUCN.UK.2008.RLTS.T133467A3759369.en. Accessed on 17 June 2022.

Anacropora spinosa
(EN)

Sources consulted

(1) Richards, Z.T., Delbeek, J.T., Lovell, E.R., Bass, D., Aeby, G. & Reboton, C. 2014. *Anacropora spinosa. The IUCN Red List of Threatened Species* 2014: e.T133046A54185058. https://dx.doi.org/10.2305/IUCN.UK.2014-1.RLTS.T133046A54185058.en. Accessed on 17 June 2022.
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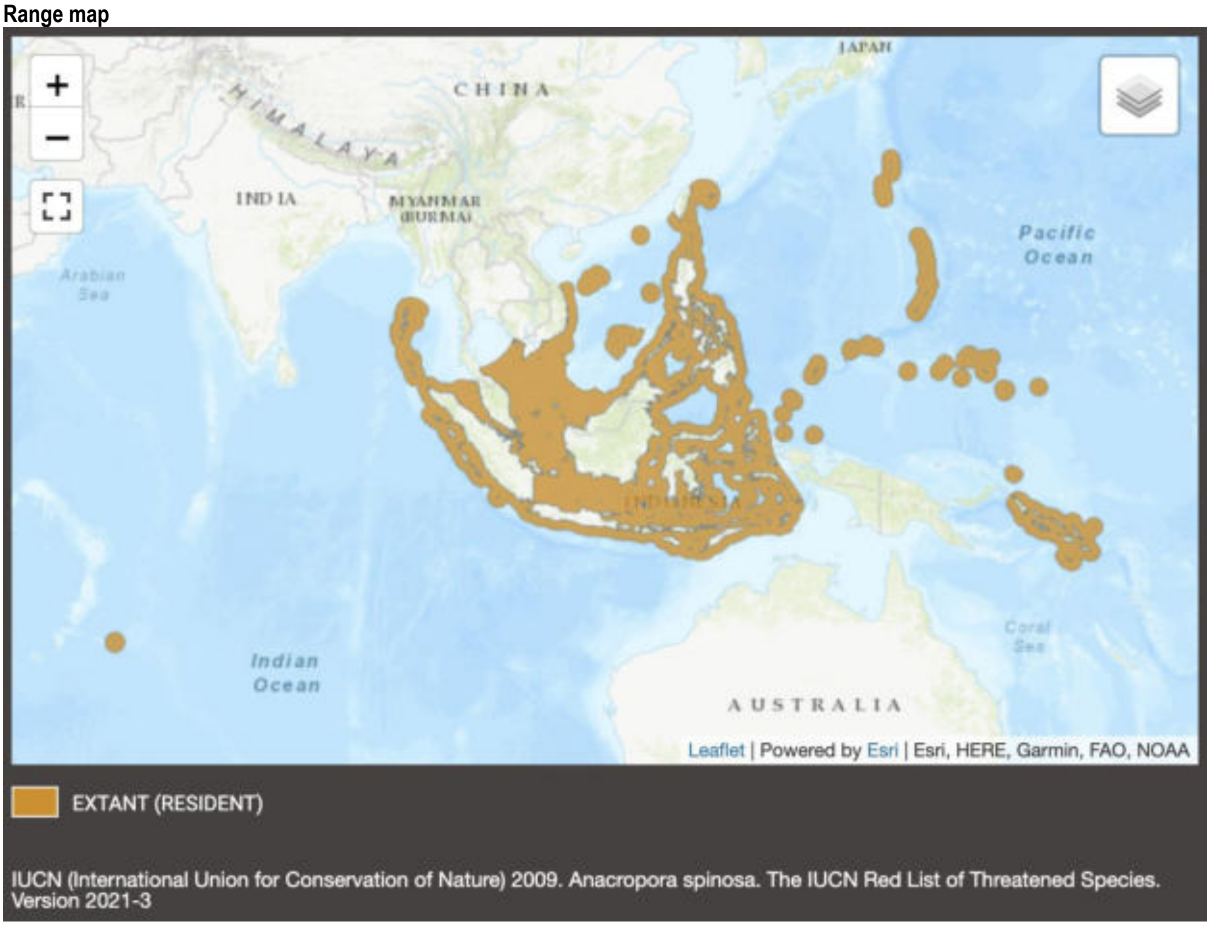
(3) Coral Trait Database. 2022. *Anacropora spinosa*. https://coraltraits.org/species/228?search=anacropora+spinosa. Accessed 28 June 2022.

Range map



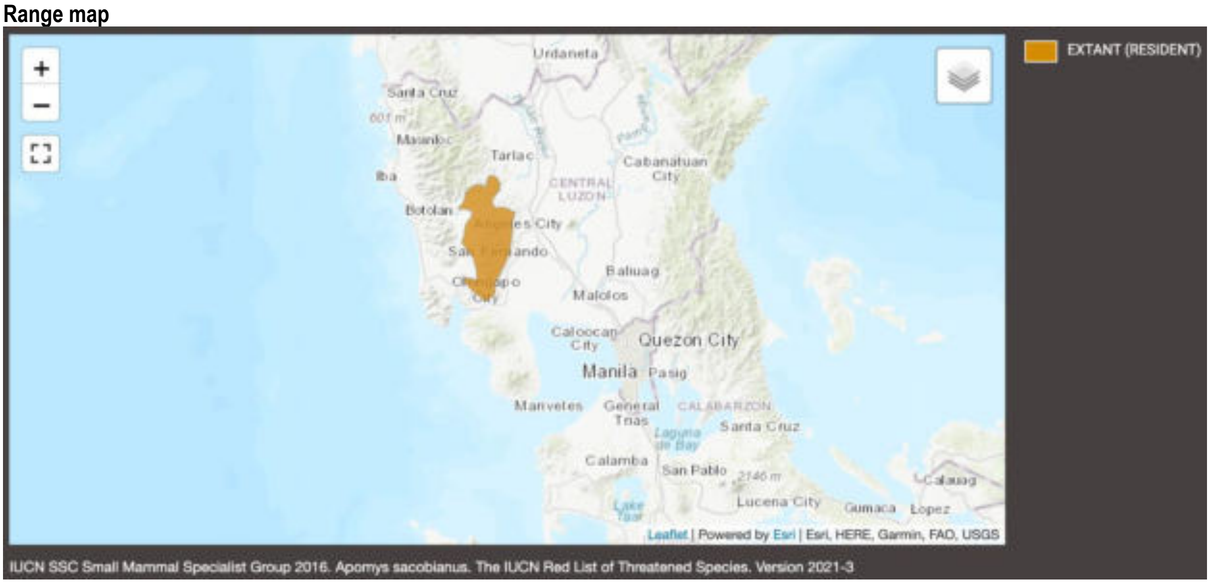
Source: Richards, Z.T., Delbeek, J.T., Lovell, E.R., Bass, D., Aeby, G. & Reboton, C. 2014. *Anacropora spinosa*. *The IUCN Red List of Threatened Species* 2014: e.T133046A54185058. https://dx.doi.org/10.2305/IUCN.UK.2014-1.RLTS.T133046A54185058.en. Accessed on 17 June 2022.

Apomys sacobianus
Long-Nosed Luzon Forest Mouse
(LC)

Sources consulted

(1) Kennerley, R. 2016. *Apomys sacobianus. The IUCN Red List of Threatened Species* 2016: e.T1916A22431969. https://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T1916A22431969.en. Accessed on 19 June 2022.

Range map



Source: Kennerley, R. 2016. *Apomys sacobianus. The IUCN Red List of Threatened Species* 2016: e.T1916A22431969. https://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T1916A22431969.en. Accessed on 19 June 2022.

Apomys zambalensis
Zambales Forest Mouse
(LC)

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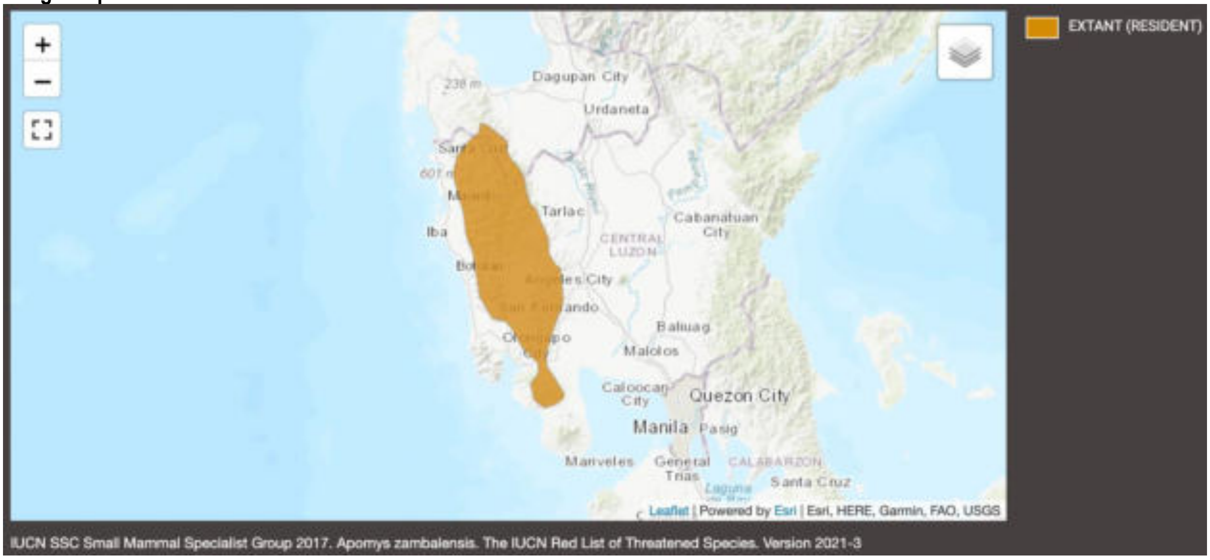
Range map



Source: Engelbrektsson, P. & Kennerley, R. 2017. *Apomys zambalensis*. *The IUCN Red List of Threatened Species* 2017: e.T45954013A45972996. https://dx.doi.org/10.2305/IUCN.UK.2017-2.RLTS.T45954013A45972996.en. Accessed on 19 June 2022.

Balaenoptera borealis
Sei Whale
(EN)

Sources consulted

(1) Cooke, J.G. 2018. Balaenoptera borealis. The IUCN Red List of Threatened Species 2018: e.T2475A130482064. https://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T2475A130482064.en. Accessed on 20 April 2022

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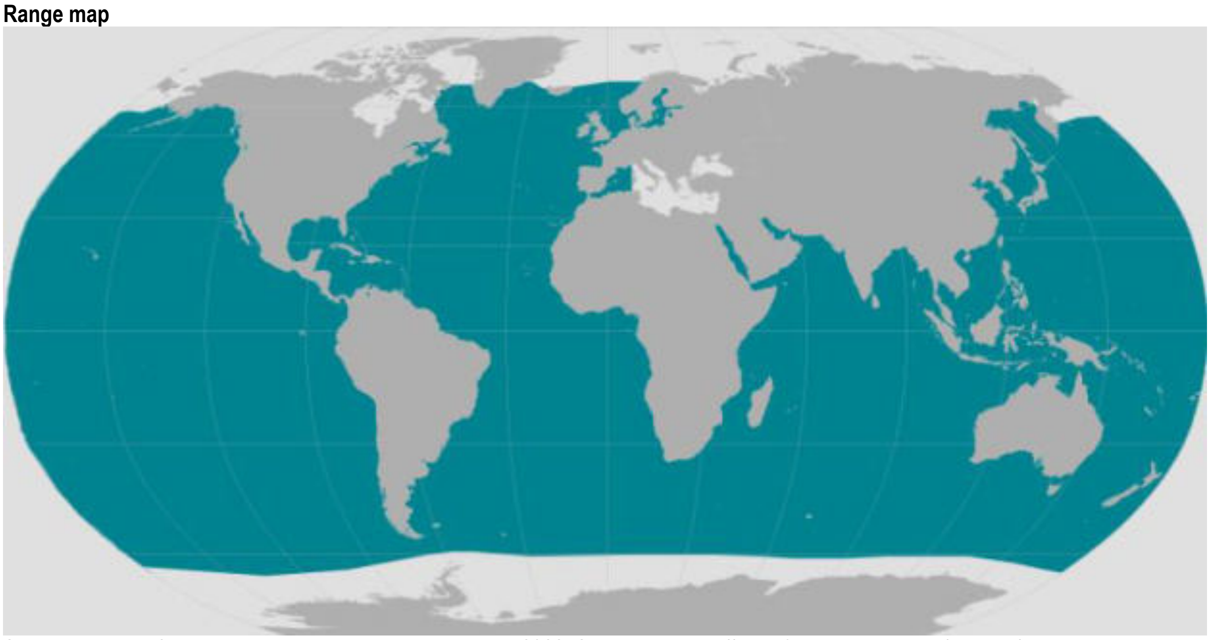
(3) National Oceanic and Atmospheric Administration. 2022. Sei Whale. https://www.fisheries.noaa.gov/species/sei-whale. Accessed 20 April 2022.

Range map



Source: National Oceanic and Atmospheric Administration. 2022. Sei Whale. https://www.fisheries.noaa.gov/species/sei-whale. Accessed 20 April 2022.

Balaenoptera musculus
Blue Whale
(EN)

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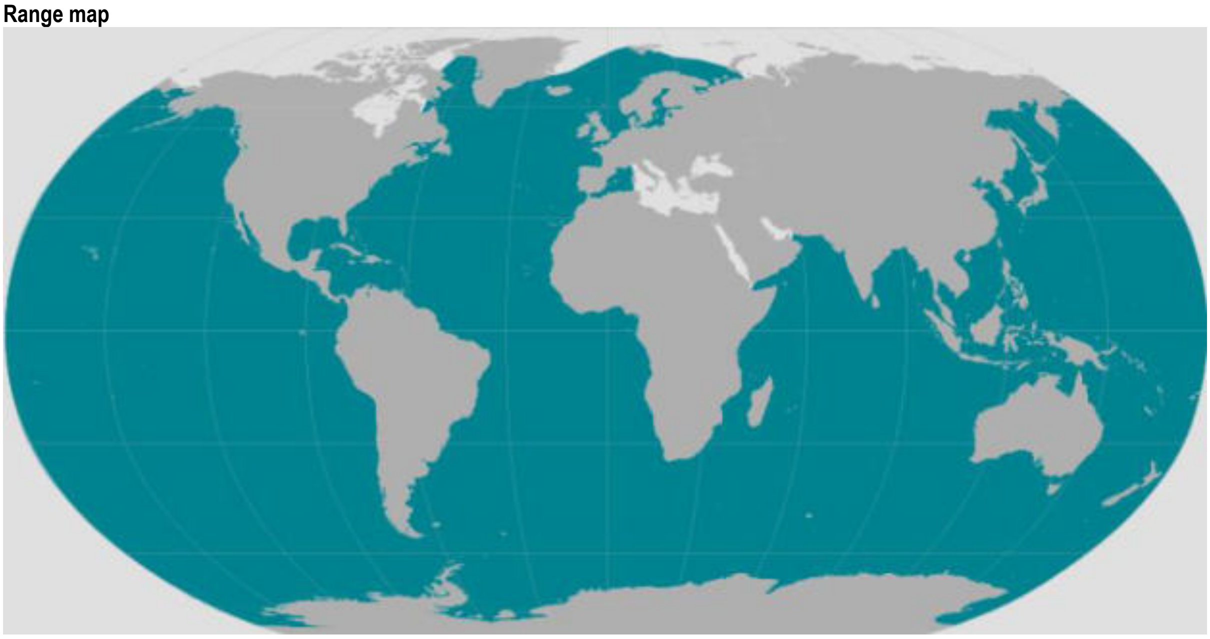
Range map



Source: National Oceanic and Atmospheric Administration. 2022. Blue Whale. https://www.fisheries.noaa.gov/species/blue-whale. Accessed 20 April 2022.

Cacatua haematuropygia
Philippine Cockatoo
(CR)

Sources consulted

(1) BirdLife International. 2017. *Cacatua haematuropygia. The IUCN Red List of Threatened Species* 2017: e.T22684795A117578604. https://dx.doi.org/10.2305/IUCN.UK.2017-3.RLTS.T22684795A117578604.en. Accessed on 20 June 2022.

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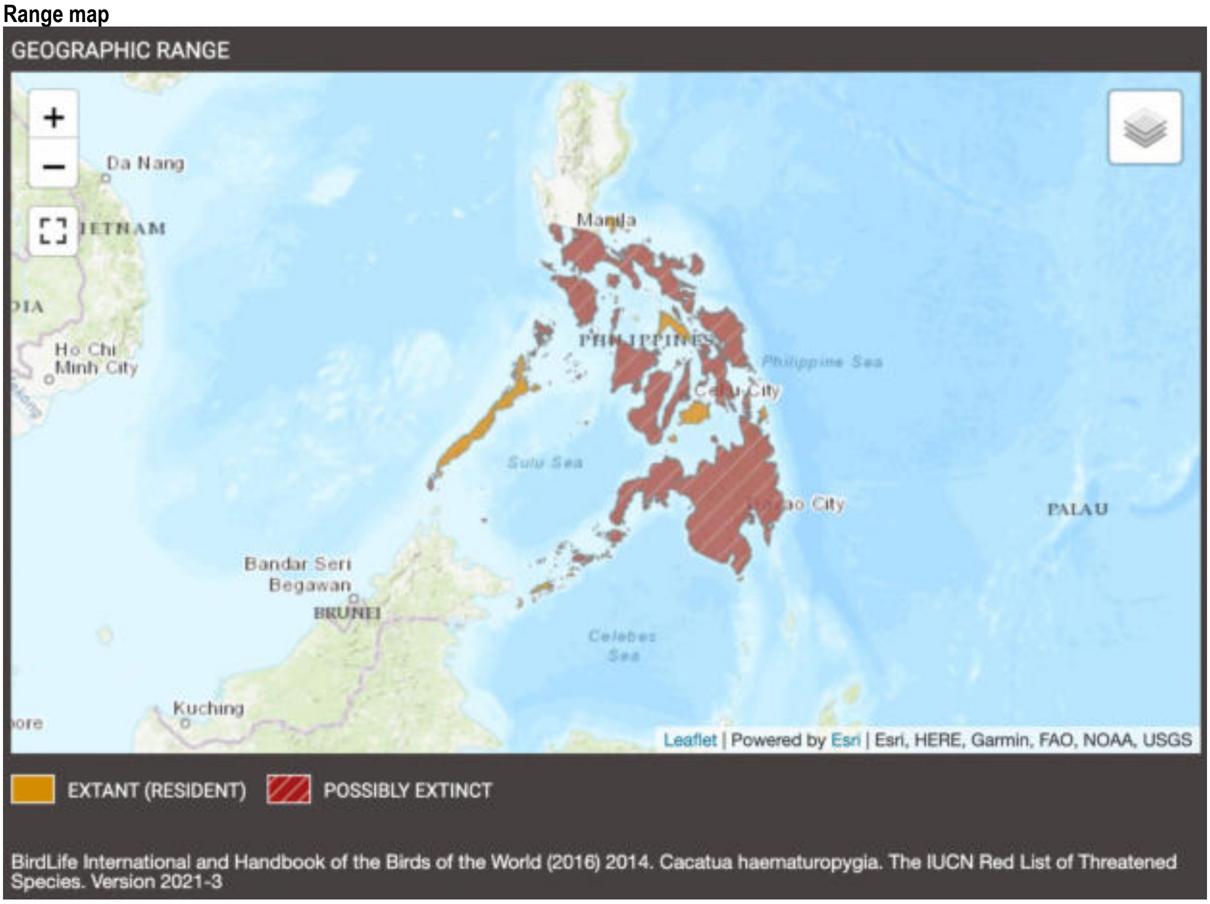
Range map



Source: (1) BirdLife International. 2017. *Cacatua haematuropygia. The IUCN Red List of Threatened Species* 2017: e.T22684795A117578604. https://dx.doi.org/10.2305/IUCN.UK.2017-3.RLTS.T22684795A117578604.en. Accessed on 20 June 2022.

Calidris tenuirostris
Great Knot
(EN)

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(1) BirdLife International. 2019. *Calidris tenuirostris* (amended version of 2016 assessment). *The IUCN Red List of Threatened Species* 2019: e.T22693359A155482913. https://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T22693359A155482913.en. Accessed on 17 June 2022.
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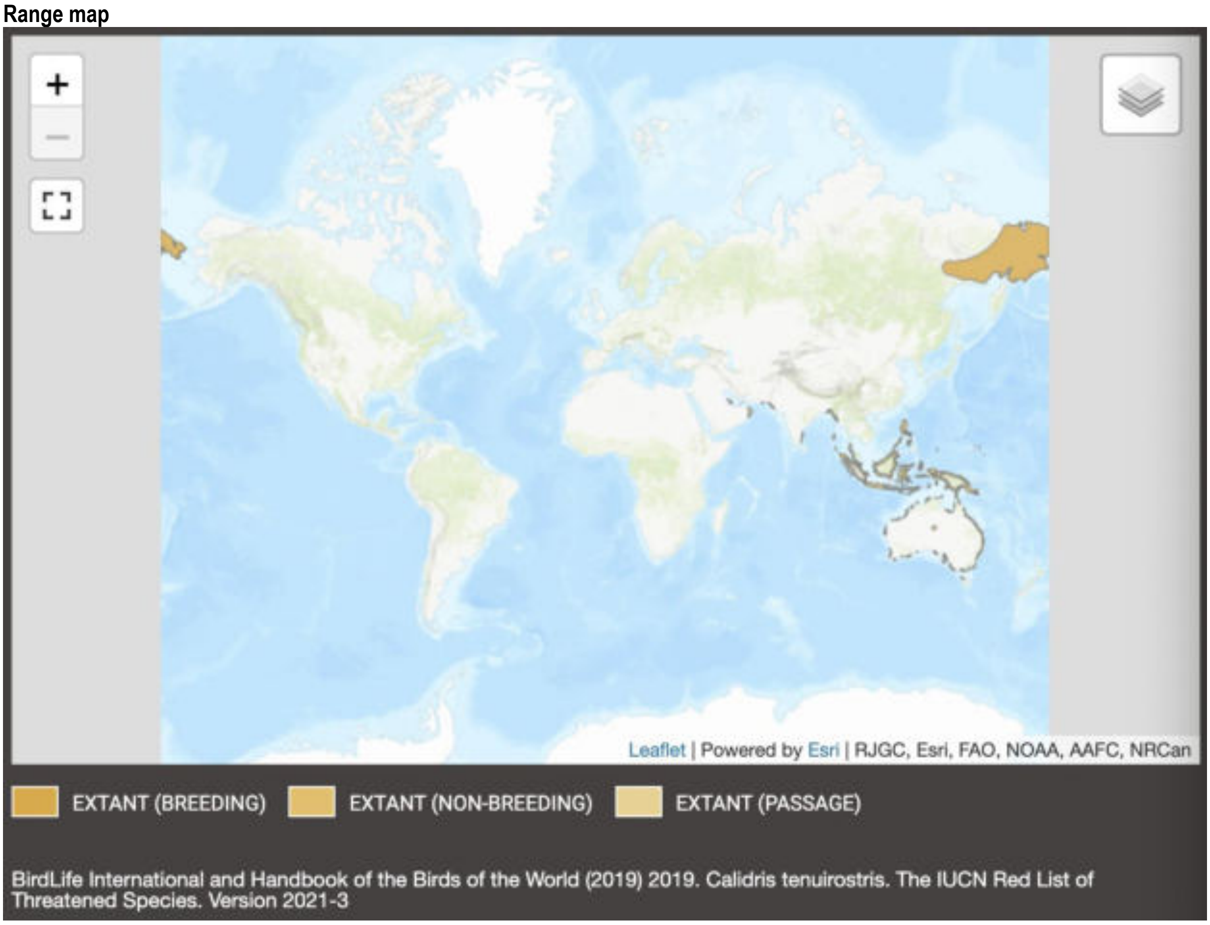
Range map



Source: BirdLife International. 2019. *Calidris tenuirostris* (amended version of 2016 assessment). *The IUCN Red List of Threatened Species* 2019: e.T22693359A155482913. https://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T22693359A155482913.en. Accessed on 17 June 2022.

***Calostoma insigne* (EN)**

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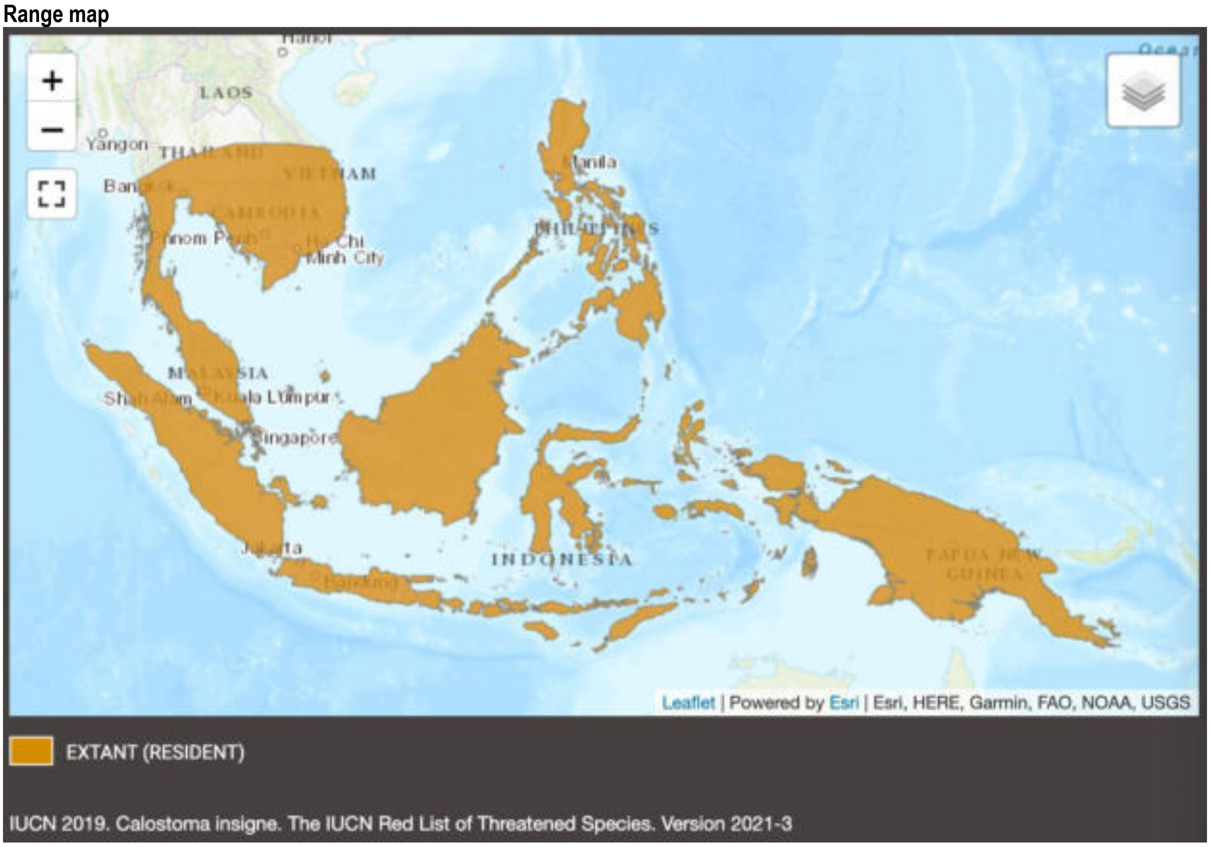
Range map



Source: Ngadin, A.A. 2019. *Calostoma insigne*. *The IUCN Red List of Threatened Species* 2019: e.T125434353A125435555. https://dx.doi.org/10.2305/IUCN.UK.2019-3.RLTS.T125434353A125435555.en. Accessed on 20 June 2022.

***Camptostemon philippinense* (EN)**

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Range map

Source: Duke, N., Kathiresan, K., Salmo III, S.G., Fernando, E.S., Peras, J.R., Sukardjo, S., Miyagi, T., Ellison, J., Koedam, N.E., Wang, Y., Primavera, J., Jin Eong, O., Wan-Hong Yong, J. & Ngoc Nam, V. 2010. *Camptostemon philippinense. The IUCN Red List of Threatened Species* 2010: e.T178808A7612909. https://dx.doi.org/10.2305/IUCN.UK.2010-2.RLTS.T178808A7612909.en. Accessed on 20 June 2022.

Carcharhinus amblyrhynchos
Grey Reef Shark
(EN)

Sources consulted

(1) Simpfendorfer, C., Fahmi, Bin Ali, A., , D., Utzurrum, J.A.T., Seyha, L., Maung, A., Bineesh, K.K., Yuneni, R.R., Sianipar, A., Haque, A.B., Tanay, D., Gautama, D.A. & Vo, V.Q. 2020. *Carcharhinus amblyrhynchos*. *The IUCN Red List of Threatened Species* 2020: e.T39365A173433550. https://dx.doi.org/10.2305/IUCN.UK.2020-3.RLTS.T39365A173433550.en. Accessed on 17 June 2022.
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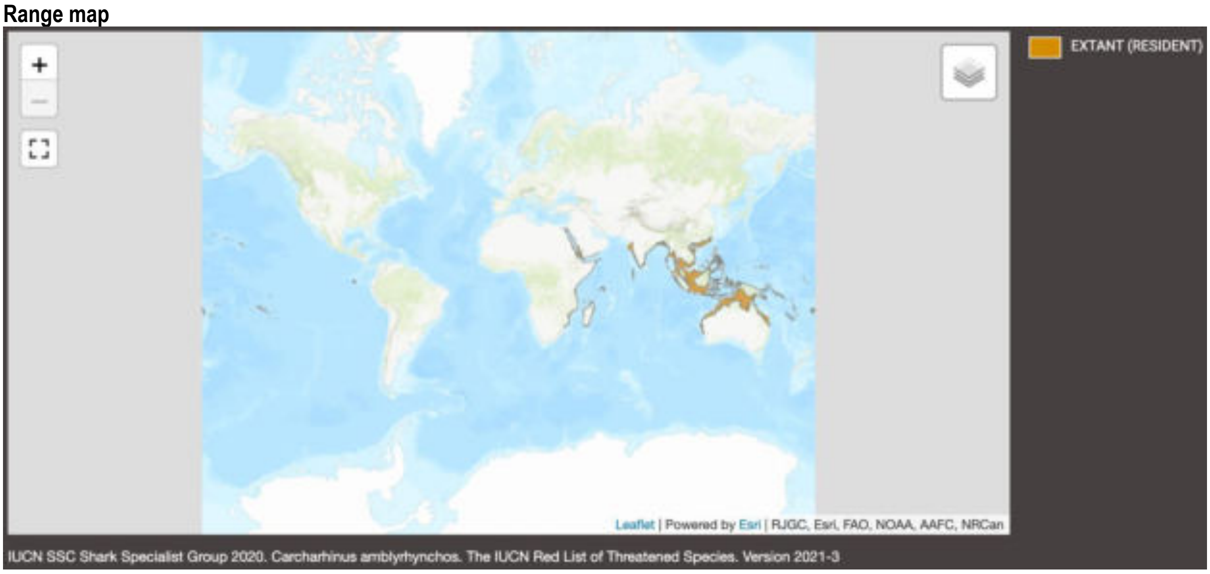
Range map



Source: Simpfendorfer, C., Fahmi, Bin Ali, A., , D., Utzurrum, J.A.T., Seyha, L., Maung, A., Bineesh, K.K., Yuneni, R.R., Sianipar, A., Haque, A.B., Tanay, D., Gautama, D.A. & Vo, V.Q. 2020. *Carcharhinus amblyrhynchos*. *The IUCN Red List of Threatened Species* 2020: e.T39365A173433550. https://dx.doi.org/10.2305/IUCN.UK.2020-3.RLTS.T39365A173433550.en. Accessed on 17 June 2022.

Carcharhinus borneensis
Borneo Shark
(CR)

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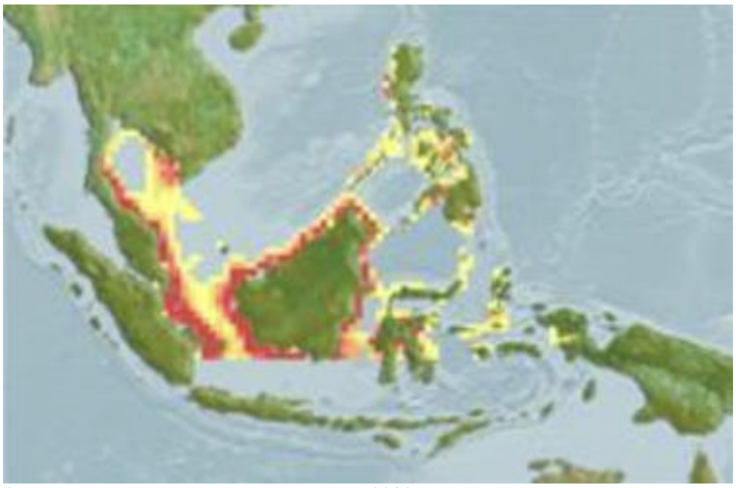

Source: Froese, R. and D. Pauly. Editors. 2022.FishBase. World Wide Web electronic publication. www.fishbase.org. Accessed 1 July 2022.

Carcharhinus longimanus
Oceanic whitetip shark
(CR)

Sources consulted

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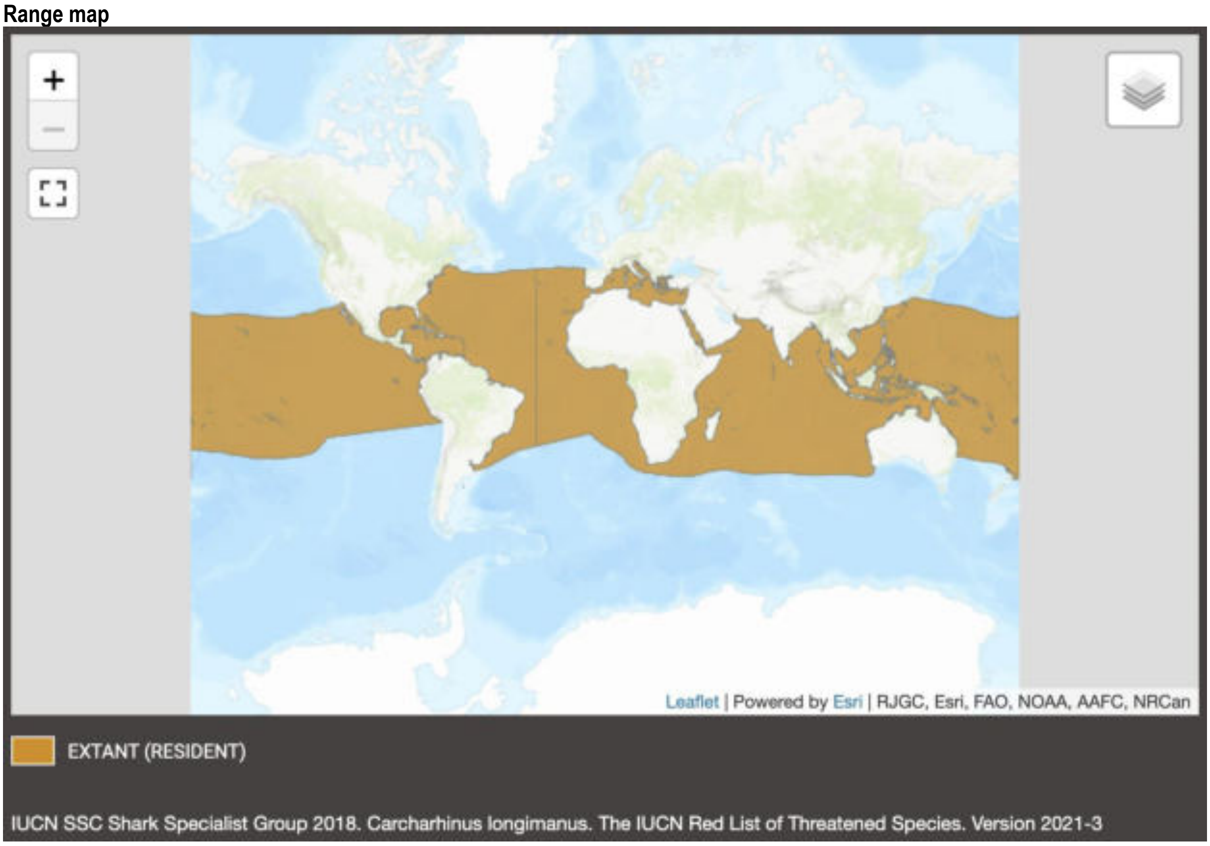
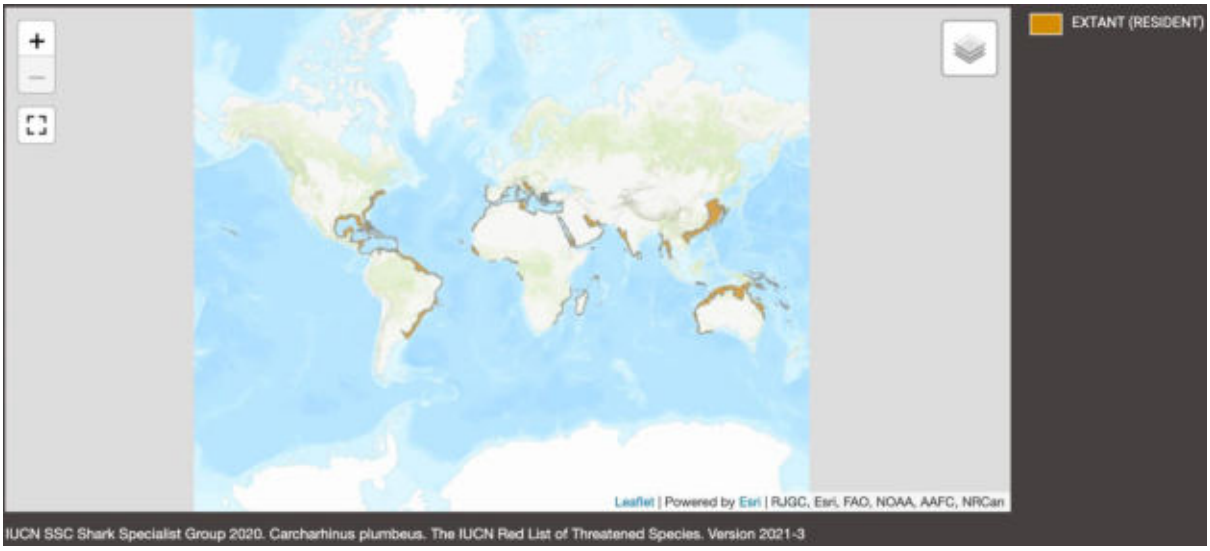
Range map



Source: Rigby, C.L., Barreto, R., Carlson, J., Fernando, D., Fordham, S., Francis, M.P., Herman, K., Jabado, R.W., Liu, K.M., Marshall, A., Pacoureau, N., Romanov, E., Sherley, R.B. & Winker, H. 2019. Carcharhinus longimanus. The IUCN Red List of Threatened Species 2019: e.T39374A2911619. https://dx.doi.org/10.2305/IUCN.UK.2019-3.RLTS.T39374A2911619.en. Accessed on 25 April 2022.

Carcharhinus plumbeus **Sandbar Shark** **(EN)**
Sources consulted
(1) Rigby, C.L., Derrick, D., Dicken, M., Harry, A.V., Pacoureau, N. & Simpfendorfer, C. 2021. *Carcharhinus plumbeus*. *The IUCN Red List of Threatened Species* 2021: e.T3853A2874370. https://dx.doi.org/10.2305/IUCN.UK.2021-2.RLTS.T3853A2874370.en. Accessed on 01 July 2022. (2) Froese, R. and D. Pauly. Editors. 2022.FishBase. World Wide Web electronic publication. www.fishbase.org. Accessed 1 July 2022.
Range map
 Source: Rigby, C.L., Derrick, D., Dicken, M., Harry, A.V., Pacoureau, N. & Simpfendorfer, C. 2021. *Carcharhinus plumbeus*. *The IUCN Red List of Threatened Species* 2021: e.T3853A2874370. https://dx.doi.org/10.2305/IUCN.UK.2021-2.RLTS.T3853A2874370.en. Accessed on 01 July 2022.

Cephaloscyllium fasciatum
Reticulated Swellshark
(CR)

Sources consulted

(1) Dulvy, N.K., Bineesh, K.K., Cheok, J., Dharmadi, Finucci, B., Rigby, C.L. & Sherman, C.S. 2020. *Cephaloscyllium fasciatum. The IUCN Red List of Threatened Species* 2020: e.T162207827A162870102. https://dx.doi.org/10.2305/IUCN.UK.2020-3.RLTS.T162207827A162870102.en. Accessed on 17 June 2022.

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Range map

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Cerberus microlepis
Lake Buhi Bockadam
(EN)

Sources consulted

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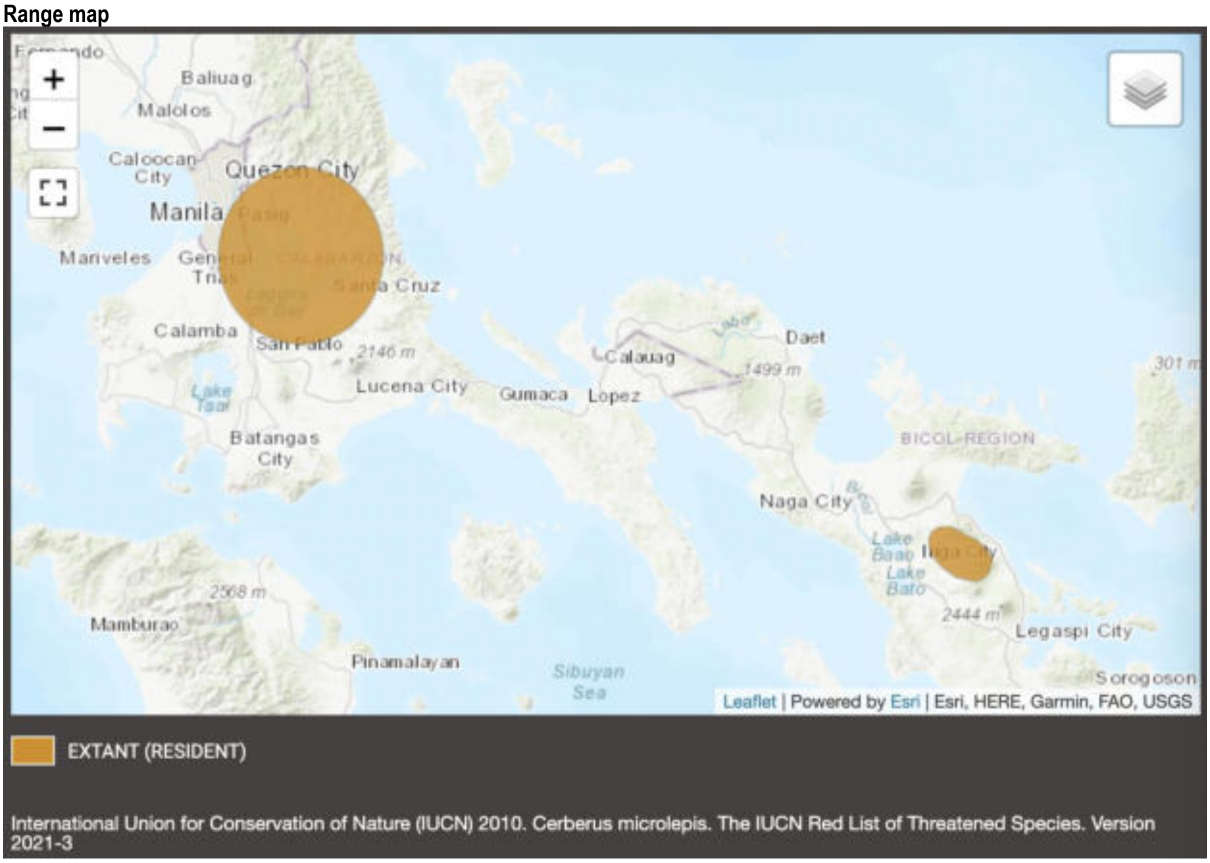
Range map



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Chelonia mydas
Green Turtle
(EN)

Sources consulted

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Range map

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Clupea manulensis (CR)
Sources consulted
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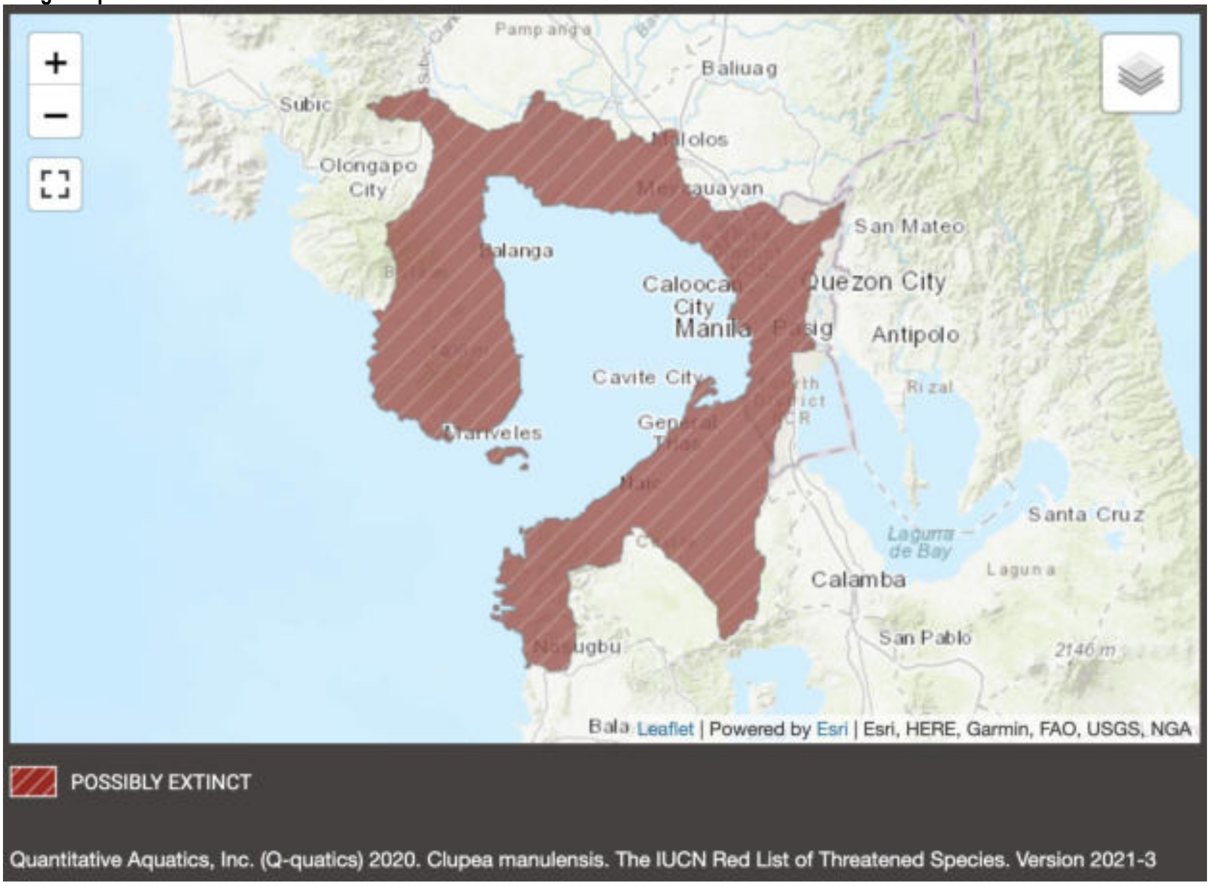
Range map



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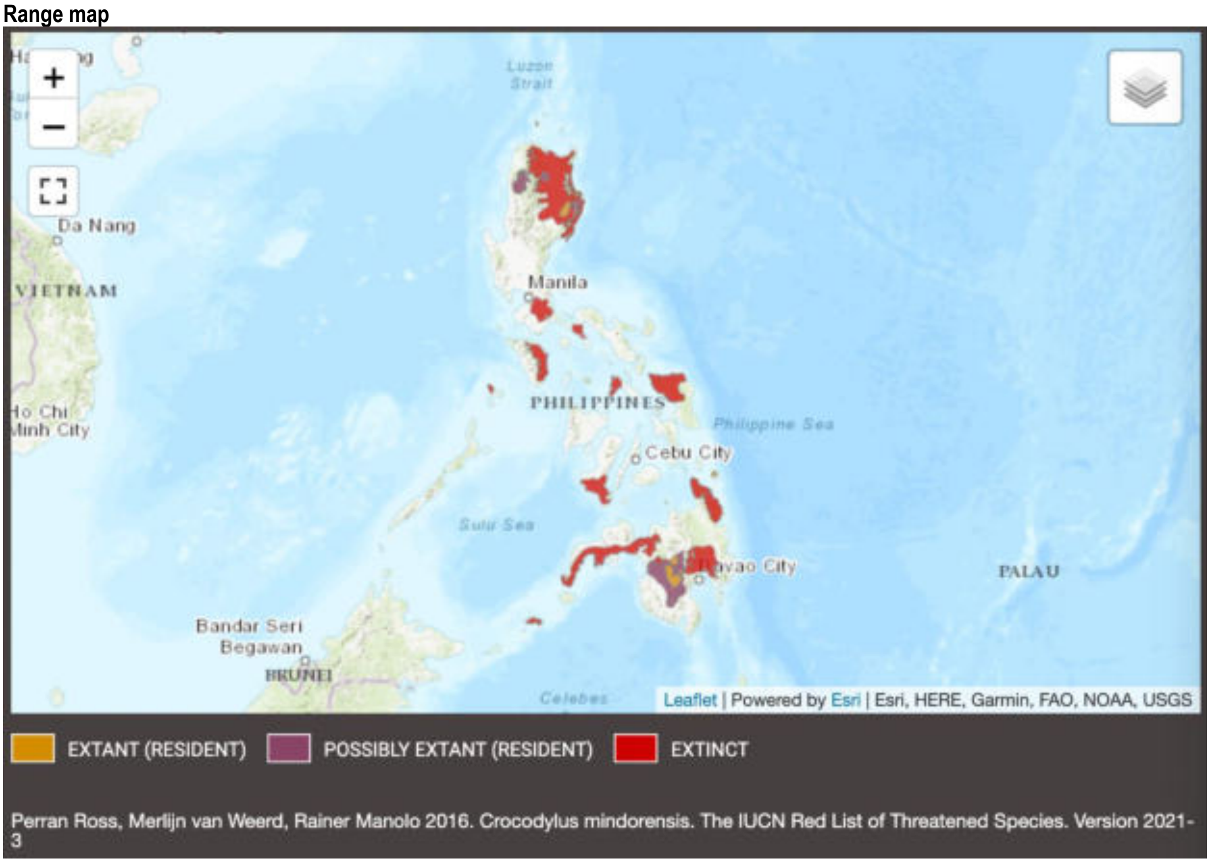
Crocodylus mindorensis
Philippine Crocodile
(CR)

Sources consulted

(1) van Weerd, M., C. Pomaro, C., de Leon, J., Antolin, R. & Mercado, V. 2016. *Crocodylus mindorensis*. *The IUCN Red List of Threatened Species* 2016: e.T5672A3048281. https://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T5672A3048281.en. Accessed on 20 June 2022.

Range map



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Cuora amboinensis
Southeast Asian Box Turtle
(EN)

Sources consulted

(1) Cota, M., Hoang, H., Horne, B.D., Kusrini, M.D., McCormack, T., Platt, K., Schoppe, S. & Shepherd, C. 2020. *Cuora amboinensis*. *The IUCN Red List of Threatened Species* 2020: e.T5958A3078812. https://dx.doi.org/10.2305/IUCN.UK.2020-2.RLTS.T5958A3078812.en. Accessed on 20 June 2022.

Range map

Source: Cota, M., Hoang, H., Horne, B.D., Kusrini, M.D., McCormack, T., Platt, K., Schoppe, S. & Shepherd, C. 2020. *Cuora amboinensis*. *The IUCN Red List of Threatened Species* 2020: e.T5958A3078812. https://dx.doi.org/10.2305/IUCN.UK.2020-2.RLTS.T5958A3078812.en. Accessed on 20 June 2022.

Dasylophus superciliosus
Red-Crested Malkoha
(LC)

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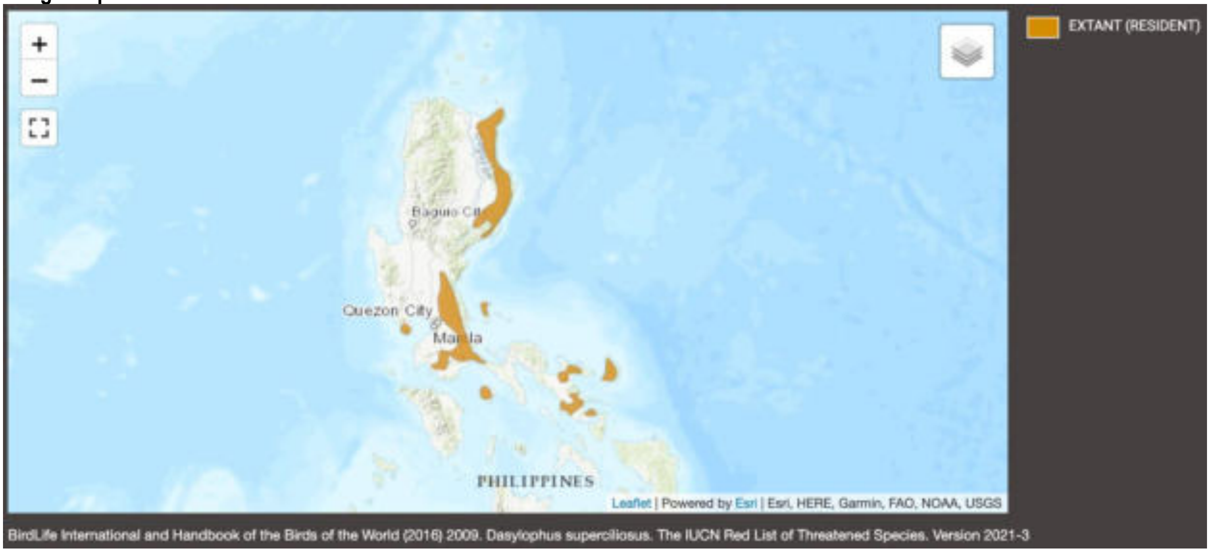
Range map



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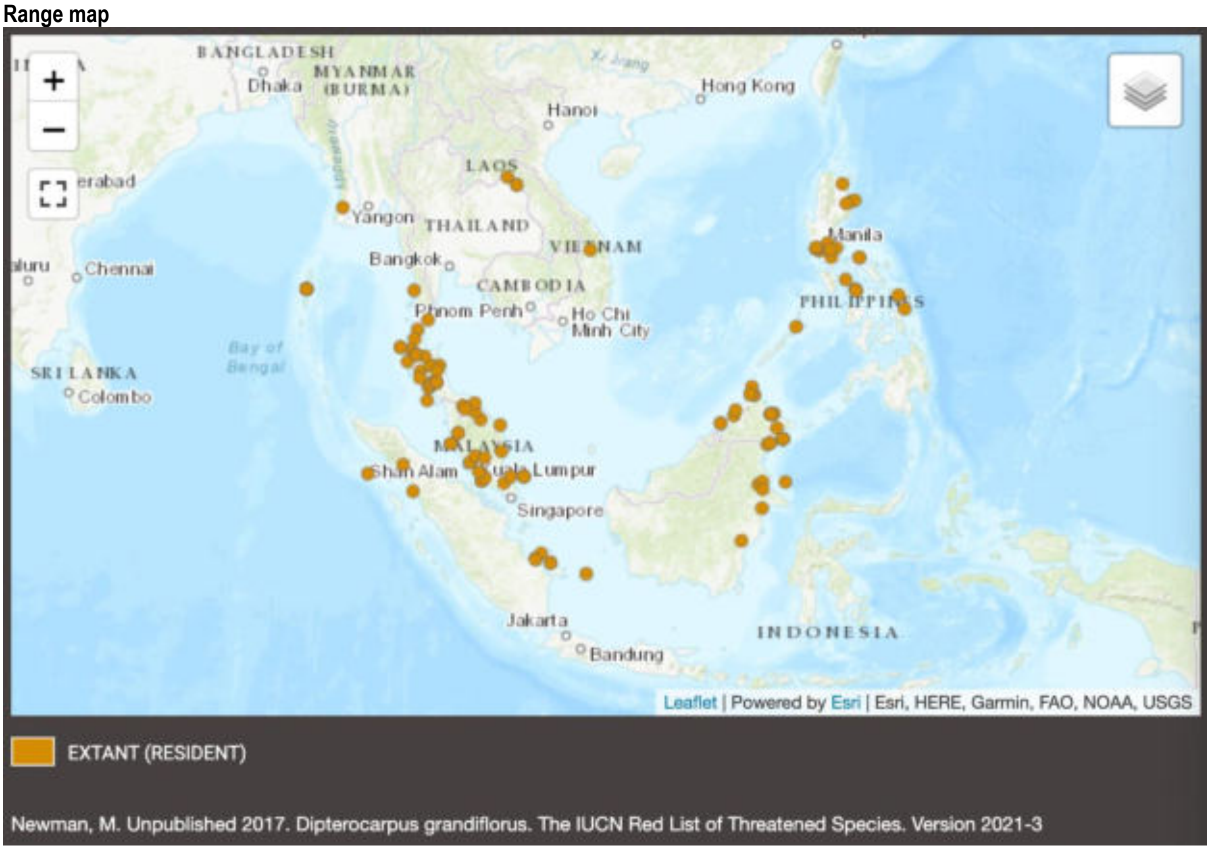
Dipterocarpus grandiflorus
(EN)

Sources consulted

(1) Ly, V., Nanthavong, K., Pooma, R., Luu, H.T., Vu, V.D., Barstow, M., Nguyen, H.N., Hoang, V.S., Khou, E. & Newman, M.F. 2017. *Dipterocarpus grandiflorus*. *The IUCN Red List of Threatened Species* 2017: e.T33012A2830533. https://dx.doi.org/10.2305/IUCN.UK.2017-3.RLTS.T33012A2830533.en. Accessed on 20 June 2022.

Range map



Source: Ly, V., Nanthavong, K., Pooma, R., Luu, H.T., Vu, V.D., Barstow, M., Nguyen, H.N., Hoang, V.S., Khou, E. & Newman, M.F. 2017. *Dipterocarpus grandiflorus*. *The IUCN Red List of Threatened Species* 2017: e.T33012A2830533. https://dx.doi.org/10.2305/IUCN.UK.2017-3.RLTS.T33012A2830533.en. Accessed on 20 June 2022.

Drepanosticta makilingia
(CR)

Sources consulted

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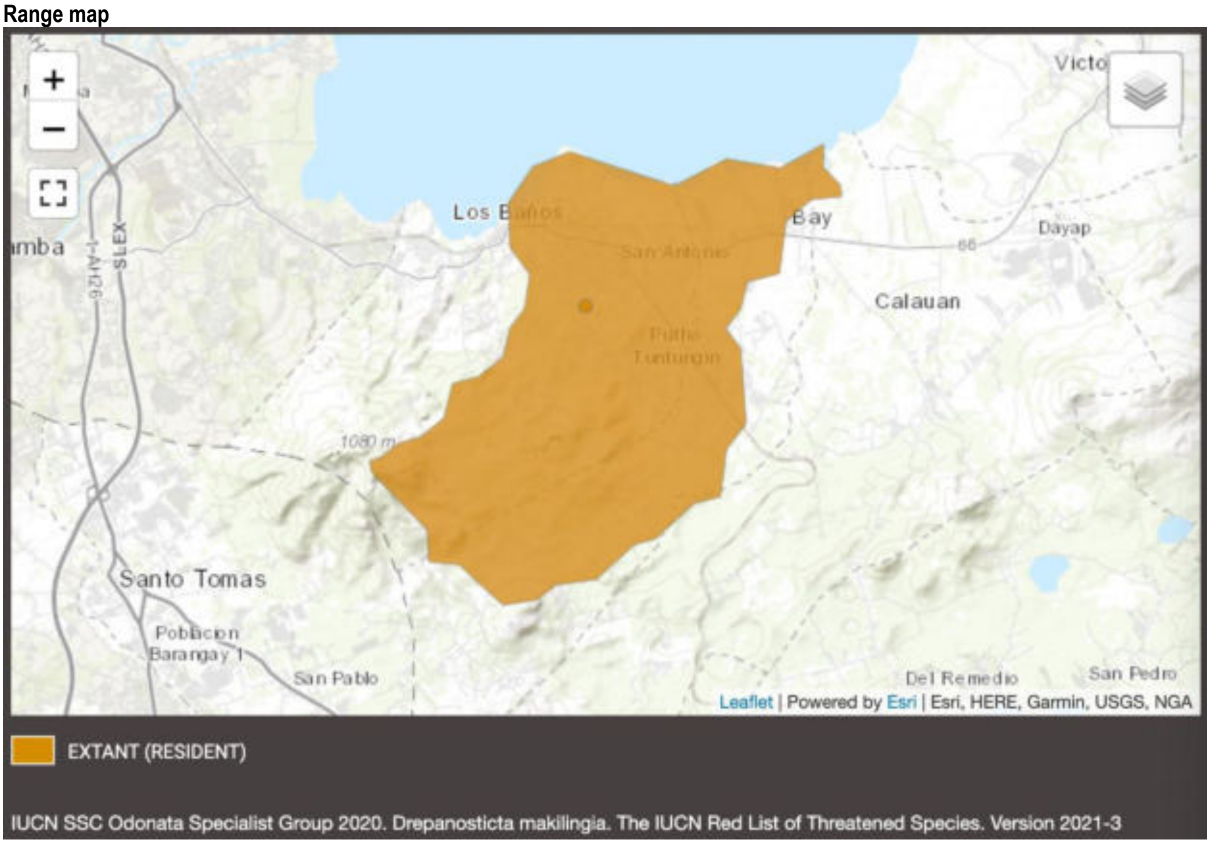
Range map



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Drepanosticta trimaculata
(CR)

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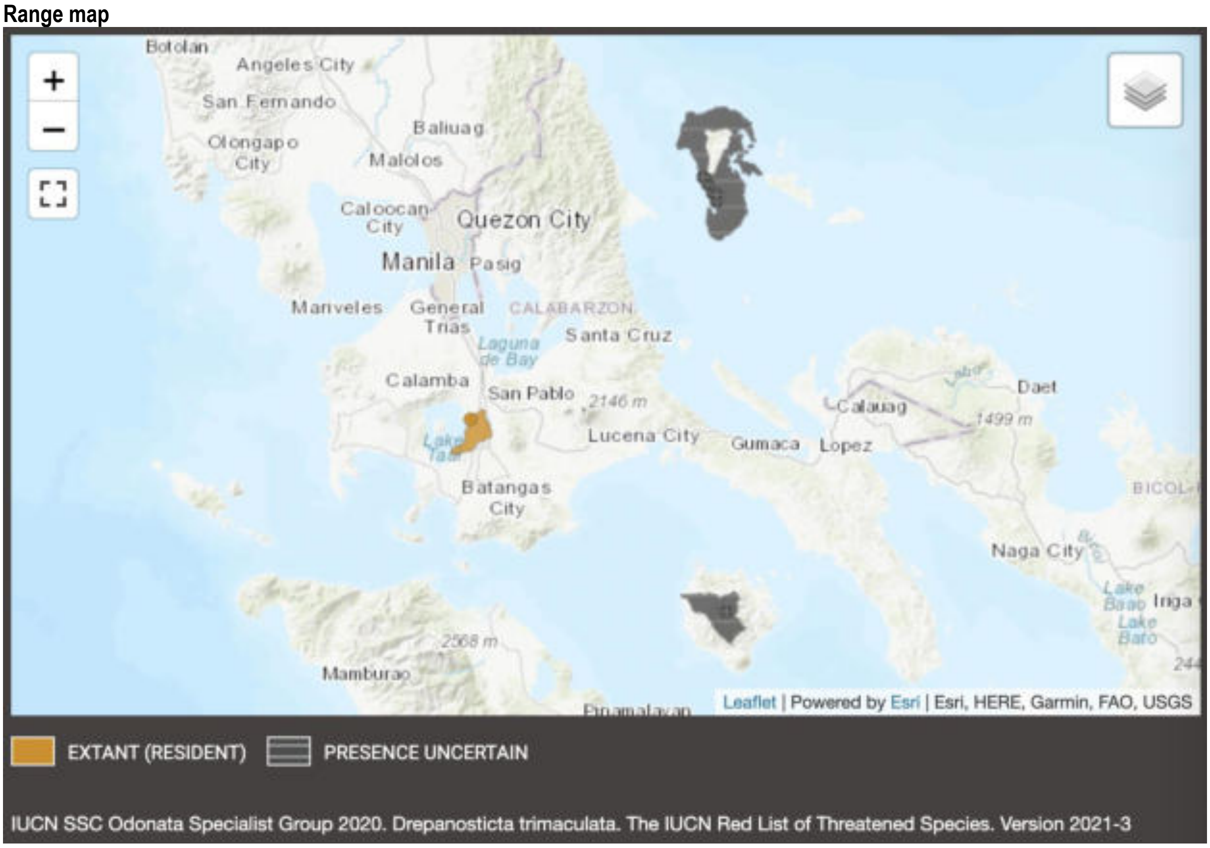
Range map



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Eretmochelys imbricata
Hawksbill Turtle
(CR)

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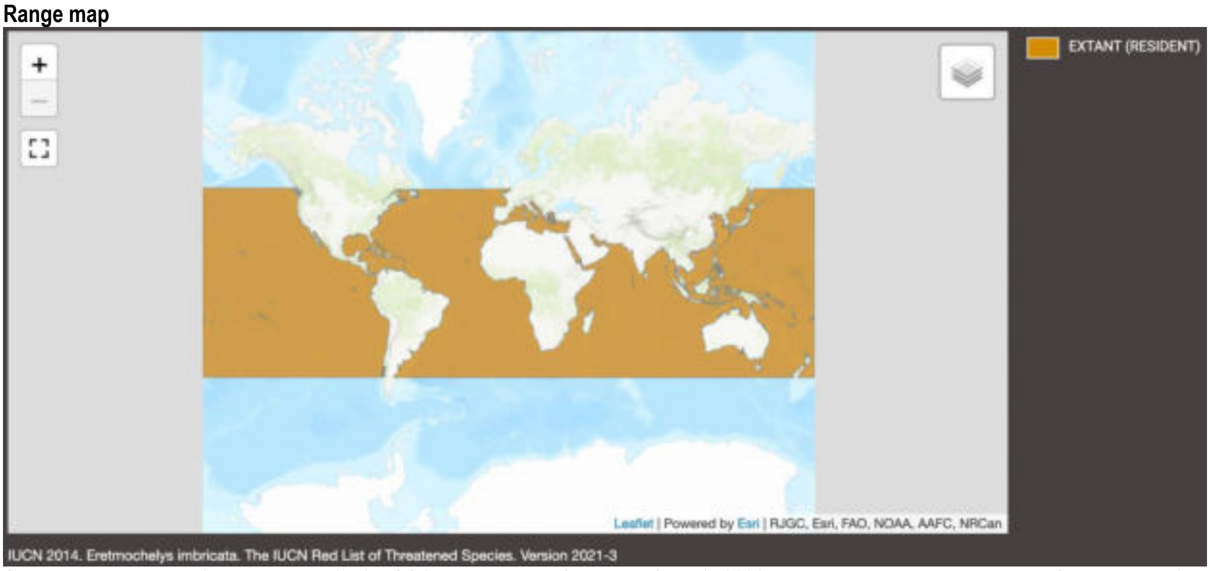
Range map



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Erythropitta kochi
Whiskered Pitta
(NT)

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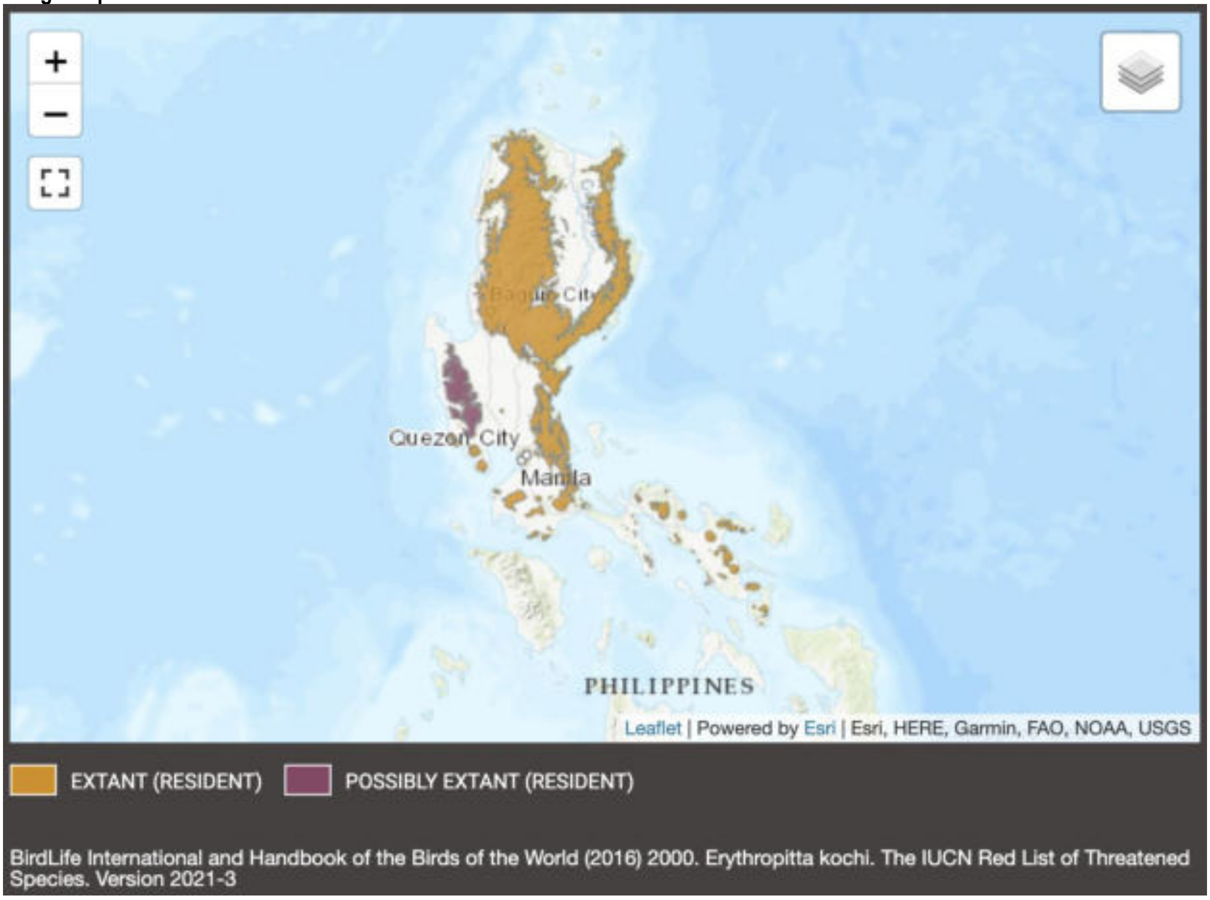
Range map



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Eusphyra blochii
Winghead Shark
(EN)

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Range map

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Ficedula disposita
Furtive Flycatcher
(NT)

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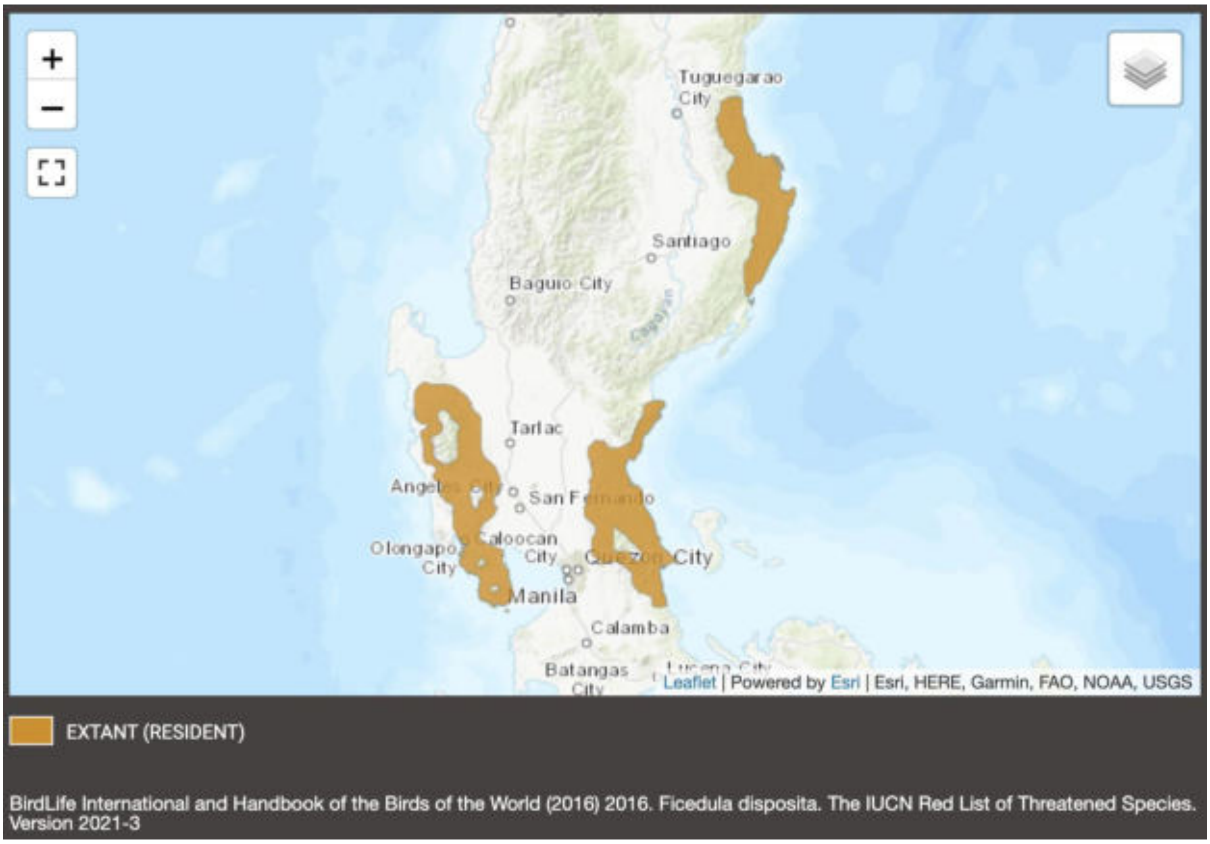
Range map



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Fregata minor
Great Frigatebird
(LC)

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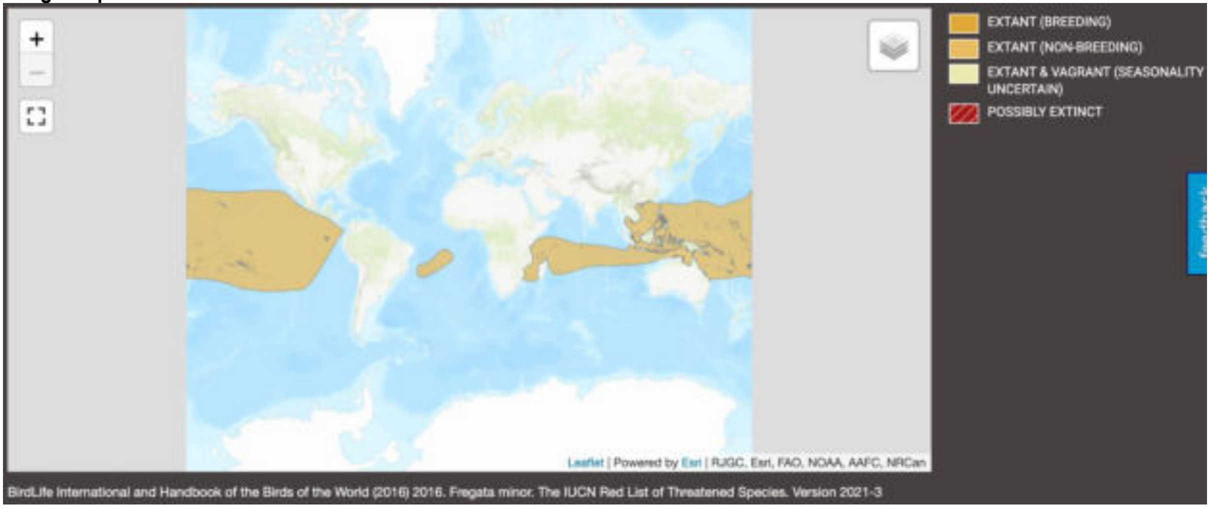

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Gymnura zonura
Zonetail Butterfly Ray
(EN)

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Hemitriakis leucoperiptera Whitefin Topeshark (CR)
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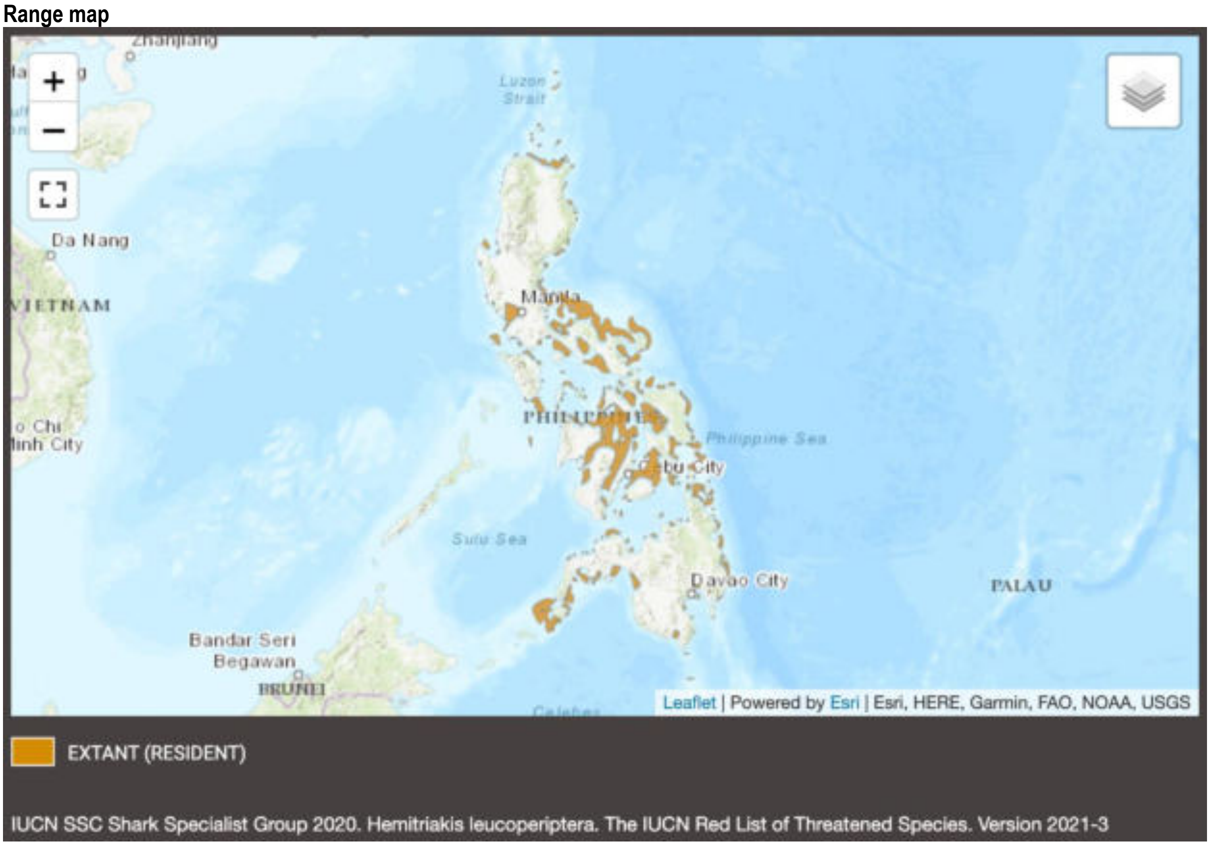
Range map

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Himantura uarnak
Reticulate Whipray
(EN)

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Holothuria lessoni
Golden Sandfish
(EN)

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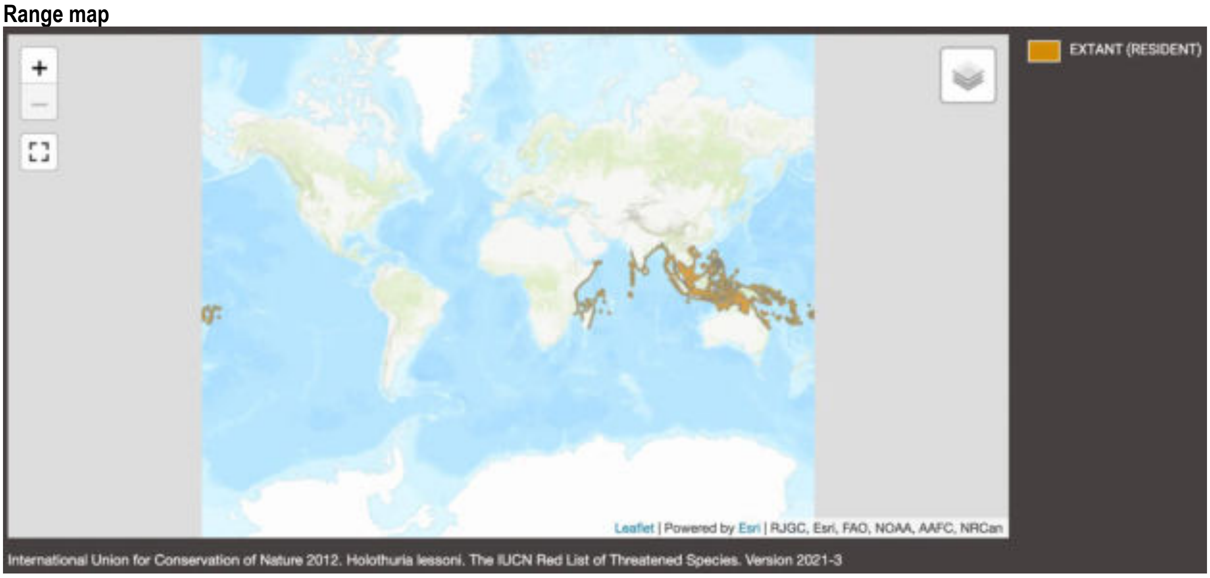
Range map



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Holothuria scabra
Golden Sandfish
(EN)

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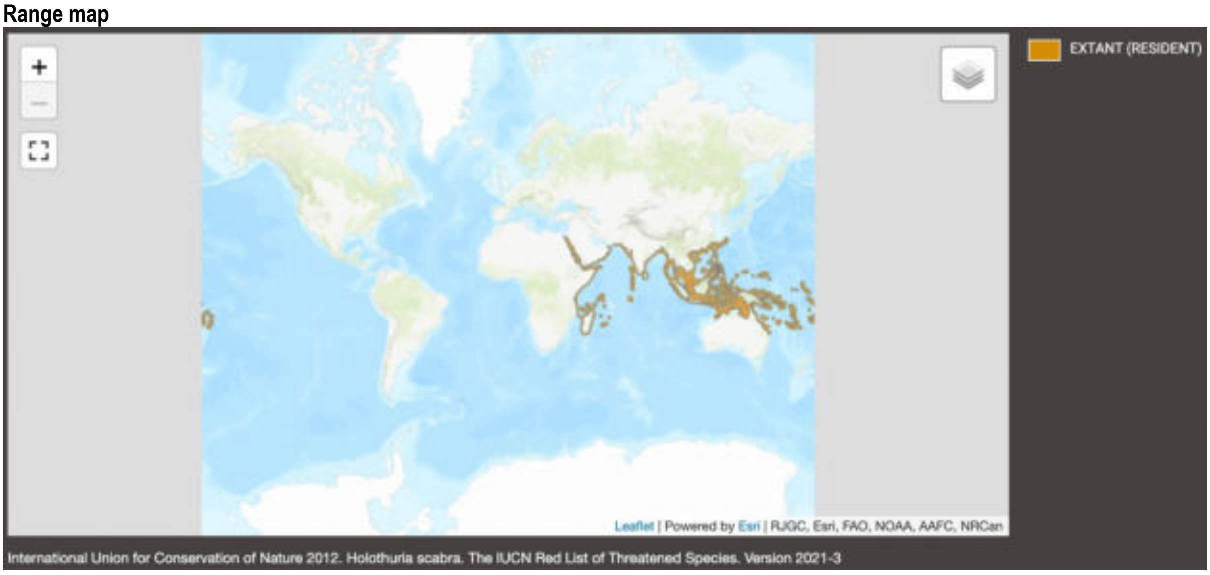
Range map



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Holothuria whitmaei
Black Teatfish
(EN)

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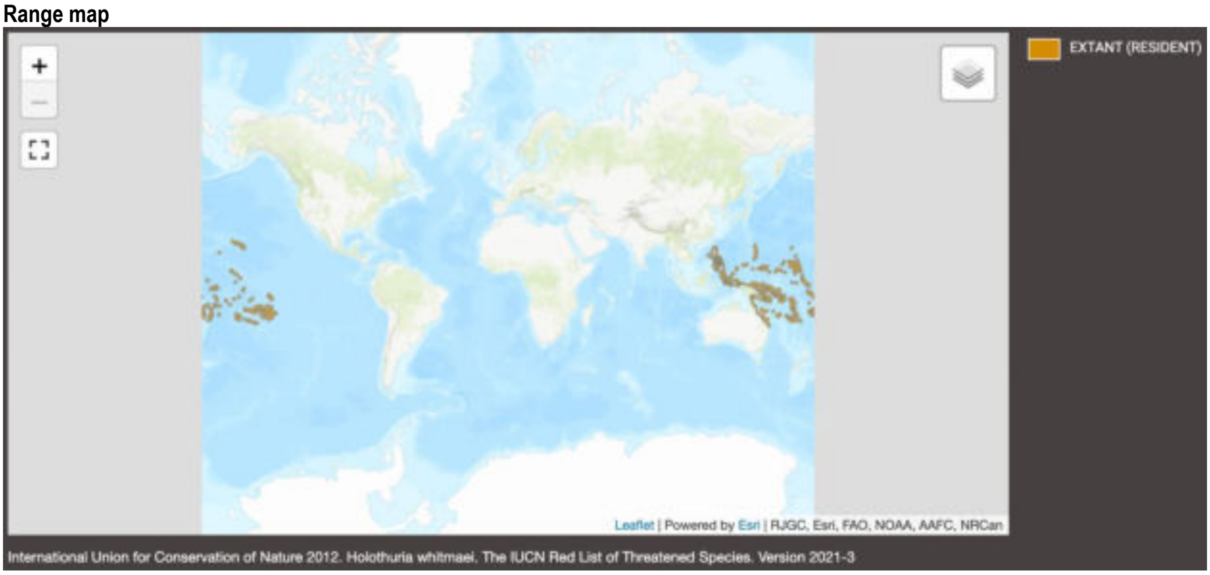
Range map



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Isurus oxyrinchus
Shortfin Mako
(EN)

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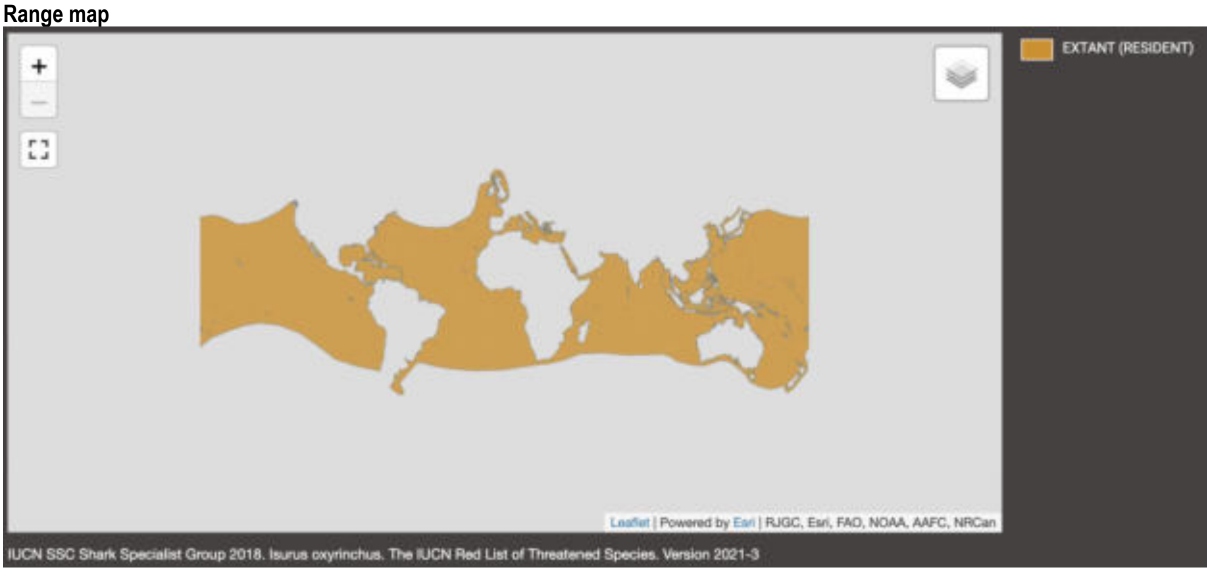
Range map



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Isurus paucas
Longfin Mako
(EN)

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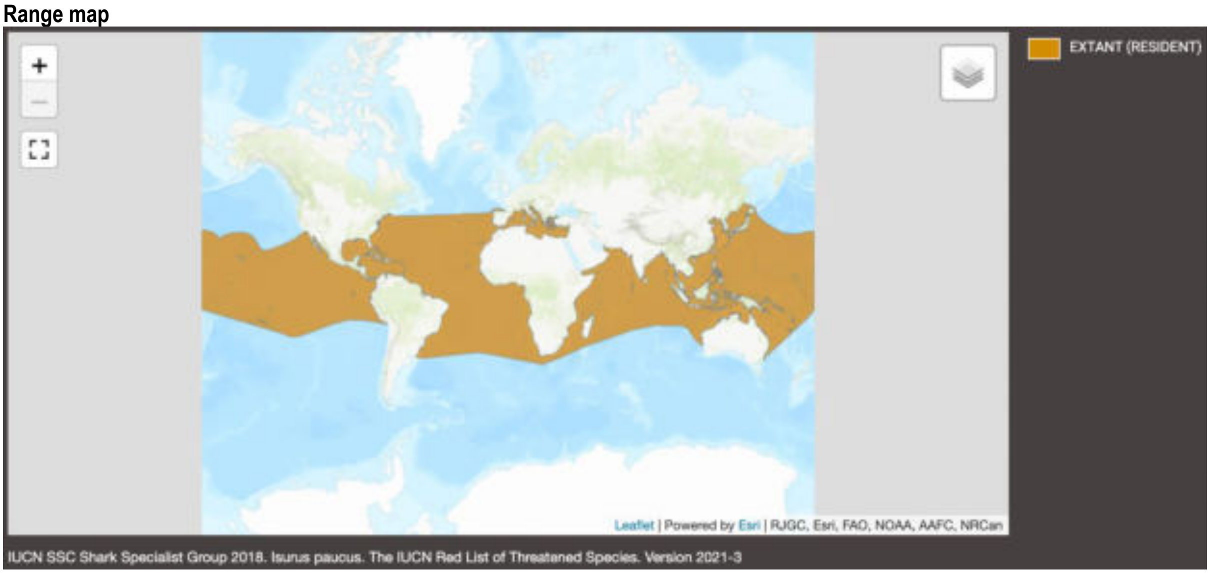
Range map



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Lepidogrammus cumingi
Scale-Feathered Malkoha
(LC)

Sources consulted

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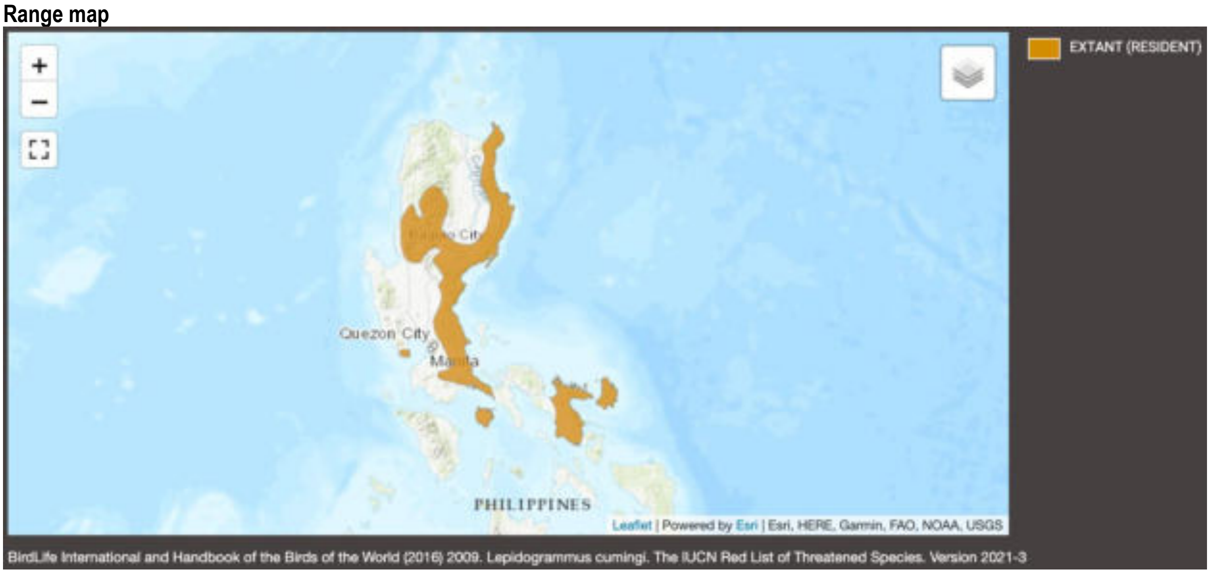
Range map



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Lobophyllia serratus
(EN)

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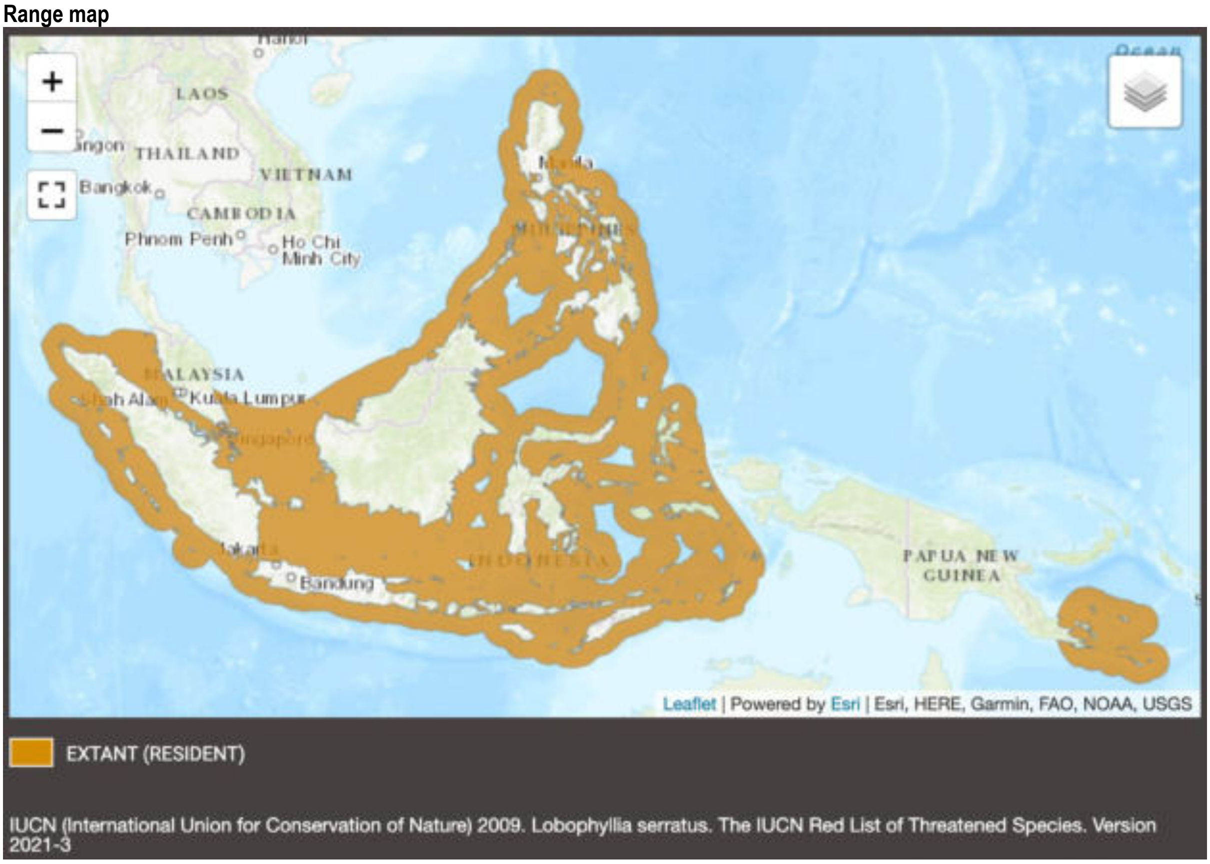
Range map



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Lonchura oryzivora
Java Sparrow
(EN)

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Range map

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Macromia negrito
(EN)

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Range map

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Maculabatis macrura
Sharpnose Whipray
(EN)

Sources consulted

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Mobula birostris
Giant Manta Ray
(EN)

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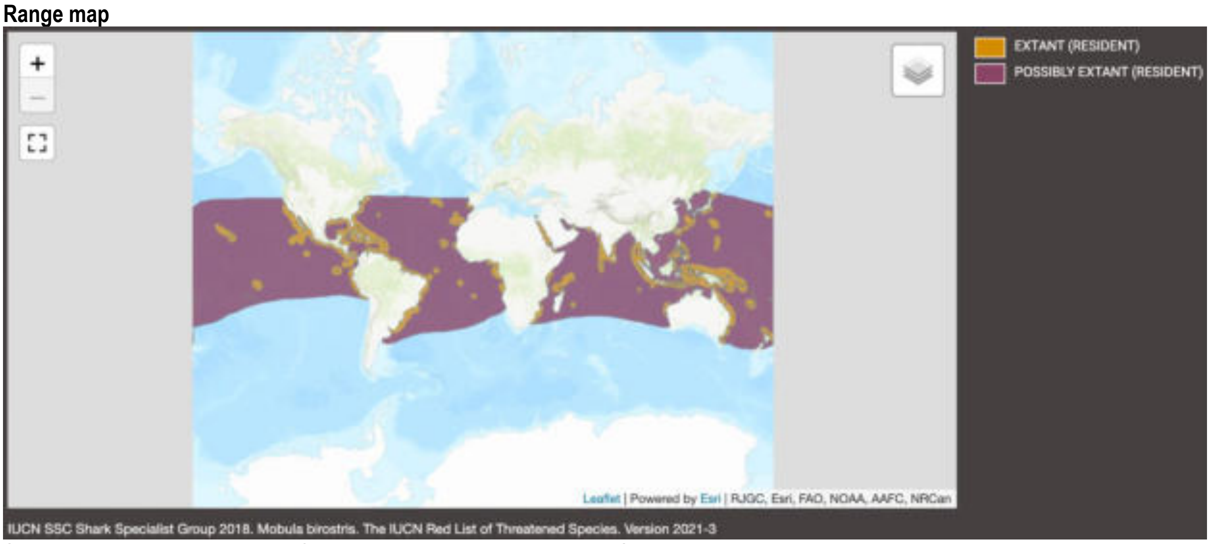

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Mobula kuhlii
Shortfin Devilray
(EN)

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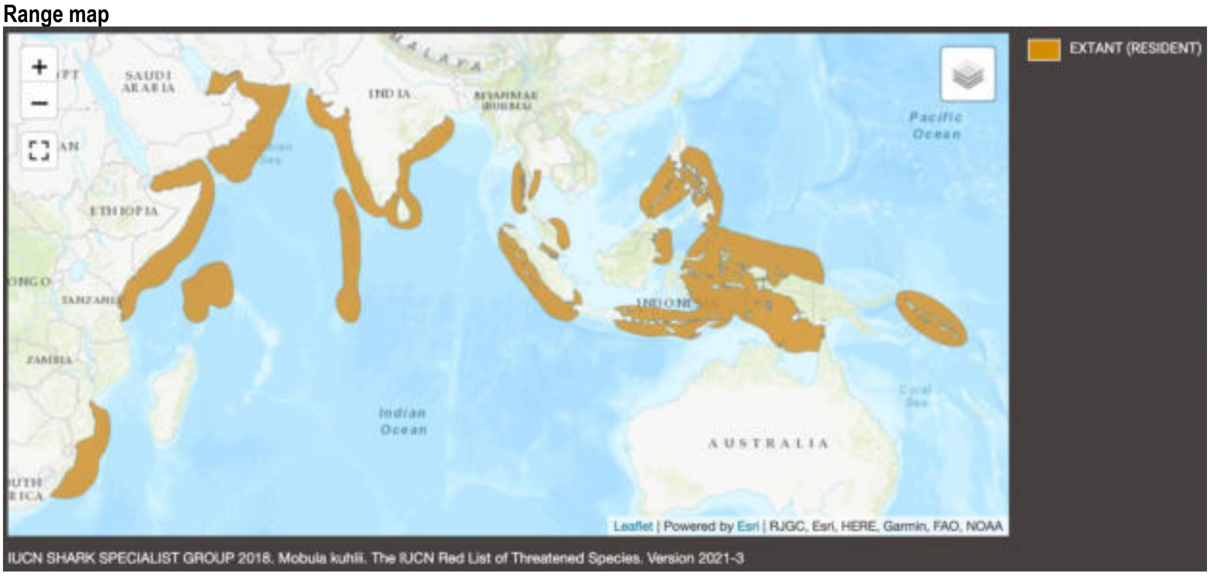
Range map



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Mobula mobular
Spinetail Devilray
(EN)

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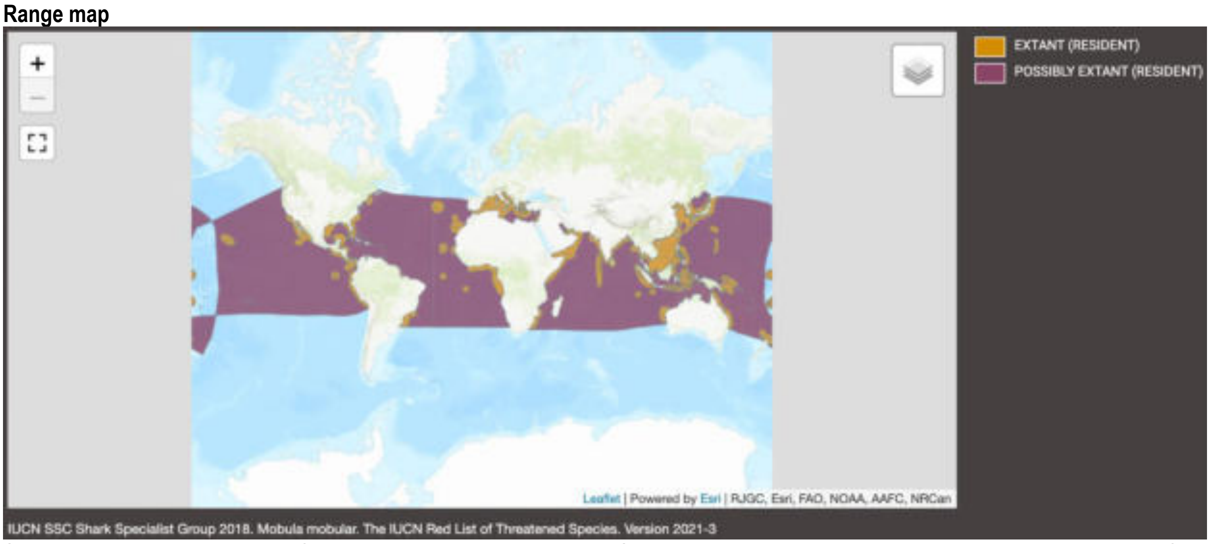
Range map



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Mobula tarapacana
Sicklefin Devilray
(EN)

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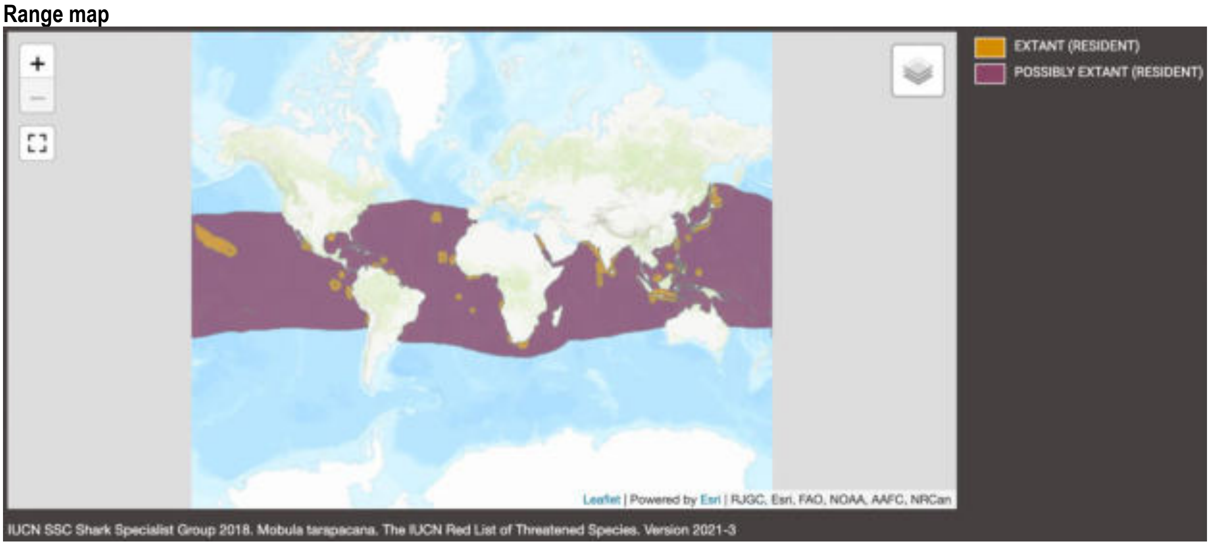
Range map



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Mobula thurstoni
Bentfin Devilray
(EN)

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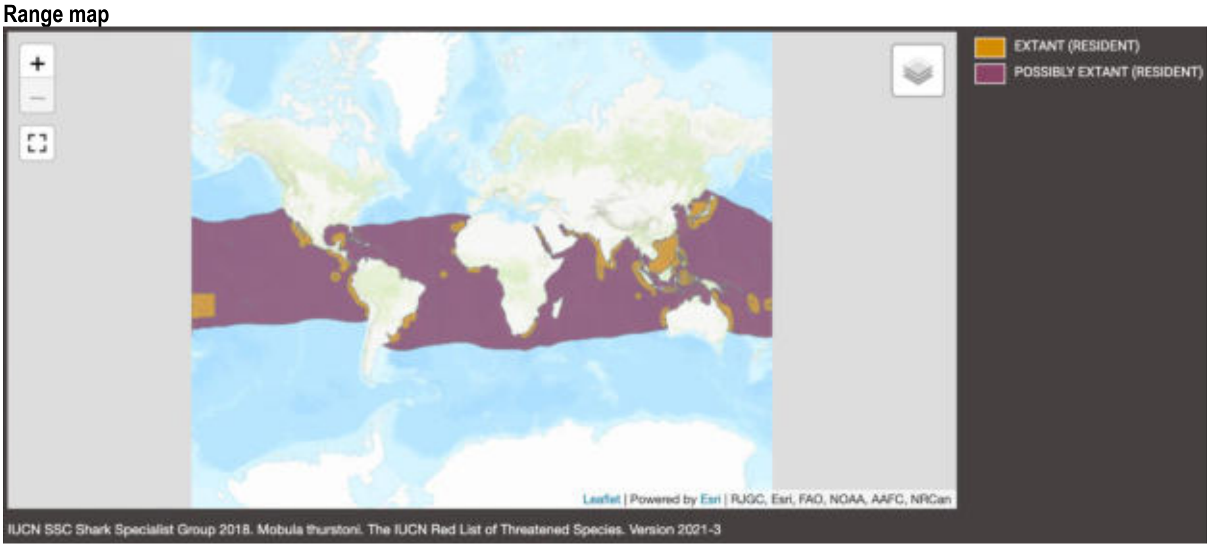
Range map



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Montipora setosa (EN)

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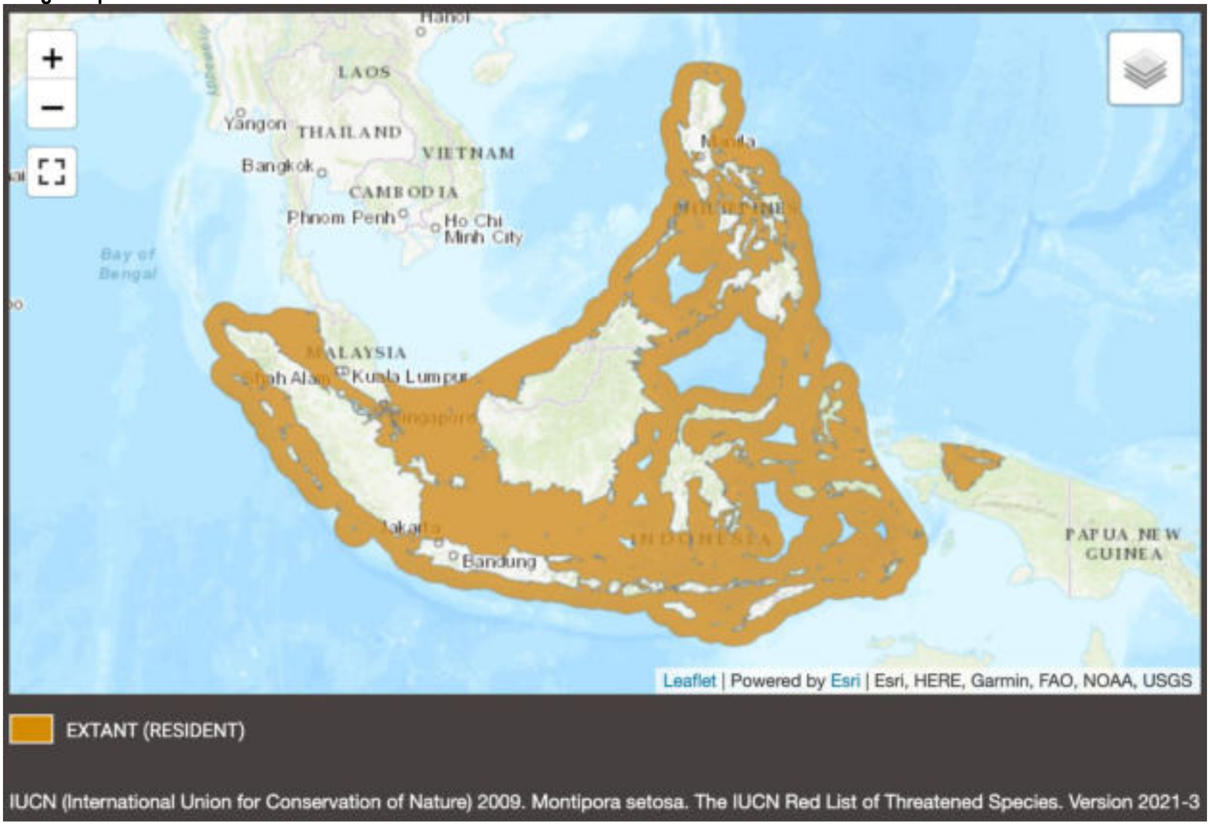
Range map



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Nisaetus philippensis
North Philippine Hawk-Eagle
(EN)

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Range map

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Numenius madagascariensis
Far Eastern Curlew
(EN)

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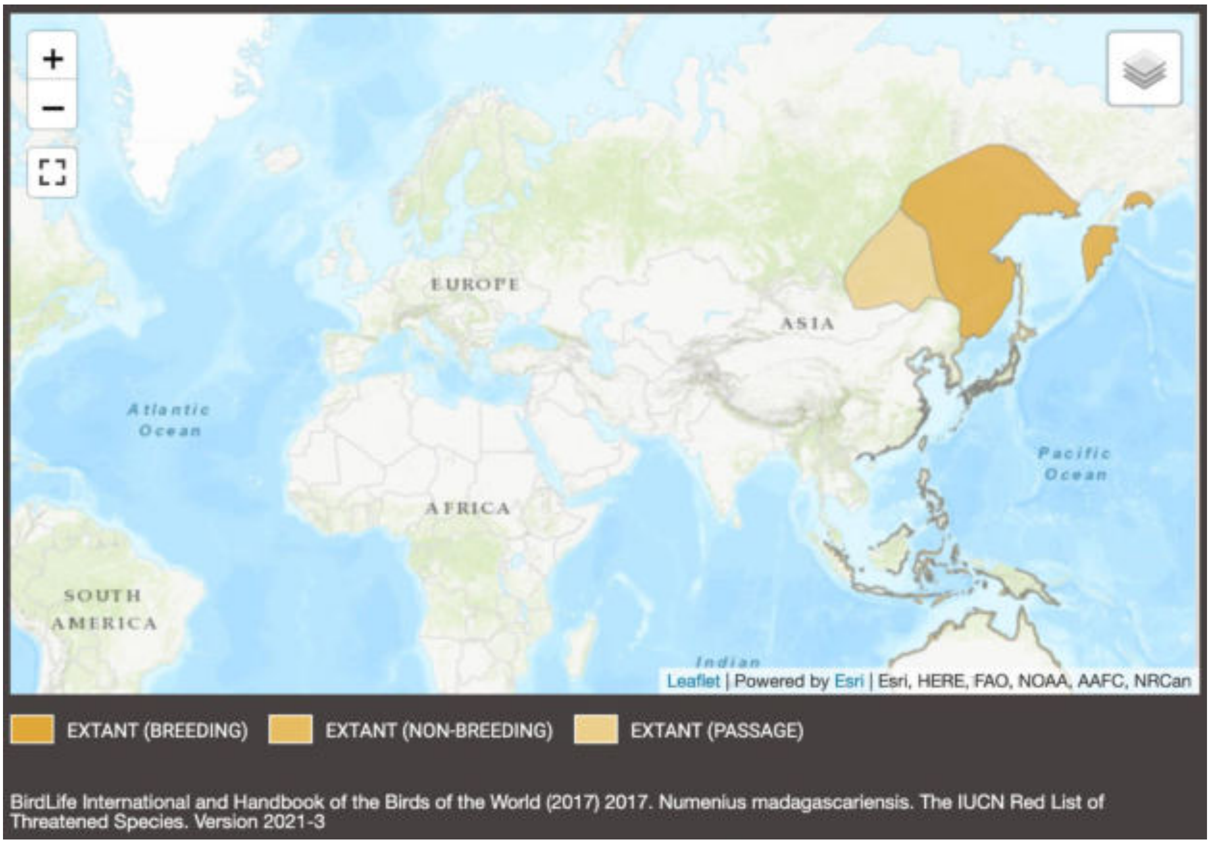

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Oriolus albiloris
White-Lored Oriole
(LC)

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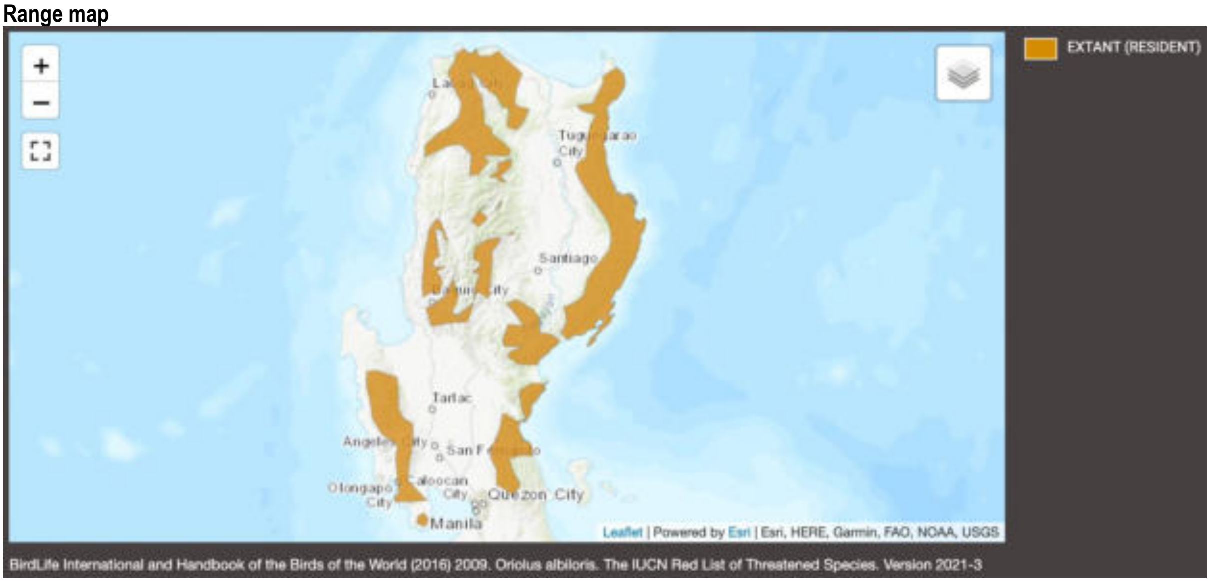
Range map



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Oriolus isabellae
Isabela Oriole
(CR)

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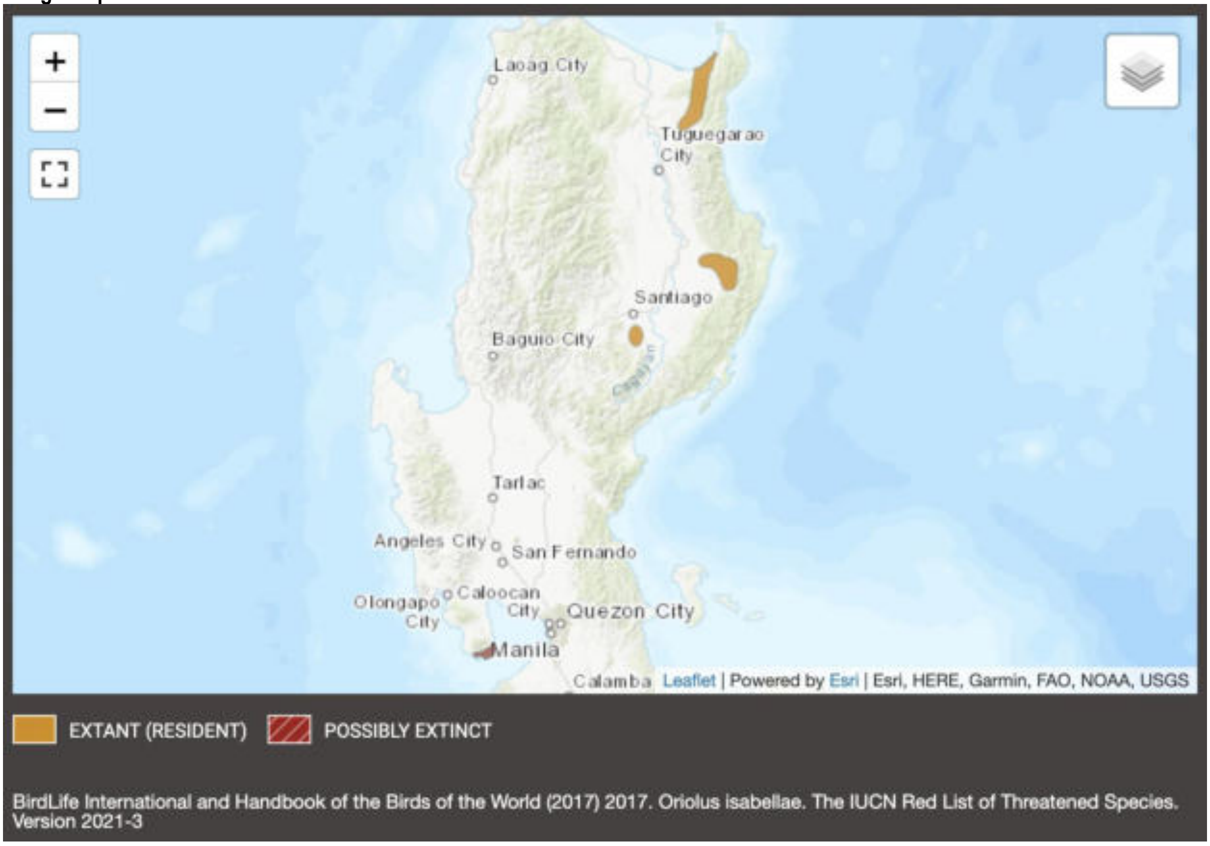

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Pectinia maxima
(EN)

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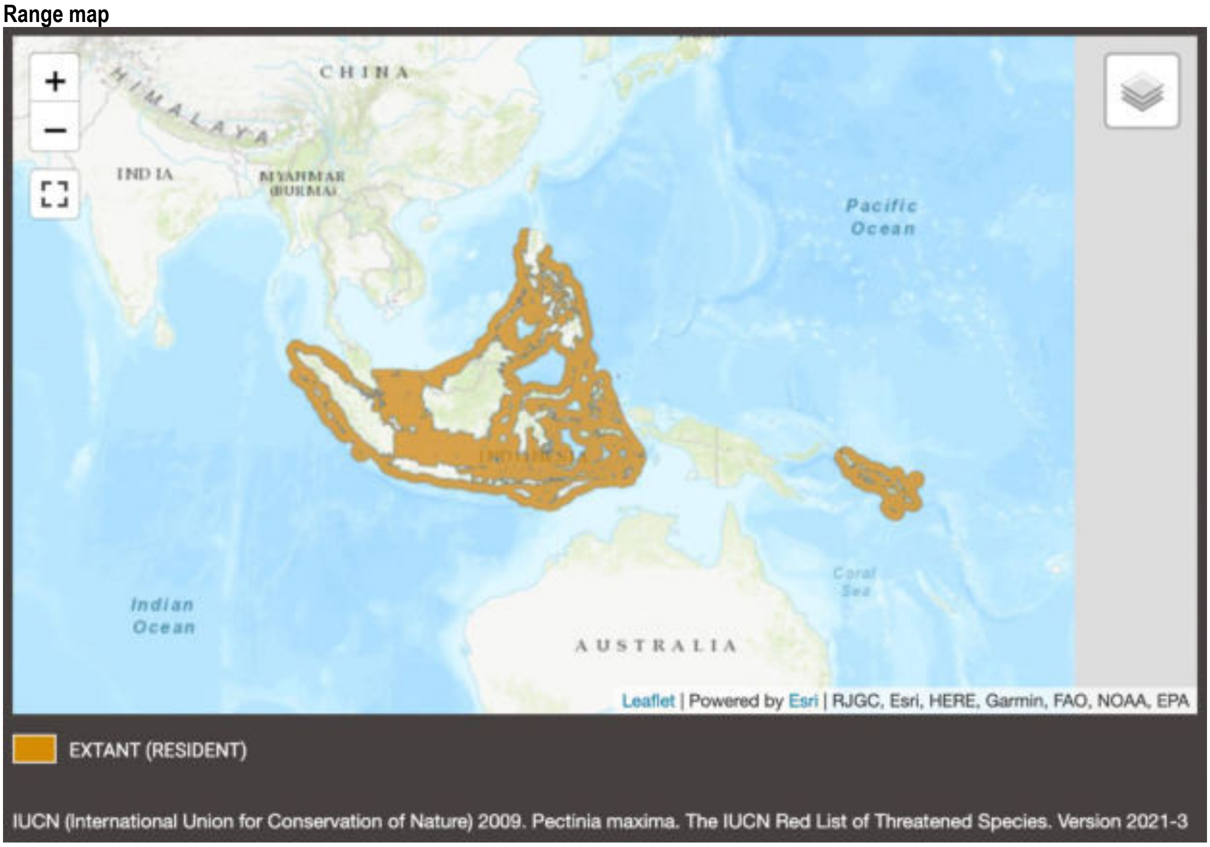
Range map



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Pericnemis bonita
(EN)

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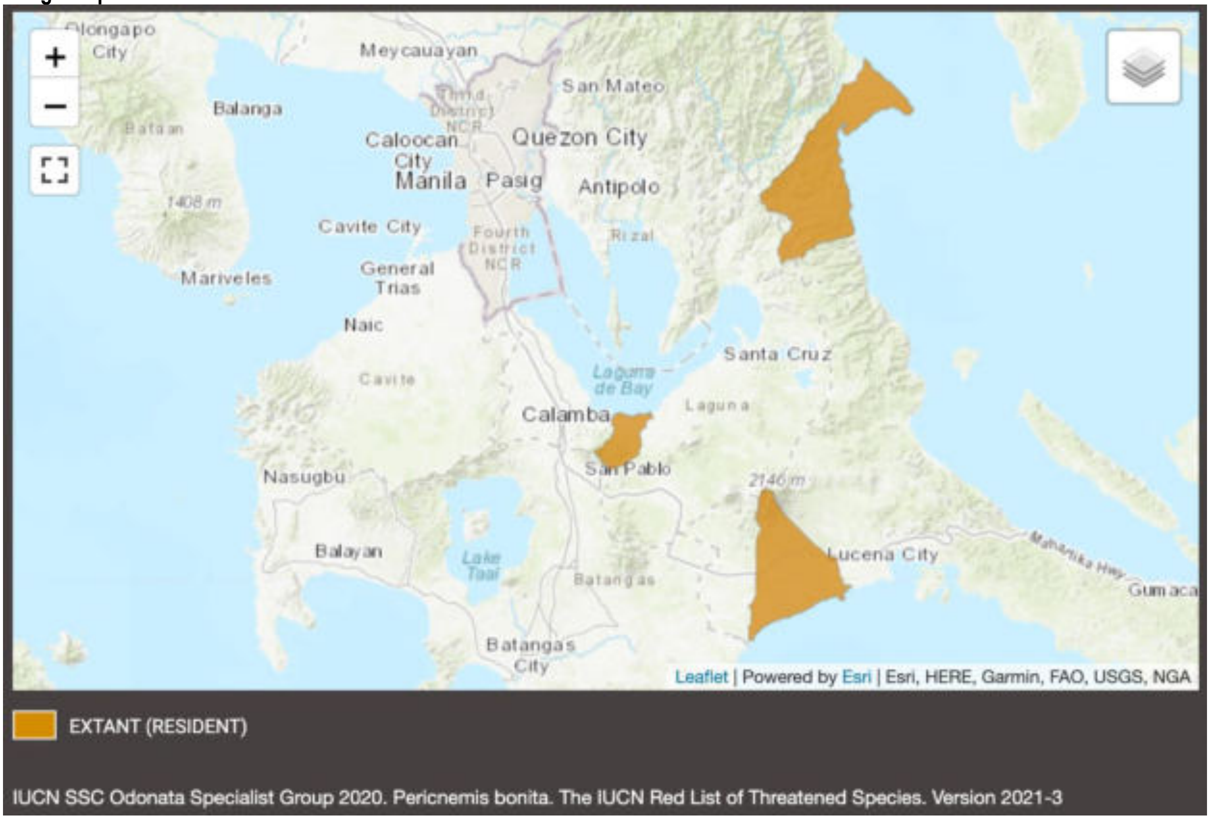
Range map



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Pericnemis incallida
(EN)

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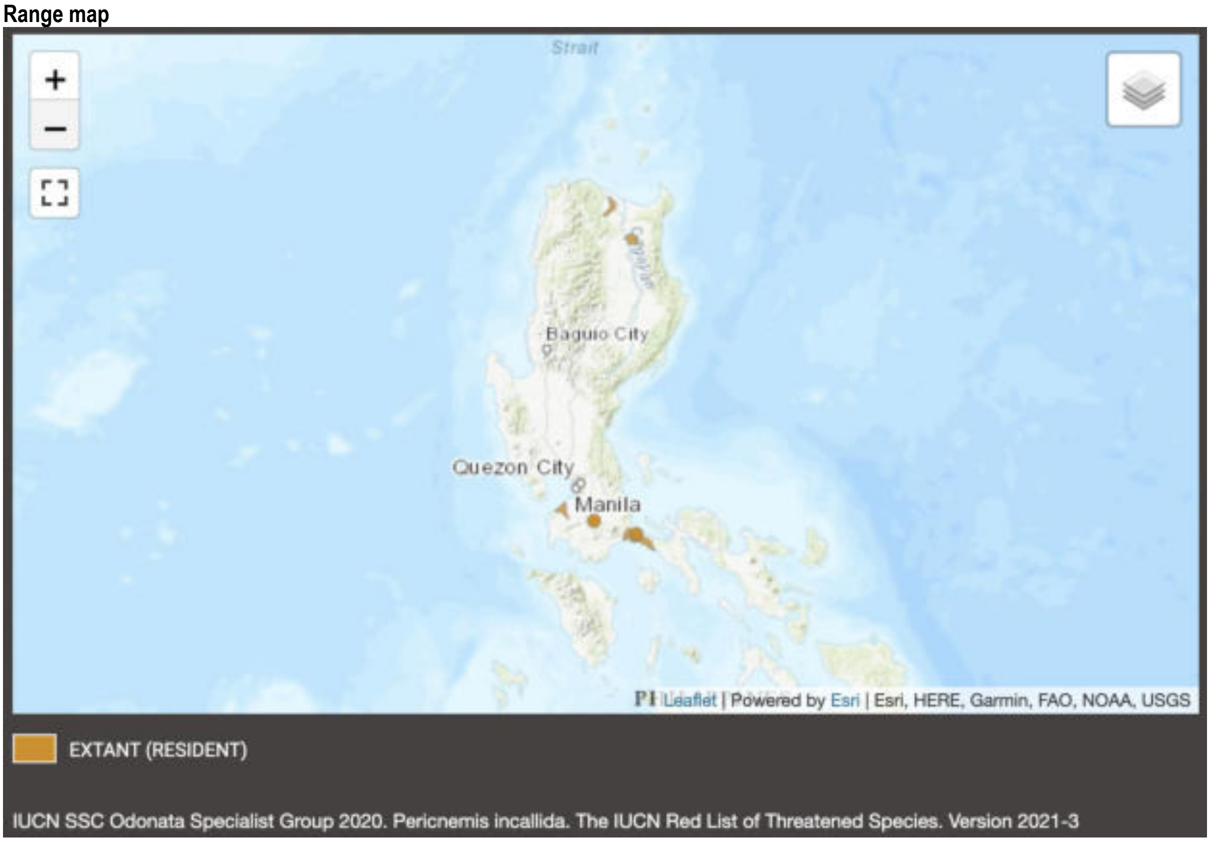
Range map



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Phoenicurus bicolor
Luzon Water-Redstart
(NT)

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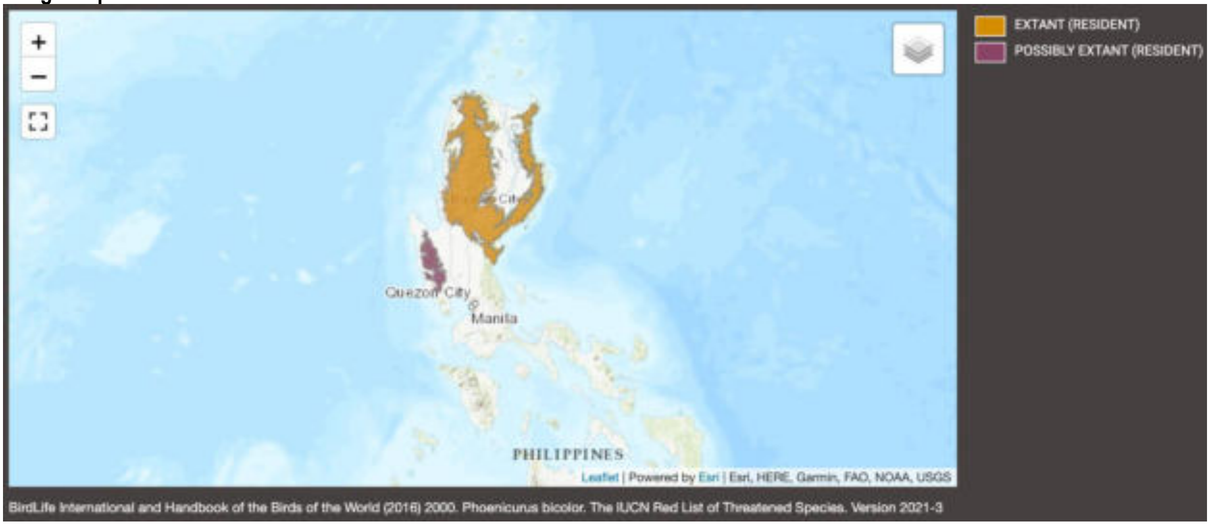
Range map



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Phylloscopus ijimae
Ijima's Leaf-Warbler
(VU)

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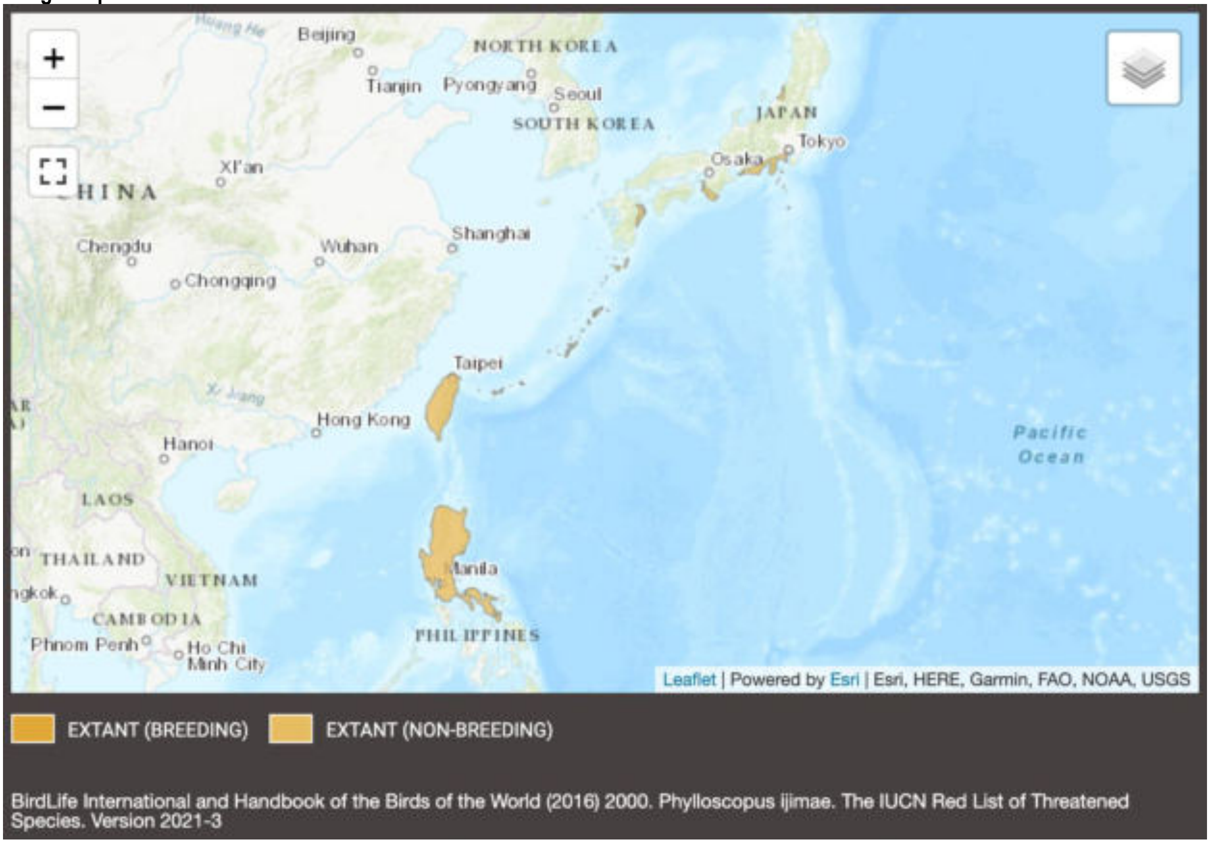
Range map



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Pithecophaga jefferyi
Philippine Eagle
(CR)

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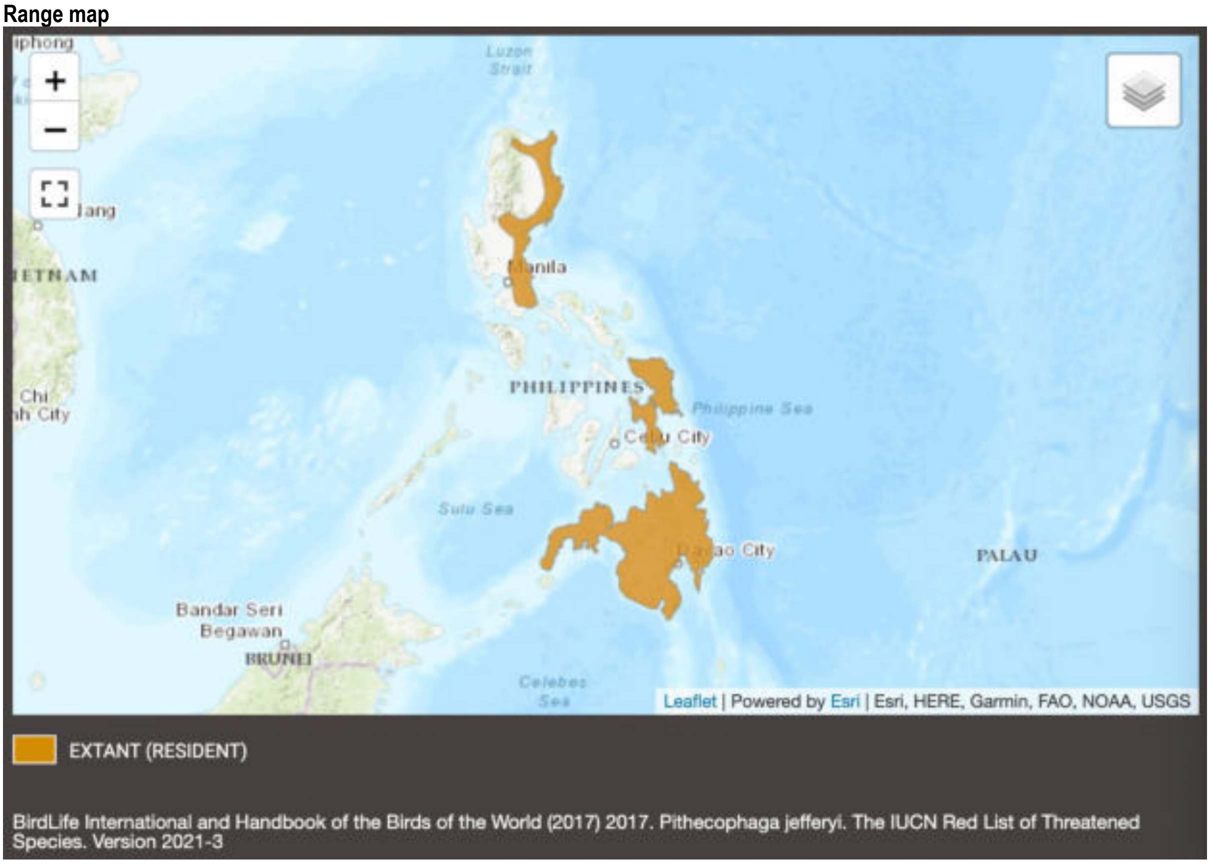
Range map



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Platymantis luzonensis
(NT)

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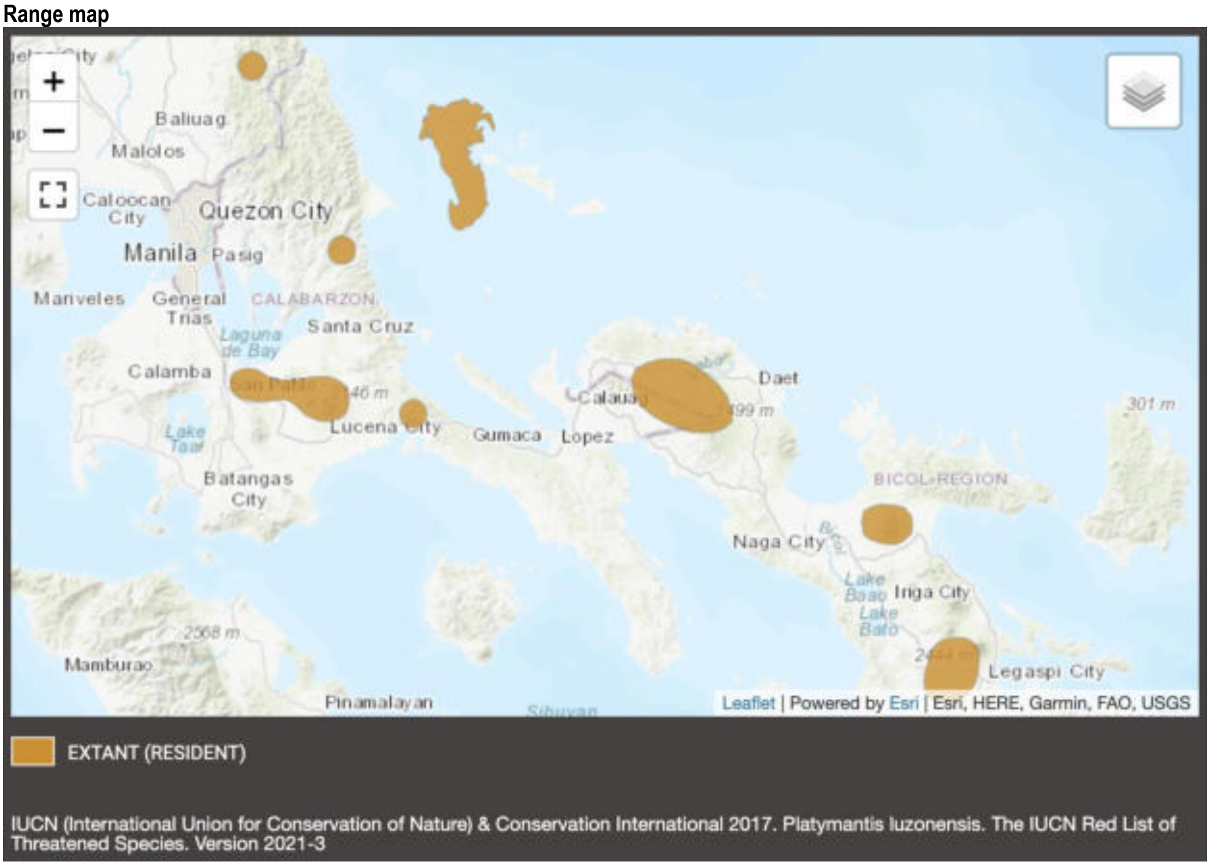
Range map



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Platymantis mimulus
Diminutive Forest Frog
(LC)

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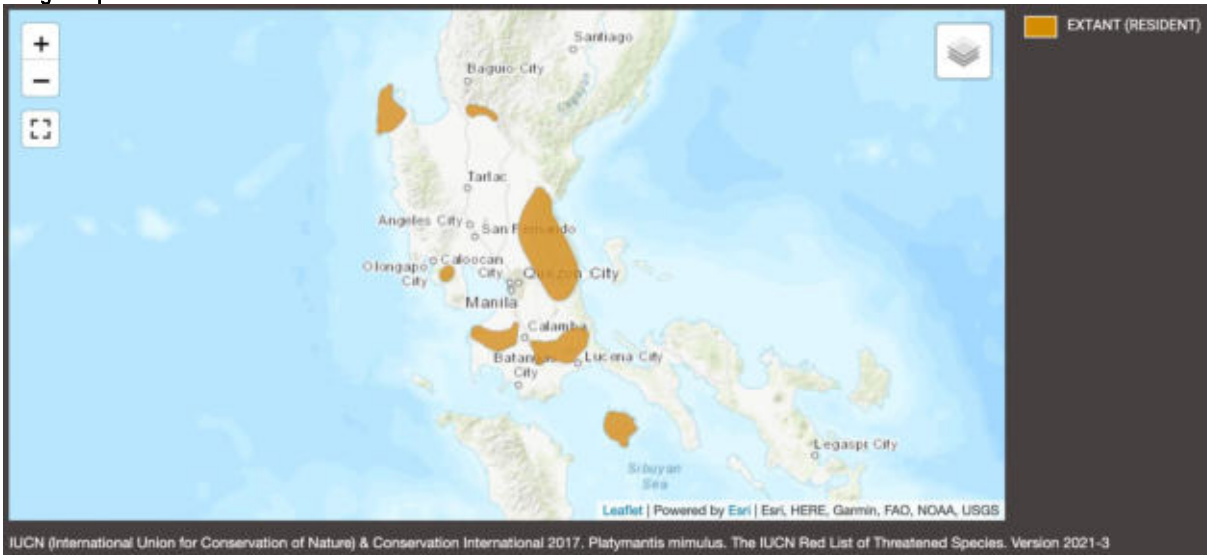
Range map



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Platymantis montanus
(VU)

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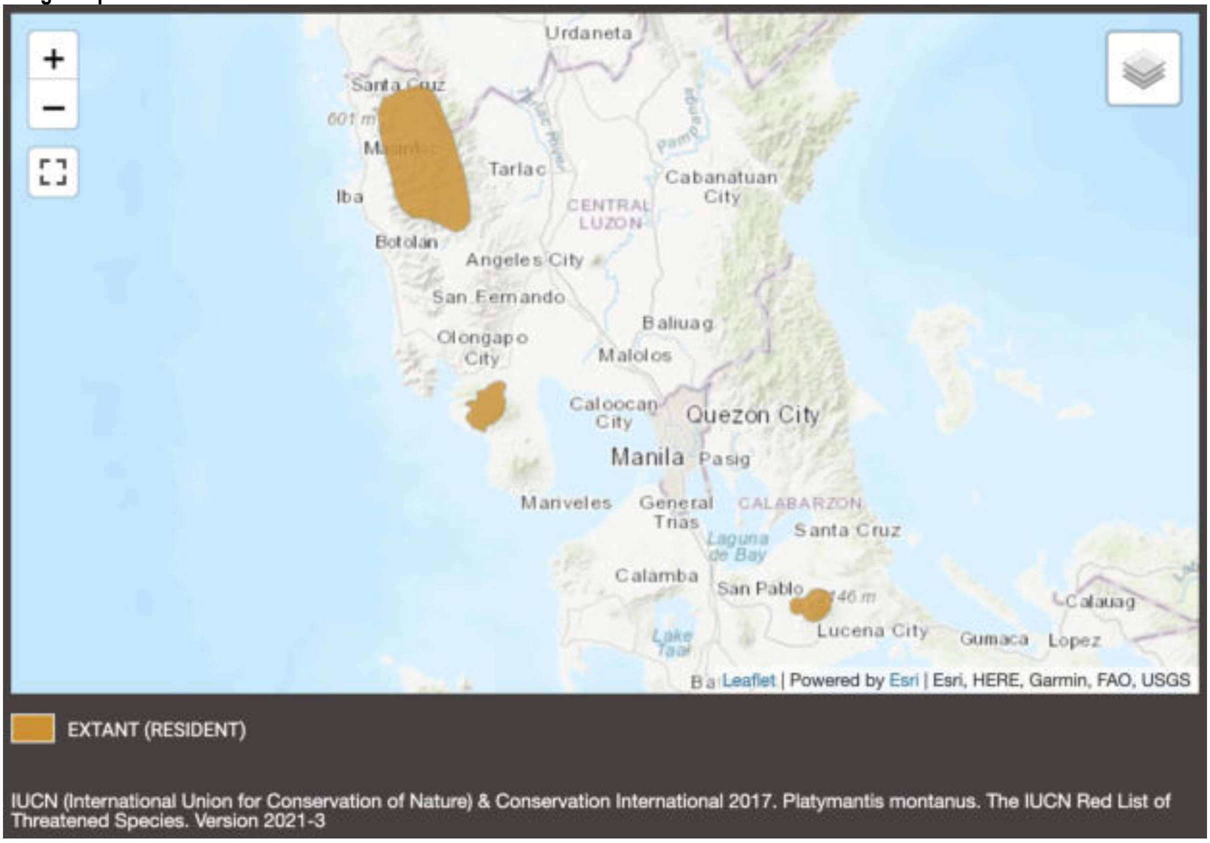
Range map



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Porites eridani
(EN)

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Range map

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Porites ornata
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Range map

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Prioniturus luconensis
Green Racquet-Tail
(EN)

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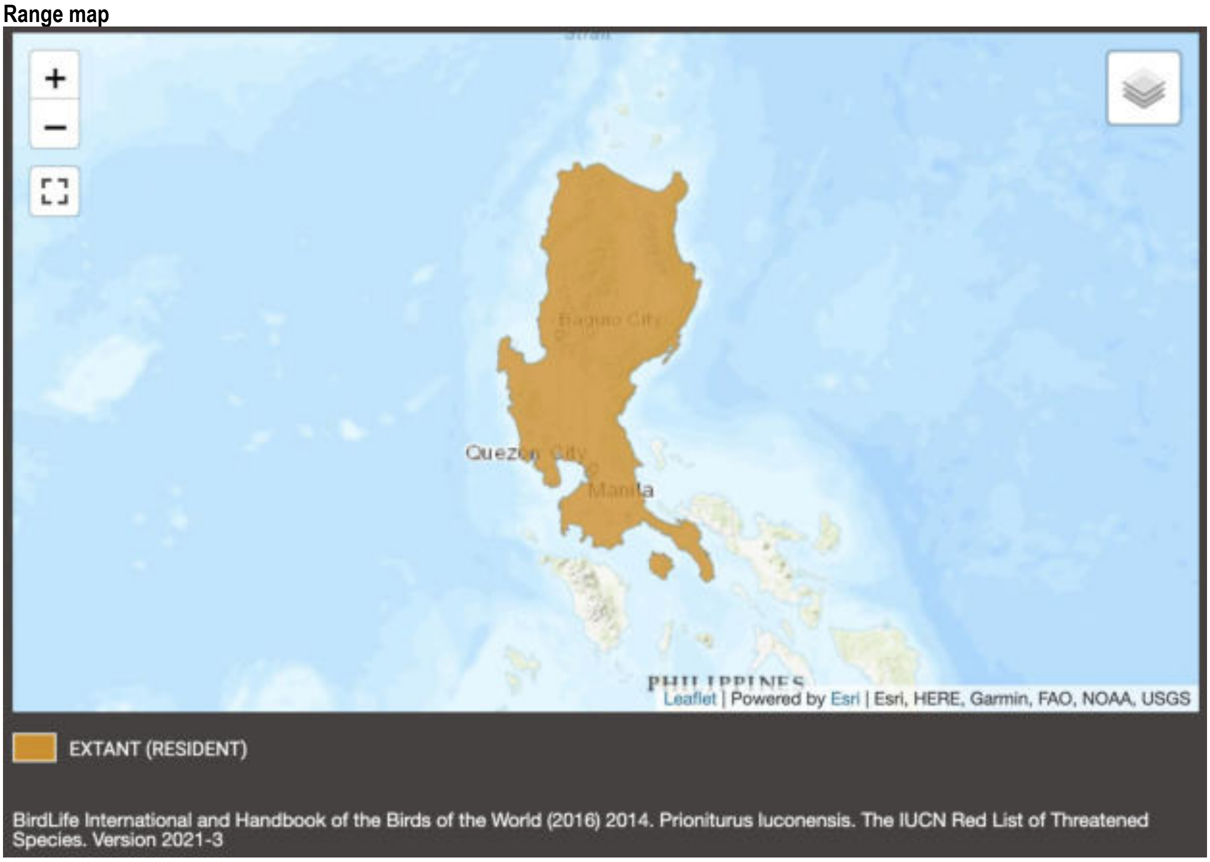
Range map



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Pristis pristis
Largetooth Sawfish
(CR)

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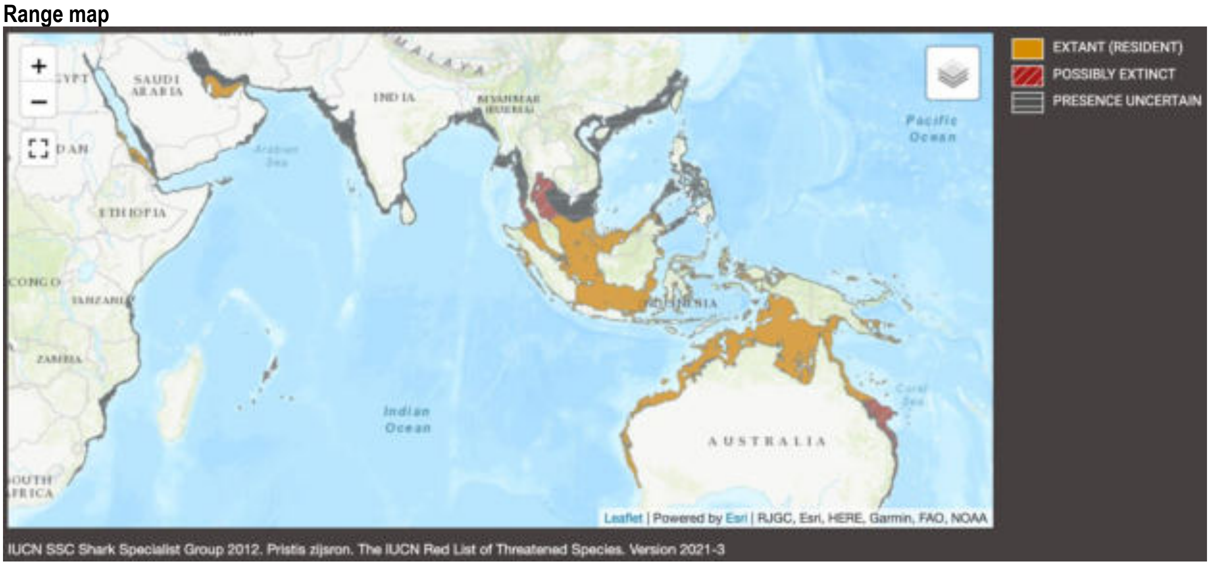
Pristis zijsron
Green Sawfish
(CR)

Sources consulted

(1) Simpfendorfer, C. 2013. Pristis zijsron (errata version published in 2019). The IUCN Red List of Threatened Species 2013: e.T39393A141792003. http://dx.doi.org/10.2305/IUCN.UK.2013-1.RLTS.T39393A141792003.en
(2) Froese, R. and D. Pauly. Editors. 2022.FishBase. World Wide Web electronic publication. www.fishbase.org. Accessed 17 May 2022.

Range map



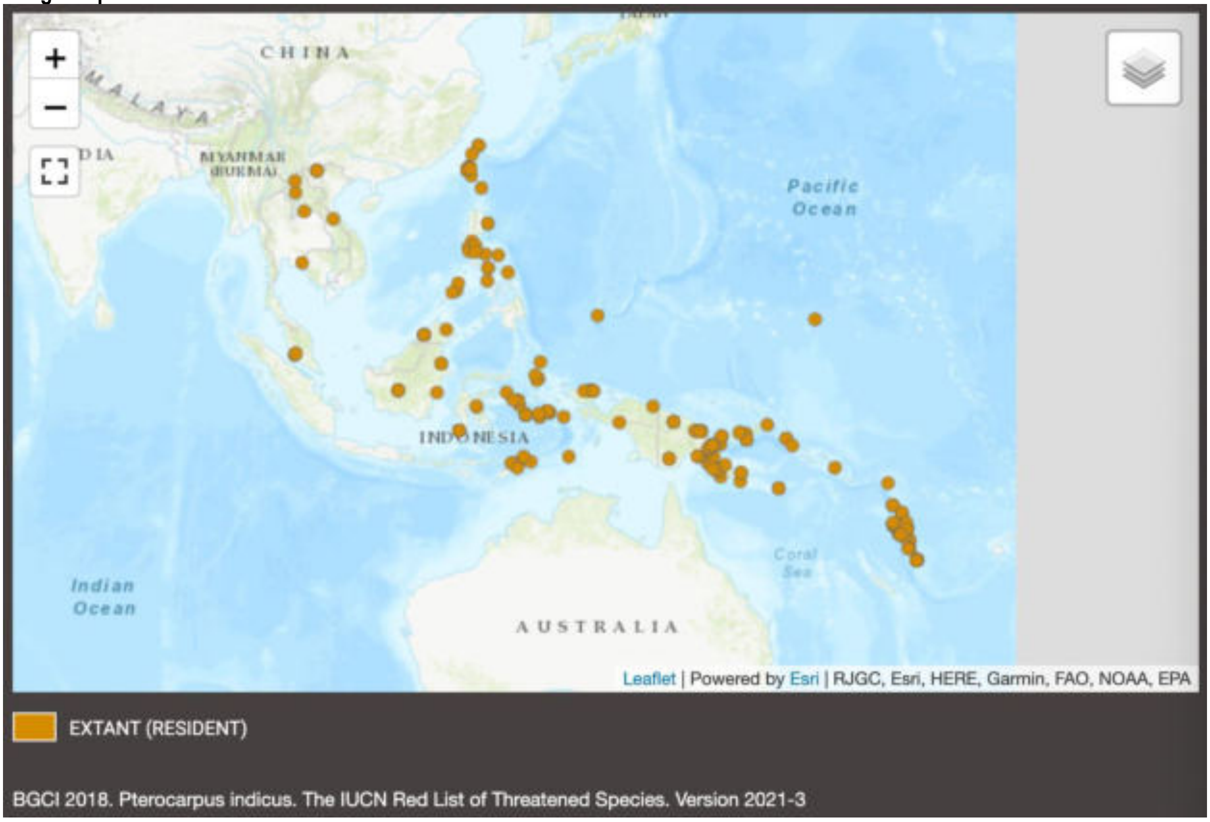
Source: Simpfendorfer, C. 2013. Pristis zijsron (errata version published in 2019). The IUCN Red List of Threatened Species 2013: e.T39393A141792003. http://dx.doi.org/10.2305/IUCN.UK.2013-1.RLTS.T39393A141792003.en

Pterocarpus indicus
Burmese Rosewood
(EN)

Sources consulted

(1) Barstow, M. 2018. *Pterocarpus indicus*. *The IUCN Red List of Threatened Species* 2018: e.T33241A2835450. https://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T33241A2835450.en. Accessed on 20 June 2022.

Range map



Source: Barstow, M. 2018. *Pterocarpus indicus*. *The IUCN Red List of Threatened Species* 2018: e.T33241A2835450. https://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T33241A2835450.en. Accessed on 20 June 2022.

Pterospermum cumingii
(EN)

Sources consulted

(1) Ganesan, S.K. 2017. *Pterospermum cumingii. The IUCN Red List of Threatened Species* 2017: e.T113756520A113756522. https://dx.doi.org/10.2305/IUCN.UK.2017-3.RLTS.T113756520A113756522.en. Accessed on 20 June 2022.

Range map

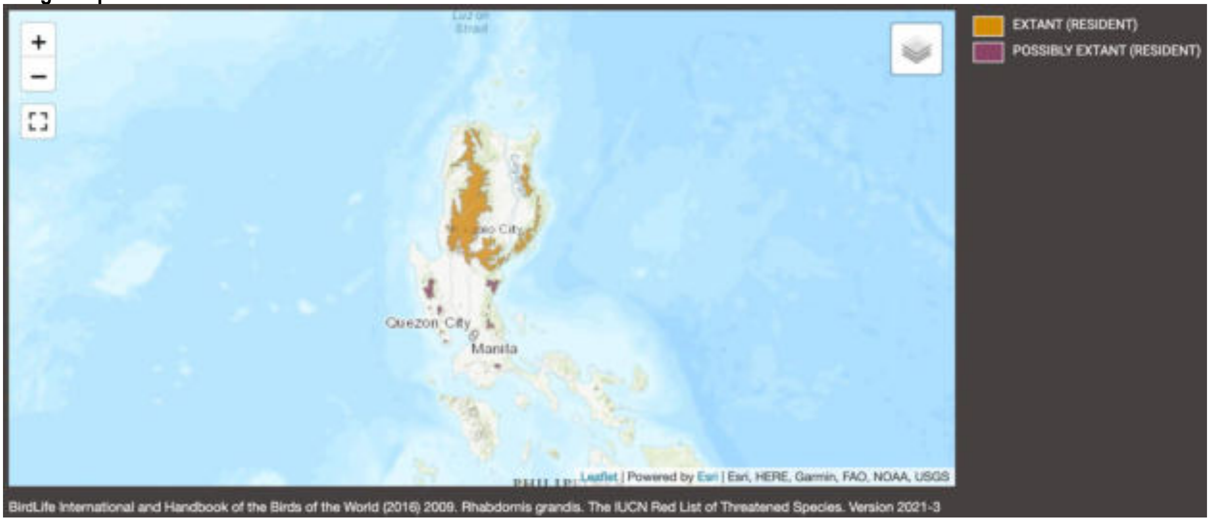
Source: Ganesan, S.K. 2017. *Pterospermum cumingii. The IUCN Red List of Threatened Species* 2017: e.T113756520A113756522. https://dx.doi.org/10.2305/IUCN.UK.2017-3.RLTS.T113756520A113756522.en. Accessed on 20 June 2022.

Rhabdornis grandis
Grand Rhabdornis
(LC)

Sources consulted

(1) BirdLife International. 2016. *Rhabdornis grandis*. *The IUCN Red List of Threatened Species* 2016: e.T22716853A94514558. https://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T22716853A94514558.en. Accessed on 17 June 2022.
(2) Jensen et al (2020): Checklist of Birds of the Philippines. Wild Bird Club of the Philippines. www.birdwatch.ph

Range map



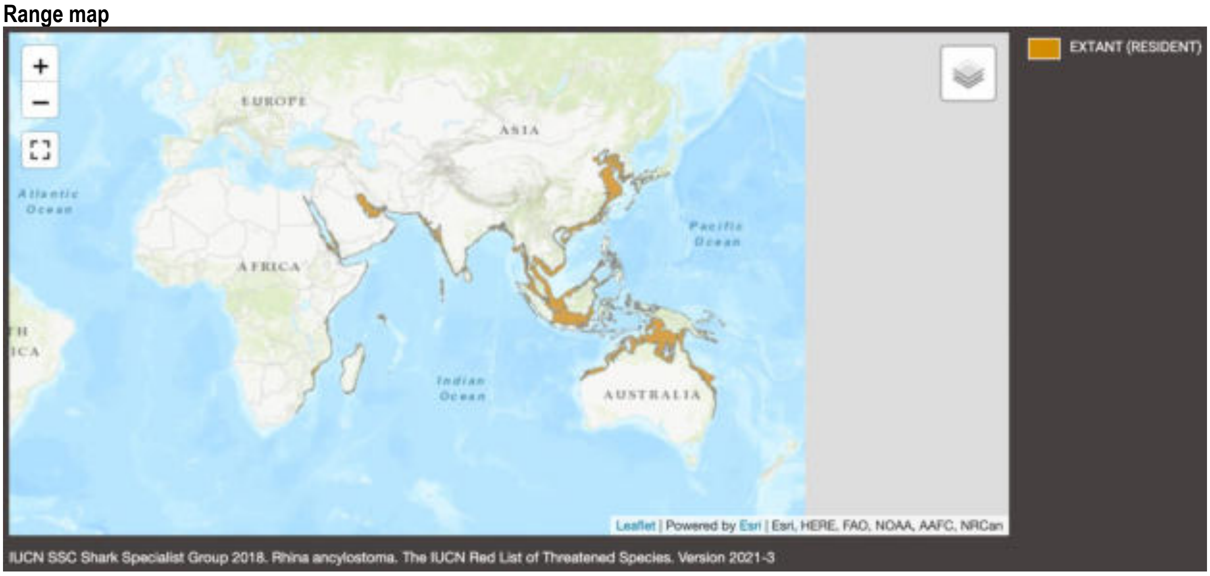
Source: BirdLife International. 2016. *Rhabdornis grandis*. *The IUCN Red List of Threatened Species* 2016: e.T22716853A94514558. https://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T22716853A94514558.en. Accessed on 17 June 2022.

Rhina ancylostoma
Bowmouth Guitarfish
(CR)

Sources consulted

(1) Kyne, P.M., Rigby, C.L., Dharmadi & Jabado, R.W. 2019. Rhina ancylostoma. The IUCN Red List of Threatened Species 2019: e.T41848A124421912. https://dx.doi.org/10.2305/IUCN.UK.2019-2.RLTS.T41848A124421912.en. Accessed on 25 April 2022.
(2) Froese, R. and D. Pauly. Editors. 2022.FishBase. World Wide Web electronic publication. www.fishbase.org. Accessed 17 May 2022.

Range map



Source: Kyne, P.M., Rigby, C.L., Dharmadi & Jabado, R.W. 2019. Rhina ancylostoma. The IUCN Red List of Threatened Species 2019: e.T41848A124421912. https://dx.doi.org/10.2305/IUCN.UK.2019-2.RLTS.T41848A124421912.en. Accessed on 25 April 2022.

Rhincodon typus
Whale Shark
(EN)

Sources consulted

(1) Pierce, S.J. & Norman, B. 2016. *Rhincodon typus*. *The IUCN Red List of Threatened Species* 2016: e.T19488A2365291. https://dx.doi.org/10.2305/IUCN.UK.2016-1.RLTS.T19488A2365291.en. Accessed on 19 June 2022.

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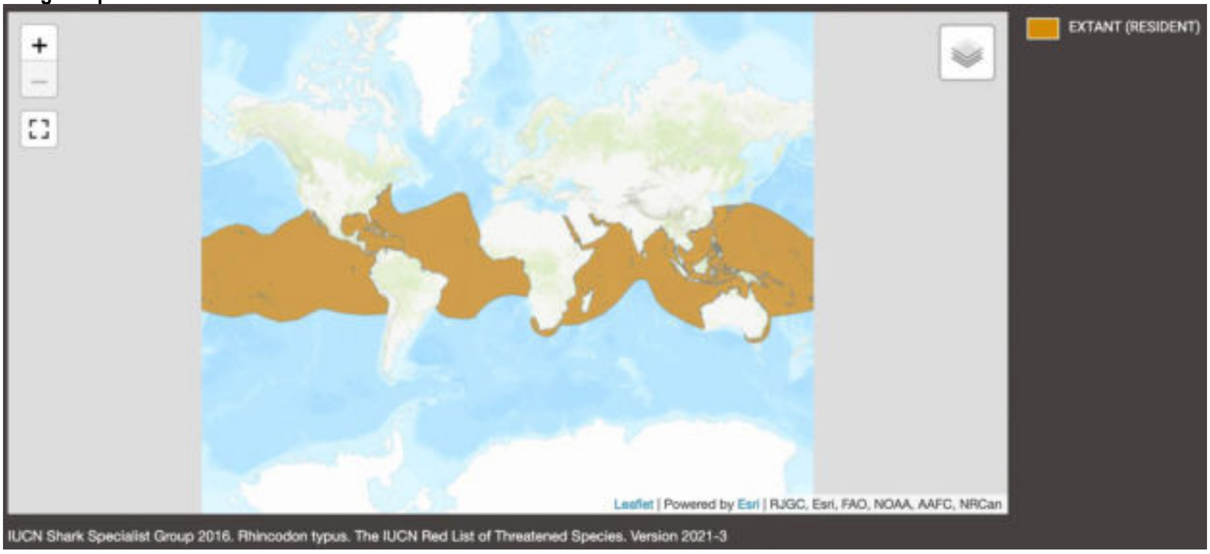
Range map



Source: Pierce, S.J. & Norman, B. 2016. *Rhincodon typus*. *The IUCN Red List of Threatened Species* 2016: e.T19488A2365291. https://dx.doi.org/10.2305/IUCN.UK.2016-1.RLTS.T19488A2365291.en. Accessed on 17 June 2022.

Rhinoptera javanica
Javanese Cownose Ray
(EN)

Sources consulted

(1) Sherman, C.S., Bin Ali, A., Bineesh, K.K., Derrick, D., Dharmadi, Fahmi, Fernando, D., Haque, A.B., Maung, A., Seyha, L., Tanay, D., Utzurrum, J.A.T., Vo, V.Q. & Yuneni, R.R. 2021. Rhinoptera javanica. The IUCN Red List of Threatened Species 2021: e.T60129A124442197. https://dx.doi.org/10.2305/IUCN.UK.2021-2.RLTS.T60129A124442197.en. Accessed on 25 April 2022.
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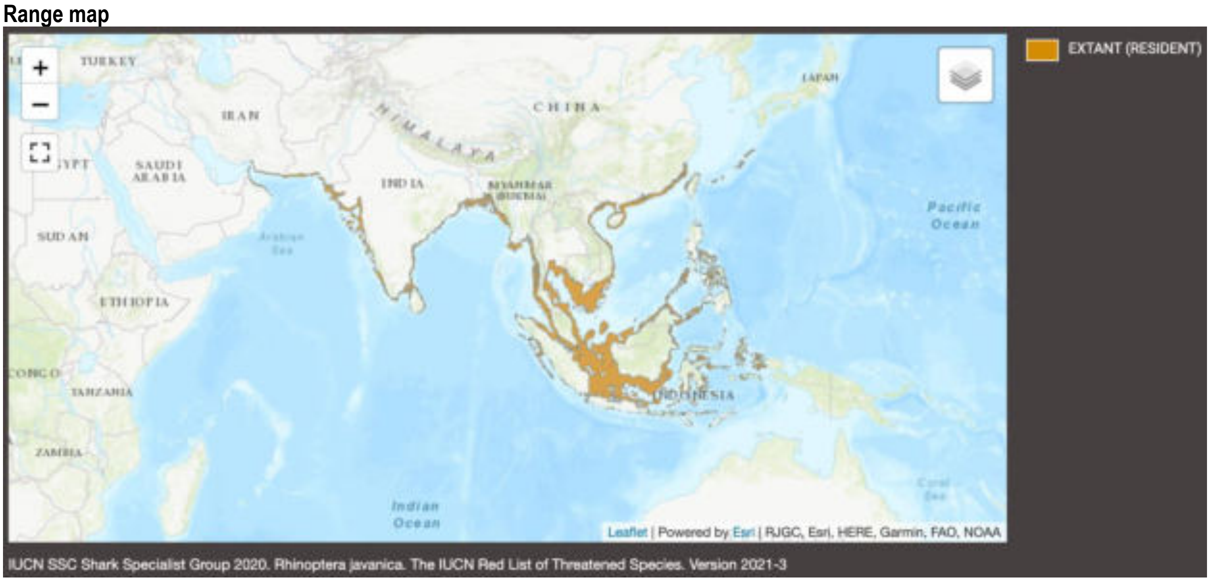
Range map



Source: Sherman, C.S., Bin Ali, A., Bineesh, K.K., Derrick, D., Dharmadi, Fahmi, Fernando, D., Haque, A.B., Maung, A., Seyha, L., Tanay, D., Utzurrum, J.A.T., Vo, V.Q. & Yuneni, R.R. 2021. Rhinoptera javanica. The IUCN Red List of Threatened Species 2021: e.T60129A124442197. https://dx.doi.org/10.2305/IUCN.UK.2021-2.RLTS.T60129A124442197.en. Accessed on 25 April 2022.

Rhynchobatus australiae
Bottlenose wedgefish
(CR)

Sources consulted

(1) Kyne, P.M., Rigby, C.L., Dharmadi & Jabado, R.W. 2019. Rhynchobatus australiae. The IUCN Red List of Threatened Species 2019: e.T41853A68643043. https://dx.doi.org/10.2305/IUCN.UK.2019-2.RLTS.T41853A68643043.en. Accessed on 25 April 2022.
(2) Froese, R. and D. Pauly. Editors. 2022.FishBase. World Wide Web electronic publication. www.fishbase.org. Accessed 17 May 2022.

Range map

Source: Kyne, P.M., Rigby, C.L., Dharmadi & Jabado, R.W. 2019. Rhynchobatus australiae. The IUCN Red List of Threatened Species 2019: e.T41853A68643043. https://dx.doi.org/10.2305/IUCN.UK.2019-2.RLTS.T41853A68643043.en. Accessed on 25 April 2022.

Rhynchobatus springeri
Broadnose wedgefish
(CR)

Sources consulted

(1) Kyne, P.M. 2019. Rhynchobatus springeri. The IUCN Red List of Threatened Species 2019: e.T60182A124448942. https://dx.doi.org/10.2305/IUCN.UK.2019-2.RLTS.T60182A124448942.en. Accessed on 25 April 2022.
(2) Froese, R. and D. Pauly. Editors. 2022.FishBase. World Wide Web electronic publication. www.fishbase.org. Accessed 17 May 2022.

Range map

Source: Kyne, P.M. 2019. Rhynchobatus springeri. The IUCN Red List of Threatened Species 2019: e.T60182A124448942. https://dx.doi.org/10.2305/IUCN.UK.2019-2.RLTS.T60182A124448942.en. Accessed on 25 April 2022.

Robsonius sorsogonensis
Bicol Ground-Warbler
(NT)

Sources consulted

(1) BirdLife International. 2019. *Robsonius sorsogonensis*. *The IUCN Red List of Threatened Species* 2019: e.T22735664A156385693. https://dx.doi.org/10.2305/IUCN.UK.2019-3.RLTS.T22735664A156385693.en. Accessed on 17 June 2022.
(2) Jensen et al (2020): Checklist of Birds of the Philippines. Wild Bird Club of the Philippines. www.birdwatch.ph

Range map

Source: BirdLife International. 2019. *Robsonius sorsogonensis*. *The IUCN Red List of Threatened Species* 2019: e.T22735664A156385693. https://dx.doi.org/10.2305/IUCN.UK.2019-3.RLTS.T22735664A156385693.en. Accessed on 17 June 2022.

Scolopax bukidnonensis
Bukidnon Woodcock
(LC)

Sources consulted

(1) BirdLife International. 2016. *Scolopax bukidnonensis*. *The IUCN Red List of Threatened Species* 2016: e.T22729854A95022201. https://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T22729854A95022201.en. Accessed on 17 June 2022.
(2) Jensen et al (2020): Checklist of Birds of the Philippines. Wild Bird Club of the Philippines. www.birdwatch.ph

Range map

Source: BirdLife International. 2016. *Scolopax bukidnonensis*. *The IUCN Red List of Threatened Species* 2016: e.T22729854A95022201. https://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T22729854A95022201.en. Accessed on 17 June 2022.

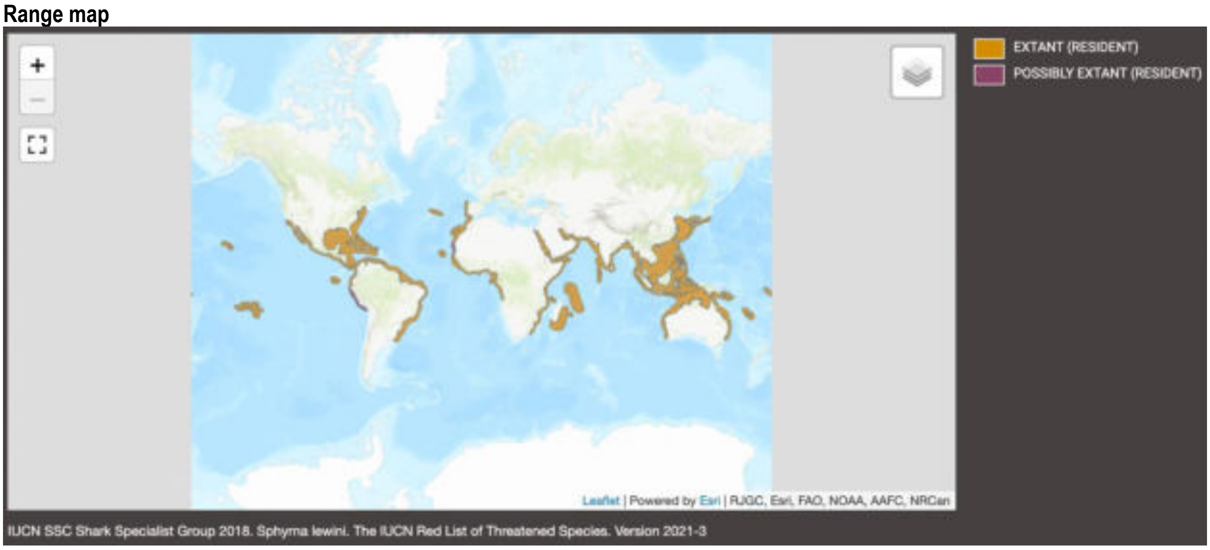
Sphyrna lewini
Scalloped Hammerhead
(CR)

Sources consulted

(1) Rigby, C.L., Dulvy, N.K., Barreto, R., Carlson, J., Fernando, D., Fordham, S., Francis, M.P., Herman, K., Jabado, R.W., Liu, K.M., Marshall, A., Pacoureau, N., Romanov, E., Sherley, R.B. & Winker, H. 2019. Sphyrna lewini. The IUCN Red List of Threatened Species 2019: e.T39385A2918526. Accessed on 25 April 2022.

(2) Froese, R. and D. Pauly. Editors. 2022.FishBase. World Wide Web electronic publication. www.fishbase.org. Accessed 17 May 2022.

Range map



Source: Rigby, C.L., Dulvy, N.K., Barreto, R., Carlson, J., Fernando, D., Fordham, S., Francis, M.P., Herman, K., Jabado, R.W., Liu, K.M., Marshall, A., Pacoureau, N., Romanov, E., Sherley, R.B. & Winker, H. 2019. Sphyrna lewini. The IUCN Red List of Threatened Species 2019: e.T39385A2918526. Accessed on 25 April 2022.

Sphyrna mokarran
Great Hammerhead
(CR)

Sources consulted

(1) Rigby, C.L., Barreto, R., Carlson, J., Fernando, D., Fordham, S., Francis, M.P., Herman, K., Jabado, R.W., Liu, K.M., Marshall, A., Pacoureau, N., Romanov, E., Sherley, R.B. & Winker, H. 2019. Sphyrna mokarran. The IUCN Red List of Threatened Species 2019: e.T39386A2920499. https://dx.doi.org/10.2305/IUCN.UK.2019-3.RLTS.T39386A2920499.en. Accessed on 25 April 2022.
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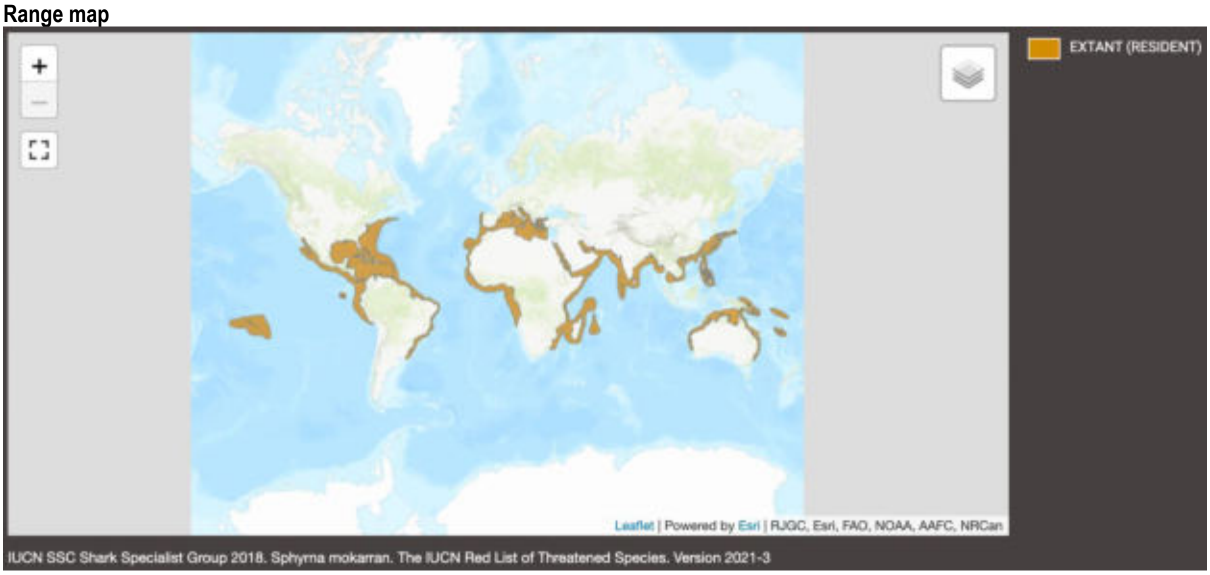
Range map



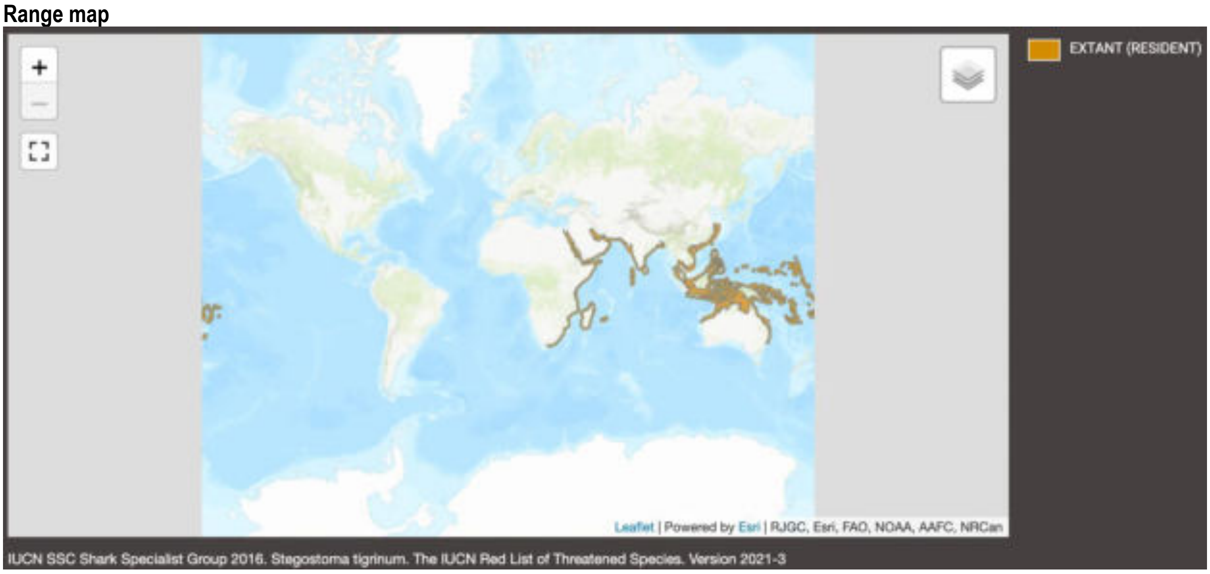
Source: Rigby, C.L., Barreto, R., Carlson, J., Fernando, D., Fordham, S., Francis, M.P., Herman, K., Jabado, R.W., Liu, K.M., Marshall, A., Pacoureau, N., Romanov, E., Sherley, R.B. & Winker, H. 2019. Sphyrna mokarran. The IUCN Red List of Threatened Species 2019: e.T39386A2920499. https://dx.doi.org/10.2305/IUCN.UK.2019-3.RLTS.T39386A2920499.en. Accessed on 25 April 2022.

Stegostoma tigrinum
Zebra Shark
(EN)

Sources consulted

(1) Dudgeon, C.L., Simpfendorfer, C. & Pillans, R.D. 2019. Stegostoma fasciatum (amended version of 2016 assessment). The IUCN Red List of Threatened Species 2019: e.T41878A161303882. https://dx.doi.org/10.2305/IUCN.UK.2019-3.RLTS.T41878A161303882.en. Accessed on 25 April 2022.
(2) Froese, R. and D. Pauly. Editors. 2022.FishBase. World Wide Web electronic publication. www.fishbase.org. Accessed 17 May 2022.

Range map



Source: Dudgeon, C.L., Simpfendorfer, C. & Pillans, R.D. 2019. Stegostoma fasciatum (amended version of 2016 assessment). The IUCN Red List of Threatened Species 2019: e.T41878A161303882. https://dx.doi.org/10.2305/IUCN.UK.2019-3.RLTS.T41878A161303882.en. Accessed on 25 April 2022.

Sterrhoptilus nigrocapitatus
Black-Crowned Babbler
(LC)

Sources consulted

(1) BirdLife International. 2016. *Sterrhoptilus nigrocapitatus*. *The IUCN Red List of Threatened Species* 2016: e.T22716204A94484596. https://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T22716204A94484596.en. Accessed on 17 June 2022.
(2) Jensen et al (2020): Checklist of Birds of the Philippines. Wild Bird Club of the Philippines. www.birdwatch.ph

Range map

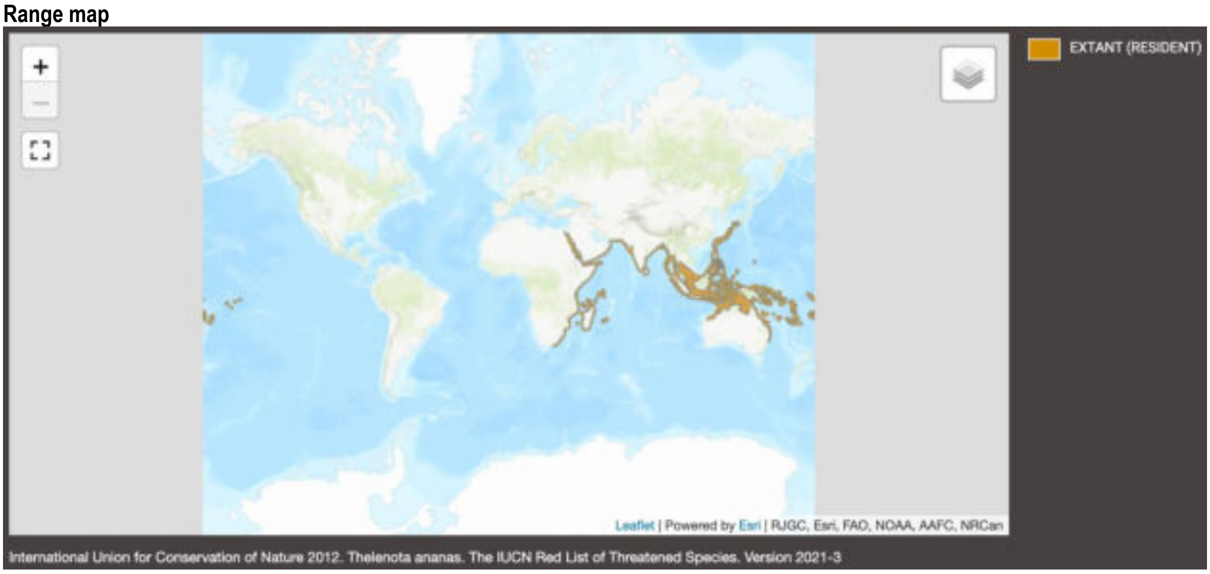
Source: BirdLife International. 2016. *Sterrhoptilus nigrocapitatus*. *The IUCN Red List of Threatened Species* 2016: e.T22716204A94484596. https://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T22716204A94484596.en. Accessed on 17 June 2022.

Thelenota ananas
Prickly Redfish
(EN)

Sources consulted

(1) Conand, C., Gamboa, R. & Purcell, S. 2013. *Thelenota ananas*. *The IUCN Red List of Threatened Species* 2013: e.T180481A1636021. https://dx.doi.org/10.2305/IUCN.UK.2013-1.RLTS.T180481A1636021.en. Accessed on 17 June 2022.
(2) Palomares, M.L.D. and D. Pauly. Editors. 2022. SeaLifeBase. World Wide Web electronic publication. www.sealifebase.org, version (04/2022).

Range map



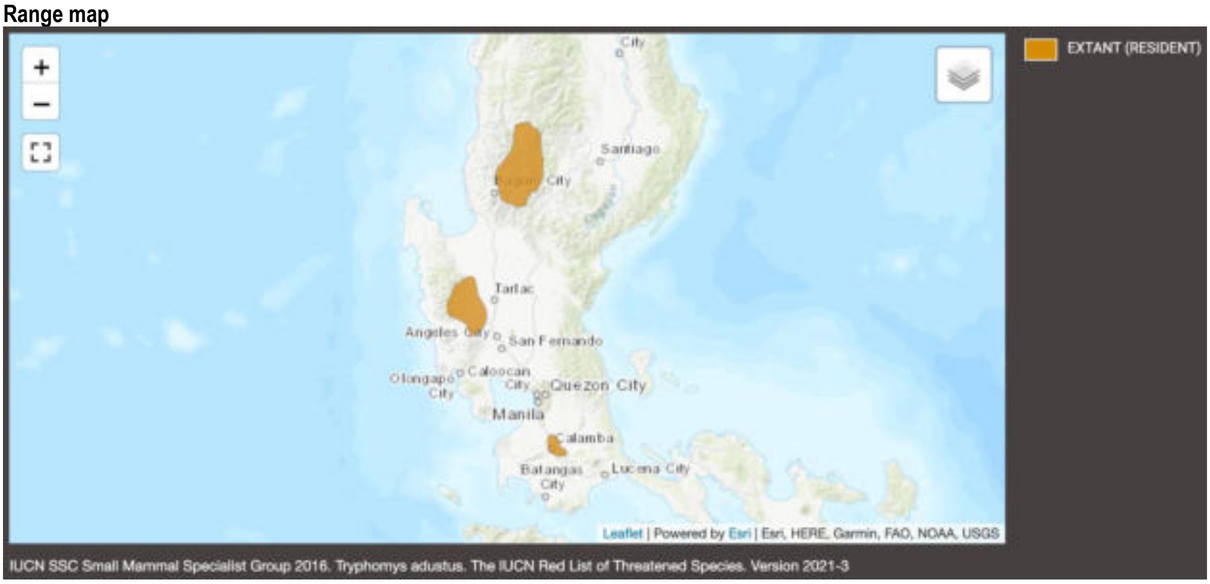
Source: Conand, C., Gamboa, R. & Purcell, S. 2013. *Thelenota ananas*. *The IUCN Red List of Threatened Species* 2013: e.T180481A1636021. https://dx.doi.org/10.2305/IUCN.UK.2013-1.RLTS.T180481A1636021.en. Accessed on 17 June 2022.

Tryphornys adustus
Luzon Short-Nosed Rat
DD

Sources consulted

(1) Kennerley, R. 2016. *Tryphomys adustus*. *The IUCN Red List of Threatened Species* 2016: e.T22431A22439774. https://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T22431A22439774.en. Accessed on 17 June 2022.
(2) Heaney, L.R., Balete, D.S. and Rickart, E.A. 2016. The Mammals of Luzon Island: Biogeography and Natural History of a Philippine Fauna. Johns Hopkins University Press, Baltimore, USA.

Range map



Source: Kennerley, R. 2016. *Tryphomys adustus*. *The IUCN Red List of Threatened Species* 2016: e.T22431A22439774. https://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T22431A22439774.en. Accessed on 17 June 2022.

Zosterornis striatus
Luzon Striped Babbler
(NT)

Sources consulted

(1) BirdLife International. 2016. *Zosterornis striatus*. *The IUCN Red List of Threatened Species* 2016: e.T22716227A94485369. https://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T22716227A94485369.en. Accessed on 17 June 2022.
(2) Jensen et al (2020): Checklist of Birds of the Philippines. Wild Bird Club of the Philippines. www.birdwatch.ph

Range map

Source: BirdLife International. 2016. *Zosterornis striatus*. *The IUCN Red List of Threatened Species* 2016: e.T22716227A94485369. https://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T22716227A94485369.en. Accessed on 17 June 2022.

Zosterornis whiteheadi
Chestnut-Faced Babbler
(LC)

Sources consulted

(1) BirdLife International. 2016. *Zosterornis whiteheadi. The IUCN Red List of Threatened Species* 2016: e.T22716224A94485202. https://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T22716224A94485202.en. Accessed on 17 June 2022.
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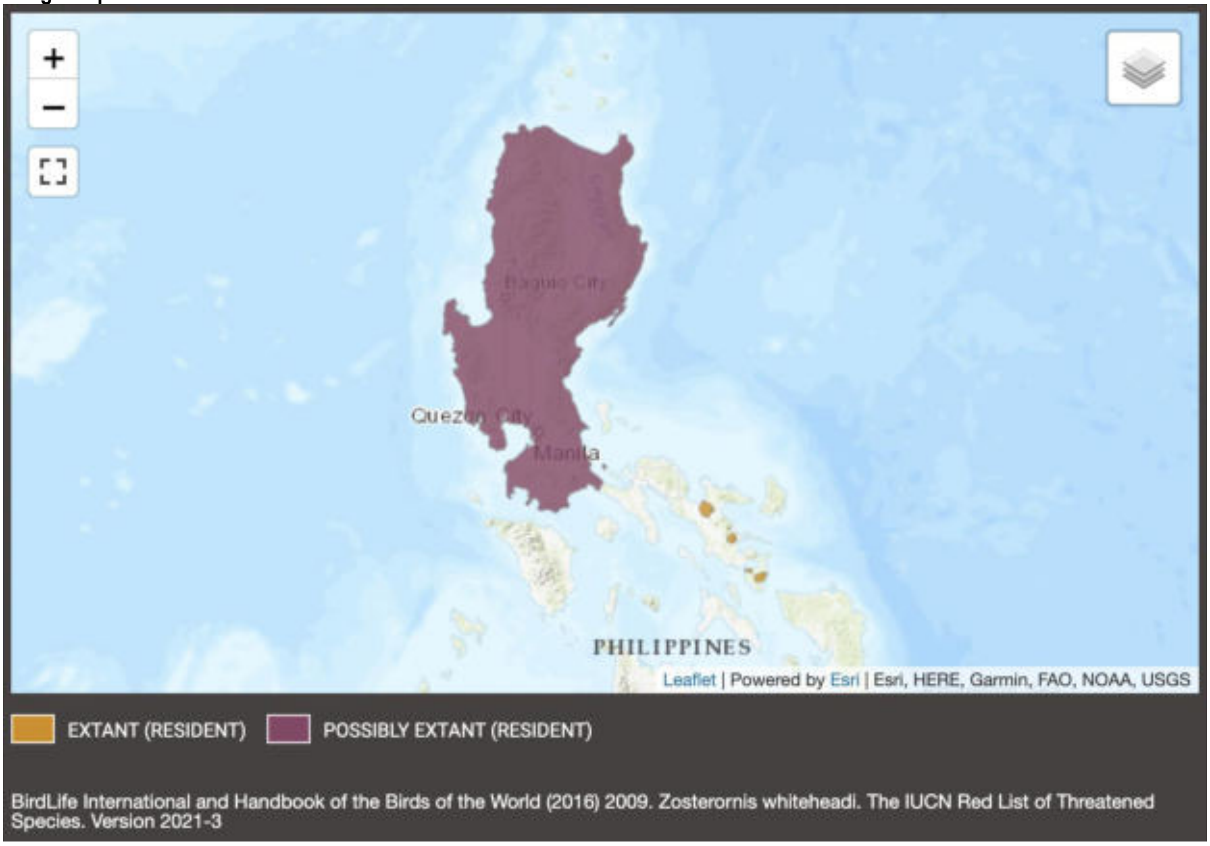
Range map



Source: BirdLife International. 2016. *Zosterornis whiteheadi. The IUCN Red List of Threatened Species* 2016: e.T22716224A94485202. https://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T22716224A94485202.en. Accessed on 17 June 2022.

ANNEX 2: PRELIMINARY BIODIVERSITY ACTION PLAN (NOVEMBER 2023)

Bataan-Cavite Interlink Bridge Project

Preliminary Biodiversity Action Plan

8 November 2023

Prepared By:

T.Y. Lin International | Pyunghwa Engineering Consultants Joint Venture

Document Code: 481714-BCIB-DED-TYLI-EIA-RPT-0001_R02
Revision: 02

Design/ Provision of Reference

Section 7: TERMS OF REFERENCE, Subsection E. Environment Safeguard Plan, Task 11
TASK 11 – Preparing Environmental Impact Assessment (EIA)/ Environmental Management Plan (EMP) Deliverable: (i) Updated EIA and (ii) Updated Comprehensive EMP

Revisions:

Date	Description	Revision	Originator	Reviewer	Approver
2022-12-07	Issue for Coordination	00	Simeon Stairs Renardet [Signature]	Jodi Ketelsen TYLin International [Signature]	Marwan Nader (TYLI/ PEC JV) [Signature]
2023-07-03	Issue to DPWH and ADB	01	Simeon Stairs Renardet	Jodi Ketelsen TYLin International	Marwan Nader (TYLI/ PEC JV)
2023-11-08	Issue to DPWH and ADB with Final EIA report	02	**Simeon Stairs** Renardet	Jodi Ketelsen TYLin International	Marwan Nader (TYLI/ PEC JV)

Abbreviations

ADB	Asian Development Bank
AoA	Area of Analysis
BAP	Biodiversity Action Plan
BCIB	Bataan–Cavite Interlink Bridge Project
BFAR	Bureau of Fisheries and Aquatic Resources
CIMP	Corregidor Islands Marine Park
CSC	Construction Supervision Consultant
DENR	Department of Environment and Natural Resources
DENR-EMB	DENR Environmental Management Bureau
DPWH	Department of Public Works and Highways
DPWH-BMU	DPWH Bridge Management Unit
DPWH-ESSD	DPWH Environmental and Social Safeguards Division
ECC	Environmental Compliance Certificate
EIA	Environmental Impact Assessment
EMA	External Monitoring Agent
EMF	Environmental Monitoring Fund
EMP	Environmental Management Plan
IBAT	Integrated Biodiversity Assessment Tool
IFC	International Finance Corporation
KBA	Key Biodiversity Area
MENRO	Municipal Environment and Natural Resources Office
PS6	IFC Performance Standard 6
SPS	Safeguards Policy Statement

Table of Contents

List of Exhibits

1 INTRODUCTION

This preliminary Biodiversity Action Plan (BAP) elaborates a set of planning, coordination. and management measures deemed necessary to ensure that the Bataan–Cavite Interlink Bridge (BCIB) project can achieve 'no net loss' and 'net gain' for key biodiversity values identified through ecological baseline studies and a critical habitat assessment. The 'no net loss' and 'net gain' objectives are mandated for projects financed by the Asian Development Bank (ADB), as stipulated in the ADB's Safeguard Policy Statement (SPS), and in Performance Standard 6 (PS6) developed by the International Finance Corporation (IFC), which has become the global standard for assessment and management of biodiversity risks in relation to large donor-financed development projects, and is expected to be applied to ADB projects. The ADB's Environmental Safeguards Good Practice Sourcebook (2012) indicates that for "projects with potentially significant biodiversity impacts and risks (e.g., involving critical habitats), the development of a Biodiversity Action Plan (BAP) or its equivalent may be appropriate."[1] Meanwhile, PS6 states that "a Biodiversity Action Plan (BAP) is required for projects located in critical habitat and is recommended for high-risk projects in natural habitats."[2] A draft critical habitat assessment was prepared for the BCIB project in 2022, and identified biodiversity features that qualify as natural habitat and critical habitat.

It is noted that this preliminary BAP is reflective of the findings of the draft Environmental Impact Assessment (EIA) and draft Critical Habitat Assessment (CHA) at the time of publishing and will not be the final version. BAPs can appropriately be managed as living documents, updated iteratively as additional information (e.g., biodiversity baseline data, stakeholder feedback) becomes available to inform and refine the plan's focus and measures. As indicated in the EIA and referenced in the CHA, biodiversity baseline data gathering begun during the feasibility and detailed design stages will be augmented by further surveys (including longitudinal ones) carried out during the project's pre-construction and construction periods. It is anticipated that additional baseline data may result in updates to the project’s residual impact assessment and may expand or subtract from the list of critical habitat trigger features, which in turn will result in an updated version of the BAP. Although change is expected, it is nevertheless useful to advance a preliminary version as a tool for constructive dialogue with stakeholders and create a foundation upon which to build later adaptations.

1.1 Project Overview

The BCIB project will entail construction and operation of a 32-km, four-lane road link across the mouth of Manila Bay, joining the provinces of Bataan and Cavite. The project aims to establish an alternative road transport corridor between Region III (Central Luzon) and Region IV-A (Calabarzon), to help ease traffic congestion in Metro Manila; achieve greater regional economic integration; ease disparities in public service access and economic opportunity that exist between Metro Manila and other parts of Luzon; enable development of ports in southern Bataan to take some of the pressure off the overburdened Port of Manila; and boost nature-based tourism on Bataan's west coast. The project has been proposed by the Department of Public Works and Highways (DPWH), and is being

[1] Asian Development Bank. 2012. Environment Safeguards: A Good Practice Sourcebook - Draft Working Document. December 2012. (p. 49)

[2] International Finance Corporation. 2012. Performance Standard 6 – Biodiversity Conservation and Sustainable Management of Living Natural Resources. January 1, 2012.

pursued under the umbrella of the 'Build, Build, Build' economic development program of the Government of the Philippines. The BCIB project is under consideration for financing by the Asian Development Bank, through its Infrastructure Preparation and Implementation Facility (IPIF) for the Philippines.

The BCIB will connect to the Roman Highway in the Municipality of Mariveles, on the southern tip of the Bataan peninsula, and to the Antero Soriano Highway in the Municipality of Naic, in Cavite. The over-water alignment will be 26 km long and will encompass two high cable-stayed bridges over navigation channels that transit the mouth of Manila Bay, as well as a smaller nearshore navigation bridge near the Cavite shore. The longest over-water component of the BCIB, at approximately 23 km, will be a series of marine viaducts, with road decks about 20 m above the water. The viaduct will pass nearby the east coast of Corregidor Island, which sits in the mouth of the bay. The bridges and viaducts will be supported on a combination of pilings and spread-foot foundations placed in the seafloor. Pilings will be installed by impact driving and boring methods, in accordance with seabed composition. It is expected that the project's construction phase will last approximately 5.5 years, with the marine construction works accounting for the vast majority of construction activity.

1.2 Key Biodiversity Values

The spatially-extensive BCIB project infrastructure will traverse a range of terrestrial and marine ecosystems, and some elements of these ecosystems have been determined to qualify as natural habitat in accordance with the habitat classification guidance provided in PS6 and its supporting Guidance Note 6 (GN6).[3] Although the terrestrial and marine ecosystems present in the BCIB project area have experienced considerable disturbance and degradation as a result of human activity, the natural habitat classification is considered to apply to grassland areas along parts of the approach road alignment on the Bataan side, and to all parts of the marine environment along the over-sea alignment. Following the ADB SPS and IFC PS6, project mitigation shall aim to achieve 'no net loss' of biodiversity values in areas classified as natural habitat.

Based on screening using the Integrated Biodiversity Assessment Tool (IBAT),[4] desktop research, field studies and key informant interviews, a total of 37 wildlife species considered endangered (EN) or critically endangered (CR) by the IUCN are believed more likely than not to use habitat within the BCIB project area; 34 of these are marine species.

As per IFC PS6 a net gain is required from biodiversity features that have been found to trigger critical habitat thresholds. At the time of writing, insufficient data was available to define species-level ecologically appropriate areas of analysis (EAAA), and a broader area of analysis (AoA) was adopted as the spatial unit for assessment until additional baseline data becomes available. In the interim a precautionary approach has been taken to the assessment. This is discussed in further detail in the draft CHA.

[3] IFC. 2019. International Finance Corporation's Guidance Note 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources January 1, 2012 (updated June 27, 2019).

[4] (1) IBAT PS6 & ESS6 Report. Generated under licence 4846-21884 from the Integrated Biodiversity Assessment Tool on 13 September 2021 (GMT). www.ibat-alliance.org (Marine screening report); (2) IBAT PS6 & ESS6 Report. Generated under licence 4846-21885 from the Integrated Biodiversity Assessment Tool on 13 September 2021 (GMT). www.ibat-alliance.org (Terrestrial screening report)

In its current form, the Draft CHA did not find that any of the IBAT-identified EN and CR species were present in the AoA in significant enough numbers to meet PS6 thresholds for Criteria 1–3. However, local individuals and populations of many of these EN and CR species can reasonably be considered vulnerable to disturbance or habitat loss as a result of project construction activities.

Notwithstanding the finding that no EN or CR species could be considered to trigger a critical habitat determination, the critical habitat assessment did identify a number of non-EN and non-CR species that may meet thresholds under Criterion 1 and Criterion 3, as well as habitat types and conservation areas that may qualify as critical habitat elements under Criterion 4. One avian species was deemed a likely qualifying species in relation to Criterion 1, Threshold (b), while another six waterbird species were found to be probable qualifying species under Criterion 3, Threshold (a). The potential for each of these seven species to experience significant adverse impacts from the BCIB project's construction or operation was subsequently evaluated (see Exhibit 1); none were found to be likely to experience significant impacts, due either to having a very low probability of actually being present within the project area (five species), or being adaptable habitat generalists with very low dependency on particular natural resources that may be affected by project activities (two species).[5]

The following is a provisional list of the Project’s critical habitat qualifying features, although again it is noted these may be updated and/or refined with future iterations of the CHA and BAP as additional baseline data becomes available.

Exhibit 1: Assessment of Potential for BCIB Impacts on Identified Qualifying Species

Qualifying Species	Criterion and Threshold	Probability of Significant Impact	Rationale for Assessment
Anas luzonica Philippine Duck VU	Criterion 1 Threshold (b)	Very low	Known to be present in Naic, but habitat generalist with low expected exposure to project activities
Calidris ruficolllis Red-Necked Stint NT	Criterion 3 Threshold (a)	Very low	Habitat within the project area can be considered marginal at best for the species, and there is no evidence of presence
Calidris subminuta Long-Toed Stint LC	Criterion 3 Threshold (a)	Very low	Habitat within the project area can be considered marginal at best for the species, and there is no evidence of presence
Charadrius alexandrinus Kentish Plover LC	Criterion 3 Threshold (a)	Very low	Habitat within the project area can be considered marginal at best for the species, and there is no evidence of presence
Childonias hybrida Whiskered Tern LC	Criterion 3 Threshold (a)	Very low	Known to be present in Naic, but habitat generalist with a varied diet and low reliance on any particular habitat within the project area
Himantopus himantopus Black-Winged Stilt LC	Criterion 3 Threshold (a)	Very low	Habitat within the project area can be considered marginal at best for the species, and there is no evidence of presence
Pluvialis fulva Pacific Golden Plover LC	Criterion 3 Threshold (a)	Very low	Habitat within the project area can be considered marginal at best for the species, and there is no evidence of presence

[5] The vulnerability of these species to project impacts is discussed in the forthcoming EIA report.

The CHA found that four general habitat types, four specific terrestrial conservation areas, and all marine protected areas present within the AoA (which encompassed all of Manila Bay and selected surrounding land areas) may qualify as critical habitat, on the basis of their meeting the conditions of Criterion 4, Threshold (b) - *Other areas not yet assessed by IUCN but determined to be of high priority for conservation by regional or national systematic conservation planning*.

Qualifying habitat types within the broad AoA are coral reefs, seagrass, mudflats and mangroves. Coral habitat is confirmed to be present within the BCIB project area, in the nearshore zones along the south coast of Mariveles and around Corregidor Island and will have high exposure to BCIB project impacts. Limited mangrove remnants are found in the estuaries of rivers and creeks in both the Bataan and Cavite portions of the project area, and to a lesser extent along the rocky shore of Mariveles. Some of these scattered mangrove patches will have minor exposure to construction activity. There are no significant mudflats or seagrass beds in the BCIB project area.

In addition to the four critical habitat types mentioned, one terrestrial key biodiversity area (Mariveles Mountains KBA), which qualifies as critical habitat, overlaps with the BCIB project area, and can be considered potentially vulnerable to land use change and enhanced exploitation risk over the long term as a result of the project's development. The other three terrestrial conservation areas were not considered vulnerable to project impacts due to distance. Two marine protected areas are within range of various impacts expected from BCIB construction activity; these are the Corregidor Islands Marine Park (CIMP) and Naic Fish Sanctuary (NFS). These marine conservation areas are both considered qualifying critical habitat elements.

2 GUIDING PRINCIPLES

2.1 Mitigation Hierarchy

The mitigation hierarchy is a fundamental organizing principle in environmental impact assessment, most particularly in relation to the selection and design of measures to manage expected impacts. Outright prevention or avoidance of anticipated impacts is the priority action under the hierarchy, with minimization being the next best option. Only once prevention and minimization have been considered and developed to the maximum extent feasible, and residual impacts are still anticipated despite such effort, should some form of compensation be proposed. The mitigation hierarchy as it applies to biodiversity is illuminated in Exhibit 2.

Many potential biodiversity impacts can be successfully avoided or substantially minimized by measures developed and implemented in the context of a project's Environmental Management Plan (EMP), and this is applicable to the EMP under development for the BCIB project. However, where biodiversity impacts cannot feasibly be avoided or minimized to an extent sufficient to render them insignificant or otherwise palatable to project stakeholders, then compensatory measures such as restoration offsets, protection offsets and other additional conservation actions have to be developed and pursued. Such measures for addressing significant residual biodiversity impacts are appropriately collected and implemented under the auspices of a BAP.

Exhibit 2: Mitigation Hierarchy Applied to Biodiversity Impacts

Avoid	Minimize	Restore	Offset
As a matter of priority, the project proponent should seek to avoid impacts on biodiversity and ecosystem services, through siting adjustments, design adaptations, selection of alternative construction methods and modification of planned project phasing	When total avoidance of significant impacts is not possible, the project proponent should seek to minimize the extent and severity of impacts, through siting adjustments, design adaptations, selection of alternative construction methods and modification of planned project phasing	When minimization measures are not expected to reduce anticipated biodiversity impacts to insignificant levels or at least levels acceptable to project stakeholders, post-impact restoration of biodiversity values and ecosystem services should be implemented by the project proponent	Biodiversity offsets may be proposed by the project proponent only after appropriate avoidance, minimization and restoration measures have been developed and significant residual impacts are still anticipated, or when additional conservation benefits are sought as an enhancement to the project

2.2 Offset Design

The objective of the BAP is to achieve net gains in biodiversity values by compensating for the expected significant residual impacts on existing values, primarily through offsets. Two main types of offset designs are delineated in PS6: restoration offsets and protection offsets.

Restoration offsets. Sites with similar underlying biodiversity characteristics to project-affected sites (e.g., species assemblages, ecosystem types, ecological functions) may often be found in degraded form nearby the project area, and such areas can be legitimate targets for an offset. Implementing durable restoration or ecological enhancement on sites of similar or greater area than the site destroyed or degraded by the project may more than compensate for the loss. In a more extreme approach, entirely new habitat may be created to replace what is to be lost, as is the case with created wetlands and artificial reefs; over time, the biodiversity values in created habitat may exceed those of the original even on an equal-area basis, particularly if the original had suffered heavy pre-project degradation, but reserving a significantly larger area for created habitat is typically appropriate to secure the desired level of offset within a program-relevant timeframe.

Protection offsets. Also called averted loss offsets, protection offsets deliver biodiversity values by securing durable protection for habitat of similar characteristics to the project-affected habitat. This is only applicable in situations in which the target offset site is realistically assessed to be at high or very high risk of being degraded or destroyed as a result of ongoing or imminent processes (e.g., general land use change, change in ownership, public policy shifts, resource concession issuance, resource market developments, etc.). Projection of the biodiversity loss that can be averted by protection of target sites requires thoughtful and rigorous analysis of the relevant threat trends.

Design of both restoration and protection offsets is guided by four principles: proportionality, additionality, equivalence and permanence.

Proportionality. The measures proposed for inclusion in the BAP should reflect the significance—and particularly the scale—of anticipated residual impacts. This is implicit in the notions of 'no net loss' and 'net gain', but it bears emphasizing that it is in the Proponent's interest, and those of at least some other stakeholders, to develop measures commensurate with the expected loss or degradation of biodiversity resources. In the face of poor data availability and predictive uncertainty, it is reasonable to try and err on the side of 'too much' by adding a surplus of management effort.

Additionality. The measures in the BAP are to be understood as incremental action relative to what would be expected to take place in the absence of the plan. Ongoing or planned activities that are not part of the offset should not normally be counted towards net biodiversity gains achieved under the BAP. That said, the probability of pre-existing plans and programs (e.g., a management plan for a protected area) actually coming to fruition on their own should be critically assessed. It may be reasonable for a BAP to count pre-existing plans if support delivered through BAP implementation is realistically the only way the plans' objectives will be fully reached. Indeed, supporting existing programs may sometimes be the most efficient and durable path to successful BAP implementation.

Equivalence. A BAP should aim to conserve the same biodiversity values (e.g., species, habitats, ecosystems or ecological functions) as what are expected to be lost or degraded due to residual project impacts. This is sometimes referred to as the 'like-for-like' principle. In some cases, this may mean that offsets are appropriately developed in locations physically removed from the project area.

Permanence. The biodiversity benefits of a BAP should be set up to last, rather than being left to fate and circumstances as soon as the project's construction winds down, consultants' contracts come to an end, regulators and funding entities lose interest and influence, and control of the project is transferred to an operating entity which may lack the expertise and resources to grapple with biodiversity management. As a general rule, the BAP's term of implementation should be set to match the expected duration of adverse biodiversity impacts from the project; for some impacts, this is likely to equate to the planned operating life of the project, which may be very long in the case of road infrastructure in particular. At least some components of the BAP may need to be conceived as permanent project features, and many or most may appropriately be conceived as parallel long-term initiatives that are linked to but largely independent of the project EMP. In this sense, the BAP can be a useful vehicle for ensuring that biodiversity-related measures that require implementation well into the project's operation phase (and which may or may not be offsets) receive sustained attention.

3 STEPS IN BAP DEVELOPMENT

Development of a BAP should progress through a series of steps, beginning with the first realization that there will be residual impacts to be addressed and ending with adaptive implementation of the plan informed by monitoring. A schematic of expected BAP planning steps is shown in Exhibit 3. It will be noted that this preliminary BAP has, at the time of writing, progressed through the first two steps in plan development, with consultations with experts and stakeholders being the next task in line. In many cases it may be appropriate to advance BAP development through to the end of the third step by the time of loan processing and defer negotiation amongst the concerned stakeholders to the pre-construction period. The fourth to sixth steps are carried forward through the formulation of a supplementary Offset Management Plan, which will complete the BAP by adding agreed-upon details of site-specific activities, roles and responsibilities, timing, costs, and funding mechanisms.

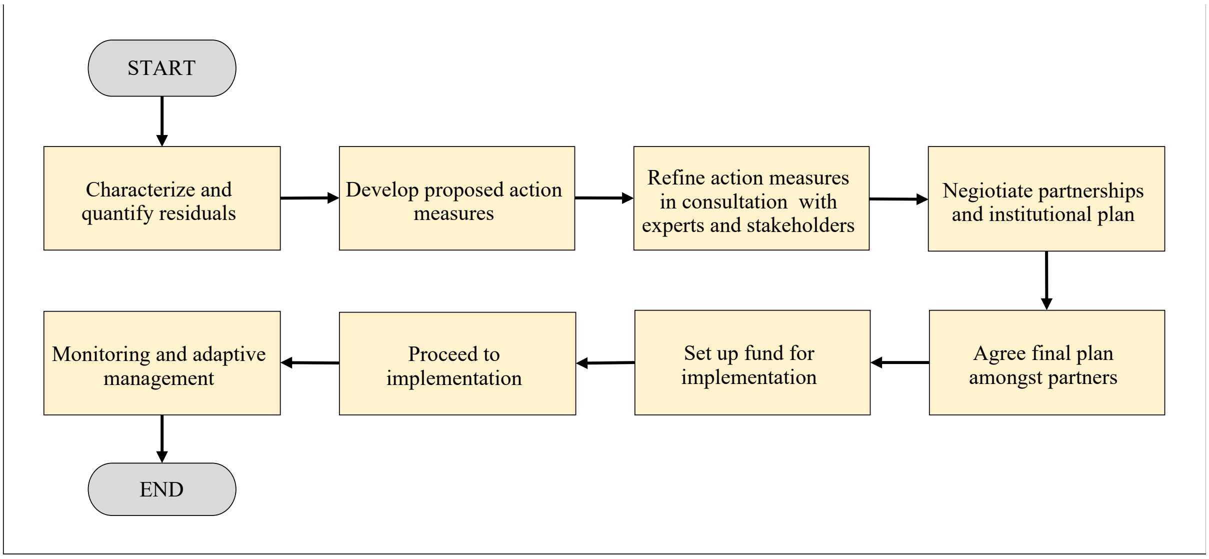


Exhibit 3: Biodiversity Action Plan Development Process

4 ANTICIPATED BIODIVERSITY LOSSES AND PROPOSED OFFSET OBJECTIVES

At the time of writing, precise quantification of some of the BCIB project's key anticipated impacts on biodiversity remains slightly beyond the horizon. It has nevertheless been possible to scope the nature and approximate scale and severity of impacts, and to develop initial proposals for practical action to be included in the BAP. The significant residual impacts on biodiversity that are foreseen as results of the BCIB project, with preliminary insights on quantification where possible, and preliminary action plan concepts, are shown in Exhibit 4.

It is acknowledged that the suitability of proposals floated in Exhibit 4 may change over time as the residual impact assessment is updated in line with additional longitudinal baseline data gathering that is planned during the pre-construction and construction phases of the project. The possible BAP measures listed below are indicative and will be subject to review by suitable experts and discussion with stakeholders as the Project refines a set of appropriate net gain (and no net loss) measures.

Exhibit 4: Preliminary Accounting of Residual Impacts and Possible BAP Measures

	Residual Impact	Preliminary Quantification of Expected Residual Impact	Possible BAP Measures
1	Increased risk of forest/grassland (Natural Habitat) loss from induced development, informal settlement, logging and mining in Mariveles Mountains KBA	Numerous factors contribute to the increased risk profile for forest/grassland areas, making quantification difficult. Based on proximity to road corridors alone, it may be inferred that as much as one quarter of the KBA's total area of 12,156 ha may be at increased risk over the long term due to the establishment of the BCIB, primarily along the southern and eastern flanks of the volcano. This is the most significant terrestrial biodiversity risk associated with the BCIB project.	Given high uncertainty regarding actual future risk to the KBA (i.e., how, where and how quickly exploitation may be manifest), an adaptive management approach that pairs regular monitoring with formulation of proactive land use controls is proposed. A long-term monitoring program could be set up to detect and analyze emerging patterns of change in forest/grassland use in the southern and eastern portions of the KBA, under the control of a multi-stakeholder partnership entity with participation of DPWH, Mariveles LGU, Limay LGU, the Ayta Magbukún indigenous community, DENR-BMB and interested NGOs. Based on information gained from the monitoring program, the same partnership entity could formulate plans to counteract threats through application of various land use controls at their disposal. What forms such protective actions would ultimately take would depend on the nature of identified threats as well as the cooperative synergies of the partner entities, but it is reasonable to speculate that tools including zoning, protective easements, protected area designations, community forestry, enhanced surveillance and law enforcement, and enhanced conservation management would likely be considered, possibly in combination. As the KBA is probable critical habitat, the overarching target of the collaborative scheme would be to achieve a net gain in biodiversity values within the KBA.
2	Direct loss of grassland (Natural Habitat) beneath ROW for approach road in Mariveles	An estimated 12.3 ha of somewhat degraded natural grassland/scrubland falls within the project ROW, primarily in the portion of the approach nearest Manila Bay (11.7 ha), but also around the Roman Highway interchange (0.6 ha).	A Natural Grassland Replacement Plan has been integrated in the project EMP to generate substantial grassland conservation using land along the approach road alignment in Bataan. However, given normally anticipated failures to achieve perfect restoration outcomes within the desired timeframe, as well as probable difficulties in securing adequate land in the immediate vicinity, a conservation offset is proposed for implementation in a suitable area elsewhere to ensure that 'no net loss' can be achieved.
3	Displacement and degradation of benthic habitat in coral habitat (Critical Habitat) areas (Mariveles nearshore and Corregidor Island nearshore)	The project's construction will directly displace or remove benthic life in areas known or predicted to be characterized by coral and coral-associated lifeforms. Permanent displacement losses (defined as the cross-section of piles or foundations installed on the seabed) are considered likely to be canceled out by development of diverse fouling communities on the piles and foundations over time. Losses of benthic life to dredging and placement/removal of rock jetties will not be permanent, but it can be expected that natural recovery would be very slow (on the order of decades), and likely impeded by presence of stressors such as fishing activity. The area of loss can be approximated based	A protection offset is proposed to compensate for coral habitat destroyed or degraded by the project works, as well as possible long-term degradation from ALAN and shading effects. Much of the affected coral habitat is in areas likely to be subject to further disturbance as a result of future industrial development (Mariveles shore), and in-situ restoration faces significant challenges in this context. At the same time, a conservation framework (as yet not followed up with substantial conservation action) already exists for the marine resources in the vicinity of Corregidor Island, and this can be readily leveraged to develop an appropriate local offset scheme.

	Residual Impact	Preliminary Quantification of Expected Residual Impact	Possible BAP Measures
		on currently available information regarding the temporary and permanent in-water infrastructure, as follows: • Dredged area for drydock facility: 10.0 ha (tentative) • Area under temporary rock jetties: 3.6 ha (tentative) • Area dredged for spread foot foundations in coral habitat areas: 1.1 ha (tentative) • Total permanent/long-term loss of coral habitat: 14.7 ha A Coral Relocation Plan has been integrated in the EMP to help minimize the loss of coral organisms despite the destruction of coral habitat, but this measure should not be expected to completely negate the anticipated losses listed above, given high uncertainty regarding transplanting success and the weakness of the substitution (i.e., a collection of transplanted organisms vs. a holistic community). In addition to benthic area that is totally removed, significant degradation of benthic life is anticipated in a zone along the alignment in coral habitat areas, where repeated disturbance over a 5 to 6- year period from anchoring, barge spuds, vessel contact, prop wash and thruster surge is to be expected. Such degradation would be expected to take some time to repair itself, a process made slower and less likely by the existence of other degradation factors such as fishing activity. The area within coral habitat that will be subject to non-trivial levels of degradation is estimated at approximately 15 ha in the Mariveles nearshore zone and 42 ha in the Corregidor Island nearshore zone, for a total of 57 ha of coral habitat subject to moderate degradation during construction. Additionally, underwater noise from piling work is likely to damage coral habitat indirectly through mortality of fish and other organisms, as well as habitat avoidance by species that play a role in coral reef maintenance. During operation, the bridge's presence will have permanent effects on benthic life in coral habitat, due to shading by the viaduct decks and effects of artificial light at night (ALAN). Direct light emissions to the water surface are to be minimized through sensitive roadway lighting design, but reflected light is difficult to eliminate, so there will be some residual effect on the ecological integrity of coral habitat areas crossed by the alignment. The significance of shading and ALAN in the BCIB context is impossible to assess with any degree of confidence with the information available (regarding both the infrastructure and the existing benthic ecology), but a modest residual effect is hypothetically assumed.	The proposed approach is to support the management activities already envisioned for the nascent Corregidor Islands Marine Park (CIMP). A protection offset is compatible with the park management plan's objective of enforcing prohibition on fishing and exploitation in almost all of the park's named management zones. Proposed support to the CIMP could include provision of technical expertise, help with capacity-building, financial support and training to establish a competent surveillance and enforcement corps, and coral restoration projects. No part of the CIMP's 508 ha presently enjoys any meaningful marine resource protection, so there is substantial scope for conservation gains. A multiplier of 10 times is probably the minimum appropriate for calculation of new area under protection to achieve net gain in coral conservation values over time, so the CIMP would need to be expanded to at least 715 ha to meet the net gain objective. Eventual expansion of the CIMP to include the sea area encompassing all of the islands in the vicinity of Corregidor has been a component of the park stakeholders' long-term vision (this is why Islands is in the plural in the park's name); expanding to include just Caballo Island along with Corregidor in a contiguous block would reasonably be expected to expand the park to about 2,500 ha, and including La Monja Island (to the west) might easily double that to about 5,000 ha. It is proposed that competent protection over such an area for at least 40–50 years could have a reasonable chance of achieving net gain in biodiversity values relative to pre-project conditions.
4	Impacts on marine turtle use of local beaches for nesting	Impacts on marine turtle use of beaches for nesting will have both permanent and temporary effects. An estimated 400 m^2 of beach area at the Naic landing point will become permanently unviable for nesting due to shading by the overhead viaduct. An estimated 2,000 m^2 of beach area adjacent to the alignment at this location is likely to suffer permanently reduced habitat suitability for nesting due to road noise and light	A protection offset is proposed to compensate for expected residual effects on marine turtles. This would consist of financial, in-kind and institutional support for substantially expanding and building the long-term institutional capacity of existing turtle hatchery programs run by the MENROs of local municipalities and establishing new programs in municipalities that currently lack one. The

	Residual Impact	Preliminary Quantification of Expected Residual Impact	Possible BAP Measures
		leakage from the overhead viaduct. While it is known that marine turtles use this beach occasionally, there is insufficient data to enable quantification of the significance of the displacement. Underwater noise, especially but not exclusively from pile driving, is very likely to disrupt marine turtle use of local beaches. This is likely to apply not just to beaches near the landing points, but to all nesting beaches further into Manila Bay as well, since the turtles have to transit the project area to access them. It is possible that no nesting will occur at all on any of the known nesting beaches inshore of the BCIB alignment, and within several kilometers seaward, for the duration of pile driving works (at least three years). Underwater noise impacts are expected to be partially mitigated by use of noise attenuation at pile driving sites, but mitigation is likely to achieve a 60 % reduction in impact radii, at best. The abundance of turtles nesting on beaches likely to be affected by project-related disturbance is very difficult to quantify based on existing hatchery program data, due to limited and irregular coverage of beaches, and other monitoring is presently non-existent.	muncipalities of Mariveles, Naic, Tanza, Rosario,Ternate and Cavite City are all known to have sandy beaches used by marine turtles for nesting, and all would be targeted for inclusion in the capacity-building program. The offset would not protect habitat, but rather protect nesting turtles and especially hatchlings from known threats, thereby increasing the viability of the subject species in local waters. The program would aim to implement sufficient activities within the construction and pre-construction phases of the project to ensure coverage of all known nesting beaches for the duration of the nesting season each year. It is suggested that sustained hatchling releases from substantially expanded hatchery programs over many years would more than make up for the expected loss of nesting opportunities on local beaches during the BCIB's heavy marine works period, and for the permanent loss and impairment of nesting habitat at the Naic landing point, thus potentially achieving a net gain. *NB: A Marine Turtle Management Plan is proposed for implementation under the project EMP, and it may be possible to subsume all elements of this proposed Action Program under that plan's measures. However, the Action Program may be seen as a better vehicle for the inter-institutional coordination that will be needed, and also provide a means of continuing monitoring well into the project's operation phase, which would allow verification of conservation results. Decisions about priorities and the ultimate shape of marine turtle conservation efforts (i.e., under the EMP, under the BAP, or some combination) are for future discussion with the relevant stakeholders.*
5	Possible impacts on nocturnal volants (avian migrants and bats) from collisions with BCIB tall bridges	Manila Bay is positioned within the East Asian-Australasian Flyway, and the northern and eastern fringes of the bay are known to host globally significant concentrations of waterbirds, numerous passerine species also use the flyway and accordingly transit through the central part of Luzon. Tall infrastructure including suspension bridges and cable-stayed bridges is known to pose significant mortality risks to nocturnal avian migrants, particularly during periods of low visibility due to weather. It is considered possible that placement of two cable-stayed bridges near the mouth of Manila Bay could result in bird deaths, and mitigation is to be pursued through adoption of a programmable lighting scheme thought likely to reduce collision risk. However, avian collision risk is highly context specific, and there are many unknowns in the BCIB situation, including the density and routes of bird movements through the project area, species composition, timing of migration for different species, and prevalence of particular atmospheric conditions. In light of these uncertainties, optimal configuration of lighting-based mitigation is not known, and residual risk cannot be quantified with any confidence. The precautionary approach supports additional action to ensure that residual risk is minimized to the greatest extent possible.	Given the high level of uncertainty regarding conditions and residuals, an adaptive management approach is recommended. A bird and bat mortality monitoring program is proposed for the early operation phase of the BCIB bridges, coupled with a systematic program of experimentation to seek optimal programming for the BCIB bridge lighting schemes, based on empirical data. The adaptive management program is proposed as a precautionary measure to address a common but poorly understood impact of tall infrastructure, one that is assuming greater importance as populations of many migrant bird species is in decline. *NB: Both a Bird Management Plan and Bat Management Plan are proposed for implementation under the project EMP, and mitigation collision risk may be a main focus of each. It may be possible to subsume all elements of this proposed Action Program under those management plans, although the BAP mechanism may be better suited for carrying forward monitoring of actual bridge effects well into the operation phase (which is when the impacts will mainly occur). Decisions about priorities and the ultimate shape of efforts to manage nocturnal collision*

	Residual Impact	Preliminary Quantification of Expected Residual Impact	Possible BAP Measures
		Bats are also known to be at risk of mortality from collisions with bridge infrastructure.	*risk and associated monitoring (i.e., under the EMP, under the BAP, or some combination) are for future discussion with the relevant stakeholders.*
6	Injury and disturbance of protected marine mammals	Underwater noise from pile driving operations is expected to be intense over a period of at least three years. Even with mitigation, the piling works can be expected to seriously affect all of the 8–15 cetacean species thought likely to be present in Manila Bay at least occasionally, with possible effects including injury and eventual death, stress, habitat avoidance, and disruption of communication, feeding and reproduction. As underwater noise is suspected to be a contributing factor in some cetacean groundings, increased groundings within the bay may become more frequent during the piling period. Significant mitigation of underwater noise from piling work is possible with existing technology, and this will be required of contractors, substantial residual effects are expected, even if they can't be quantified due to very low availability of data on abundance, distribution and movements of marine mammals in Manila Bay.	An Underwater Noise Management Plan is proposed under the project EMP, but this will primarily seek to manage construction activity in order to minimize effects on cetaceans, e.g., via longitudinal and real-time acoustic monitoring, worksite visual monitoring for cetacean presence, imposition of work stoppages and temporal restrictions on piling activity, and enforcement of controls on work vessel operation. A complementary Action Program is proposed under the BAP to offset accumulated harm to cetacean populations within and around Manila Bay from the project. This would involve strong action to support and build the capacity of existing or purpose-built cetacean rescue and conservation programs, primarily during the project's construction phase. The BAP could also serve as a mechanism for continuing support and oversight well into the operation phase. Although both the extent of harm to cetacean populations from the project and population restoration effects of the proposed conservation action will be impossible to measure with any degree of confidence, the Action Program is justified based on the precautionary principle.

5 PROPOSED ACTION PROGRAMS

The following descriptions of the action programs represent an initial high-level scoping of the practical implications of the proposed approaches to achieving net gain for the receptors of focus for this Preliminary BAP. The project will engage appropriate expertise (within the staff of the Construction Supervision Consultant) to further explore and shape these proposals—in dialogue with relevant partner entities and also with ADB— into workable programs backed up with appropriate levels of commitment, institutional foundation and fiduciary governance. It is probable that most or all will undergo substantial evolution during that process, and possible that some may be replaced entirely. As indicated earlier, a BAP should be treated as a living document in its earlier stages, and it is to be expected that this Preliminary BAP will go through multiple iterations before all Action Programs are fully agreed and set on a path to implementation under a finalized BAP and accompanying—and more detailed and technical—Biodiversity Offset Management Plan and Biodiversity Monitoring Plan.

5.1 Action Program A – Management of Exploitation Risk in Mariveles Mountains KBA

Plan Element	Explanation
Action	Proactive monitoring and management program for forest and grassland areas on the southern and eastern flanks of Mt. Mariveles, within the Mariveles Mountains KBA
Objective	To proactively protect forest and grassland areas in the Mariveles Mountains KBA from increased exploitation pressure as a result of the establishment of the BCIB, achieving a net gain in biodiversity values
Approach	**Monitoring to Inform Conservation Action** Long-term monitoring of forest/grassland use trends and land use change in the southern and eastern parts of the KBA, with participation from DPWH, Mariveles LGU, Limay LGU, the Ayta Magbukún indigenous community and DENR-BMB, is proposed to detect the emergence of worrisome trends and help focus and drive formulation of biodiversity conservation action within the KBA. Monitoring could consist of yearly collection and analysis of relevant data, as follows: (1) Land cover change analysis using newly acquired high-resolution satellite imagery, conducted by a qualified GIS technician using the same analysis and ground-truthing methodology each time; (2) Field surveys of locations with suspected emerging land use change; (3) Field interview surveys with residents along access roads regarding possible evidence of resource extraction, informal settlement, road improvements, etc. (e.g., logging and mining truck traffic, local hearsay, influx of settlers) An annual monitoring report would be expected to provide a comprehensive picture of land cover change linked to ground-level insights regarding change factors. Each annual monitoring report would include a threats analysis. **Conservation Action for Net Gain** Appropriate conservation action to achieve net gain in biodiversity values will have to be agreed by the partnering entities, and the choice of measures would ideally be influenced by results from the first 3–4 years of monitoring. Protective tools at the partners' disposal would include various municipal land use planning and permitting mechanisms, protected area and buffer zone designations, exercise of indigenous tenurial rights, and community mobilization. Development of an action plan for the KBA based on the threats analysis may also be a useful step. Restoration offsets targeted at key species could be integrated with protective efforts. This component of the Action Program will be subject to further feasibility consideration and early dialogue with potential institutional partners prior to development of the next iteration of the BAP.
Outcome	The expected outcome of the proposed program is the long-term maintenance and restoration of stable land cover over the Mariveles and Limay portions of the Mariveles Mountains KBA, despite the possibility of increased exploitation pressure due to development of the BCIB.

Plan Element	Explanation
Timing	Details of timing will need to be discussed with key stakeholders and will be contingent upon formation of a solid working partnership. The monitoring program should begin as soon as possible after project approval, to allow refinement of methodologies and establishment of a baseline and longitudinal trends analysis prior to opening of the BCIB link. The monitoring should continue until at least the tenth year of BCIB operation, to capture the emerging influence of the anticipated BCIB induced development effect and inform continuing adaptation of the protective measures selected for implementation. Practical conservation actions defined by the implementing partnership should ideally be implemented beginning in the first half of the construction phase, to cement durable mechanisms as much as possible ahead of anticipatory land development.
Responsible Parties	It is proposed that the Action Program should be implemented under a partnership entity composed of, at minimum, DPWH (Chair), Mariveles LGU, Limay LGU, Ayta Magbukún indigenous community, DENR-BMB Region III, and an established biodiversity-focused NGO. Funding would be provided by DPWH, through a comprehensive Biodiversity Action Plan Fund for the BCIB project. Annual monitoring would be carried out on a contract basis by a qualified firm with solid GIS and qualitative field survey capabilities, with logistical support and participation from the partners as needed. Early coordination and guidance for partnership formation and planning, as well as implementation guidance for the duration of the construction phase, would be the responsibility of biodiversity specialists in the employ of the Construction Supervision Consultant. ADB would provide specialist review inputs and coordination assistance as needed for the duration of the construction phase.
Accountability	It is recommended that a Biodiversity Offset Committee be established to provide oversight for all Action Programs grouped under the BAP, to be chaired by ADB with representation from DPWH Environmental and Social Safeguards Division (DPWH-ESSD), DENR-Biodiversity Management Bureau (DENR-BMB), Bureau of Fisheries and Aquatic Resources under the Ministry of Agriculture (BFAR), the Marine Sciences Institute of the University of the Philippines (MSI), and a selection of nationally-recognized NGOs.
Verification	Verification measures will need to be confirmed once final actions have been confirmed.
Estimated Cost	Due to uncertainty regarding the final set of actions that will be developed by the partners in this Action Program (particularly with regards to the practical conservation actions that may be developed), only a broadly indicative breakdown of costs for the Action Program can be suggested, as follows: Monitoring: PHP 20,000,000 Conservation actions: PHP 300,000,000 – 1,000,000,000 **Total: PHP 320,000,000 – 1,020,000,000**

5.2 Action Program B – Biodiversity Offset for Natural Grassland Habitat of Alas-Asin

Plan Element	Explanation
Action	Establishment of a supplementary off-site biodiversity offset
Objective	To formulate, plan and implement permanent protection and/or restoration of grassland habitat somewhere in southern Bataan to help offset biodiversity values lost to conversion of 12.3 ha of Natural Habitat for development of the BCIB approach road in Bataan.
Approach	A Natural Grassland Replacement Plan is proposed under the project EMP to set aside and restore grassland on remnant parcels along the BCIB approach road alignment in Bataan, but this is not expected to achieve no net loss of biodiversity values due to land availability constraints. The Action Program is proposed under the BAP to derive additional biodiversity benefits, bringing the overall balance of biodiversity values to at least the no net loss threshold (required for Natural Habitat). Determination of an appropriate offset hectarage and location for the supplemental offsite will be subject to prior calculation of biodiversity values contributed by the actions implemented under the Natural Grassland Replacement Plan. Accordingly, further formulation of the offset plan should appropriately wait until the Natural Grassland Replacement Plan has been prepared. A broadly indicative estimate at this early stage is for a supplemental offset area somewhere in the range of 10–20 ha.
Outcome	The expected outcome of the Action Program is no net loss (and ideally some net gain) of biodiversity values despite the conversion of 12.3 ha of Natural Habitat for the Bataan approach road.

Plan Element	Explanation
Timing	The timing of offset design will be dependent on development of the Natural Grassland Replacement Plan under the project EMP. That plan is expected to be prepared during the late pre-construction phase, for implementation beginning around the start of construction. Thus, determination of a target offset hectarage, identification of appropriate site or sites, and formation of necessary implementation partnerships could proceed from the start of the construction phase. Timing of subsequent steps would be dependent on the balance of protection and restoration needed to achieve the desired offset values on the selected site, and on the particular institutional arrangements required (i.e., land acquisition vs partnership with managers of an existing conservation site).
Responsible Parties	It is expected that the Action Program would need to be implemented through a partnership agreement between DPWH and at least one other entity, such as DENR-BMB or a land conservancy. Involvement of an established NGO with biodiversity expertise in an advisory role would also be advisable. The Action Program's formulation and development would be spearheaded by the biodiversity specialists to be engaged by the Construction Supervision Consultant, per the project EMP. Funding for the Action Program would be supplied by DPWH, through a proposed Biodiversity Action Plan Implementation Fund, which is accounted for in the EMP cost estimate. ADB would provide specialist review inputs and coordination assistance as needed for the duration of the construction phase.
Accountability	It is recommended that a Biodiversity Offset Committee be established to provide oversight for all programs grouped under the BAP, to be chaired by ADB with representation from DPWH Environmental and Social Safeguards Divisions (DPWH-ESSD), DENR-Biodiversity Management Bureau (DENR-BMB), Bureau of Fisheries and Aquatic Resources under the Ministry of Agriculture (BFAR), the Marine Sciences Institute of the University of the Philippines (MSI), and a selection of nationally-recognized NGOs.
Verification	The approach to verification will need to be developed once the action Program has been more fully developed.
Estimated Cost	Due to high uncertainty regarding the magnitude of the supplemental offset that will ultimately be needed, and also regarding mechanisms (land acquisition vs partnership) and actions (protection vs restoration), only a broadly indicative estimate of costs for the Action Program can be suggested, as follows: **Total: PHP 50,000,000 – 200,000,000**

5.3 Action Program C – Offset of Residual Effects on Coral Habitat Through Enhancement of Corregidor Islands Marine Park Management Programs

Plan Element	Explanation
Action	Support for enhancement and expansion of protection and management plans proposed for the Corregidor Islands Marine Park (CIMP)
Objective	To help build a competent and stable protective management and restoration scheme for the marine environment in the vicinity of the BCIB project area to secure net gain in marine biodiversity values despite anticipated losses due to project implementation, based around the existing Corregidor Islands Marine Park concept.
Approach	The main thrust of the proposed Action Program would be a protection offset of sufficient magnitude to secure, with a high degree of confidence, net gain in biodiversity values despite loss of approximately 14 ha of benthic habitat and significant reversible degradation of about 57 ha of benthic habitat. Determination of an appropriate offset ratio will be informed by longitudinal marine surveys to be carried out during the pre-construction and construction phases under the EMP, but it is provisionally suggested that a multiplier of at least 10 x (and most likely well above that) would be appropriate. Accordingly, substantial expansion of the CIMP would be envisioned under the Action Program, to include at least Caballo Island and environs, as well as the entirety of the San Jose Bay caldera (essentially the entire underwater area of the Corregidor seamount); this would encompass approximately 4,500 ha. As virtually none of this sea area is now under meaningful protection, the potential biodiversity value gains from long-term protection would be substantial. Activities provisionally proposed to achieve effective long-term protection of an expanded CIMP are as follows:

Plan Element	Explanation
	• Coordination with the existing multi-stakeholder CIMP Management Board to expand the CIMP to the proposed 4,500 hectares (or larger, to include the area around La Monja Island as well) via ordinance of the Cavite City council; • Capacity-building support for the CIMP Secretariat, including establishment of permanent staff positions and training • Establishment and training of a professional surveillance and enforcement corps; • Provision of equipment for surveillance and management of restoration projects already envisioned by the CIMP Management Board; • Development of a long-term fixed-transect biodiversity monitoring program as a component of the CIMP's management; and • Establishment of an endowment fund to support maintenance of the CIMP's protective management capacity. All of the actions proposed above would be subject to discussion and agreement with the multi-stakeholder management board of the CIMP, most especially its Chair, the Cavite City LGU, which has jurisdiction over all waters surrounding the Corregidor and La Monja seamounts.
Outcome	The desired outcome of the action program is an expanded CIMP with a strengthened management team capable of ensuring effective long-term protection and management of the park's marine resources, resulting in a net gain of marine biodiversity values relative to pre-project conditions.
Timing	Timing of Action Program formulation would be a matter for discussion with the stakeholders but given that an agreed management entity already exists for the CIMP, formation of the necessary support partnership with DPWH and development of a formal offset plan could conceivably begin shortly after approval of the BCIB project. There would be no need for the proposed actions to accommodate the construction schedule, with the possible minor exception of boundary demarcation. It is foreseeable that all proposed components of the Action Program could be implemented before the end of the BCIB construction phase.
Responsible Parties	It is proposed that the action program would be implemented by a formal partnership formed between DPWH and the CIMP Management Board. The Action Program's formulation and development would be spearheaded by the biodiversity specialists to be engaged by the Construction Supervision Consultant, per the project EMP. Funding for the Action Program would be supplied by DPWH, through a proposed Biodiversity Action Plan Implementation Fund, which is accounted for in the EMP cost estimate. ADB would provide specialist review inputs and coordination assistance as needed for the duration of the construction phase.
Accountability	It is recommended that a Biodiversity Offset Committee be established to provide oversight for all programs grouped under the BAP, to be chaired by ADB with representation from DPWH Environmental and Social Safeguards Divisions (DPWH-ESSD), DENR-Biodiversity Management Bureau (DENR-BMB), Bureau of Fisheries and Aquatic Resources under the Ministry of Agriculture (BFAR), the Marine Sciences Institute of the University of the Philippines (MSI), and a selection of nationally-recognized NGOs.
Verification	The approach to verification will need to be confirmed once this action program has been finalized.
Estimated Cost	Due to uncertainty regarding the final set of actions that will be agreed by the partners in this Action Program, only a broadly indicative breakdown of costs for the Action Program is suggested at this early stage, as follows: Capacity-building for CIMP Secretariat: PHP 50,000,000 Establishment and training of professional surveillance and enforcement corps; PHP 20,000,000 Equipment provision: PHP 10,000,000 Set-up of permanent monitoring program: PHP 10,000,000 Management endowment: PHP 400,000,000 – 900,000,000 (dependent on selected term of offset) **Total: PHP 500,000,000 – 1,000,000,000**

5.4 Action Program D – Offset of Residual Effects on Marine Turtles Through Support of Municipal Hatchery and Outreach Programs

Plan Element	Explanation
Action	Implement a support and capacity-building program for local marine turtle hatchery and conservation programs
Objective	To offset residual effects on marine turtles from construction of the BCIB, including limited nesting habitat loss and medium-term exclusion from the bay due to marine pile driving
Approach	A Marine Turtle Management Plan is proposed under the project EMP (primarily aimed at minimizing risks to turtles during construction), and it may be possible to meet the objective of the Action Program under that plan alone; feasibility of this will be worked out when the Marine Turtle Management Plan is prepared based in part on findings from longitudinal marine turtle monitoring to be undertaken in the pre-construction phase. Elements of the proposed Action Program as a stand-alone offset initiative are provisionally outlined here. An understanding of turtle abundance, movements and habitat use is essential for formulation of a realistic offset proposal. Longitudinal monitoring including tracking and beach monitoring will be undertaken under the EMP during the pre-construction and early construction phases. Although offset targets cannot be set until the appropriate level of understanding is reached, mechanisms for implementation can be conceptualized. The proposed protection offset would not protect habitat, but rather protect nesting turtles and especially eggs and hatchlings from known threats, thereby increasing the viability of the subject species in local waters. The Action Program would direct attention and investment to substantially increasing the capacity of existing municipal hatchery programs around the mouth of Manila Bay, which currently provide protective intervention for only a small portion of assumed nesting activity on sandy beaches in the area. Support may include establishment of new programs in some municipalities where the operational status of existing programs has not been confirmed. The Action Program would target programs in the municipalities of Mariveles, Naic, Ternate, Tanza and Cavite City, all of which have at least one known nesting beach. Proposed supports for municipal programs are as follows: • Capacity-building for the Municipal Environment and Natural Resources Offices (MENROs) responsible for coastal conservation programs, including training in public outreach, volunteer recruitment and mobilization, beach monitoring methods, egg handling, hatchery management, hatchling handling, mapping and data management; • Investments in establishment, expansion and improvement of hatchery facilities; and • Establishment of an endowment fund to support ongoing implementation of hatchery programs. The above support activities would be implemented primarily during the pre-construction and construction phases of the project. If assessment of offset needs developed under the Marine Turtle Management Plan indicates a mismatch between proposed activity and achievable benefits, additional hatchery programs outside the bay could be selected for inclusion, or the length of time over which financial support is provided could be extended.
Outcome	Increased marine turtle populations in Manila Bay over time despite disturbance from the BCIB construction process.
Timing	Implementation of the proposed Action Program (if not subsumed within the Marine Turtle Management Plan under the EMP) could begin in the pre-construction phase and be completed before the end of construction.
Responsible Parties	It is proposed that the Action Program should be implemented at a minimum by formal partnerships between DPWH and each of the concerned LGUs (Mariveles, Naic, Ternate, Tanza, Cavite City). Participation of interested turtle-focused NGOs would also be advisable. Implementation would be spearheaded by biodiversity specialists engaged by the Construction Supervision Consultant. DPWH would provide funding for the Action Program. ADB would provide specialist review inputs and coordination assistance as needed for the duration of the construction phase.
Accountability	It is recommended that a Biodiversity Offset Committee be established to provide oversight for all programs grouped under the BAP, to be chaired by ADB with representation from DPWH Environmental and Social Safeguards Divisions (DPWH-ESSD), DENR-Biodiversity Management Bureau (DENR-BMB), Bureau of Fisheries and Aquatic Resources under the Ministry of Agriculture (BFAR), the Marine Sciences Institute of the University of the Philippines (MSI), and a selection of nationally-recognized NGOs.
Verification	The approach to verification will need to be confirmed once this Action Program has been finalized.

Plan Element	Explanation
Estimated Cost	Due to uncertainty regarding the final set of actions that will be agreed by the partners in this Action Program, only a broadly indicative breakdown of costs for the Action Program is suggested at this early stage, as follows: Training for personnel of MENRO hatchery programs: PHP 500,000 Support for hatchery improvements: PHP 2,000,000 Management support endowment: PHP 55,000,000 – 100,000,000 **Total: PHP 57,500,000 – 102,500,000**

5.5 Action Plan E – Management of Bird and Bat Collision Risk

Plan Element	Explanation
Action	Compensation measures for bird and bat mortality.
Objective	To compensate for possible residual impacts of the project on birds.
Approach	Aside from the broad-scale appreciation of the seasonal migration of passerine and waterbird species within the East Asian-Australasian Flyway, movements (including nocturnal flight) of local and migrating birds through the BCIB project area are very poorly understood. Prediction of possible avian impacts from the tall bridge infrastructure of the BCIB is essentially impossible, although other tall infrastructure including cable-stayed bridges has a record of killing substantial numbers of birds, particularly during times of reduced visibility, so the risk can be assumed to be greater than zero and possibly significant at least part of the time. Bats are also known to suffer mortality from contact with tall infrastructure. Given very high uncertainty on the scale of impacts and species affected, conceptualization of offset measures is not appropriate at this early stage. However, it is anticipated that longitudinal bird and bat surveys conducted during the pre-construction and construction phases of the project (as provided for under the EMP) may identify risks for particular species and species groups, and indicate a need for mitigation measures. This Action Program is proposed as a mechanism to address this possible eventuality, following the precautionary principle. The particular elements of the Action Program cannot be identified at this time. A preliminary high-level scoping of possible measures might include modifications to the design and operation of bridge lighting (and evaluating the effectiveness of same during operation), as well as other conservation actions to offset expected and even measured losses. Depending on what specific measures are ultimately proposed based on evaluation of longitudinal monitoring data, the Action Program objective may be more suitably achieved through the Bird Management Plan and Bat Management Plan proposed under the EMP, but this will have to be worked out and formulated for a later iteration of the BAP.
Outcome	Losses of bird and bat biodiversity values as a result of the BCIB minimized, and appropriately offset if they are found to occur.
Timing	This will need to be finalized once the appropriate set of compensation actions have been identified.
Responsible Parties	This will need to be confirmed once the final set of actions are confirmed. The action program would likely be implemented by a partnership, as a minimum, formed between, at minimum, DPWH and an established local bird advocacy group or academic institute with avian research expertise.
Accountability	It is recommended that a Biodiversity Offset Committee be established to provide oversight for all programs grouped under the BAP, to be chaired by ADB with representation from DPWH Environmental and Social Safeguards Divisions (DPWH-ESSD), DENR-Biodiversity Management Bureau (DENR-BMB), Bureau of Fisheries and Aquatic Resources under the Ministry of Agriculture (BFAR), the Marine Sciences Institute of the University of the Philippines (MSI), and a selection of nationally-recognized NGOs.
Verification	Methods for verification will need to be developed following more certain development of the Action Program elements.
Estimated Cost	Due to very high uncertainty regarding the need to develop offsets for one or more species, an indicative cost estimate is provided primarily to ensure that a provisional allocation is set aside for this Action Program, as follows: **Total: PHP 50,000,000 – 250,000,000**

5.6 Action Plan F – Offset for Expected Impacts on Marine Mammals from Project-Produced Underwater Noise

Plan Element	Explanation
Action	Actions to offset anticipated residual impacts of pile-driving noise on whales and dolphins in Manila Bay
Objectives	(1) To expand and enhance existing cetacean grounding rescue programs in Manila Bay on a precautionary basis, on the expectation that piling works may increase the incidence of groundings even with mitigation in place (2) Implement long-term cetacean conservation programs that could serve as appropriate offsets for residual impacts
Approach	A longitudinal cetacean monitoring program comprising passive acoustic monitoring and tracking is proposed under the EMP for the pre-construction and early construction phases of the BCIB project, to better characterize the presence, abundance, movements and habitat use of cetaceans within and nearby Manila Bay. Data from this monitoring effort will inform development of an Underwater Noise Management Plan under the EMP. In recognition that even thorough mitigation of noise emissions and careful species-specific management of construction activity to minimize noise-derived and other impacts on cetaceans will not eliminate harm, offset actions are proposed in this Action Program under the BAP. The proposed approach is (at present) precautionary, as it is necessitated not so much by uncertainty about whether impacts on resident cetaceans can be expected, but rather uncertainty regarding the magnitude and severity of impacts. The proposed Action Program comprises two elements, as follows: • Financial support and capacity-building for existing cetacean rescue and rehabilitation programs operating in and around Manila Bay (or establishment of one or more of these if found more appropriate); and • Development and implementation of long-term cetacean conservation programs in Manila Bay, in partnership with relevant stakeholder entities (this could include enhanced surveillance and enforcement of existing wildlife protection laws, development of whale protection measures applicable to local shipping and fishing, and public awareness programs.
Outcome	The provisional outcome of the proposed Action Program is long-term viability of cetacean populations within Manila Bay, despite anticipated adverse impacts experienced during the marine piling works carried out for the BCIB project.
Timing	Capacity-building for local cetacean rescue and rehabilitation programs would ideally be developed and implemented soon after loan approval, so that some capacity improvements can be realized before piling work begins. Formulation of long-term cetacean conservation programs should wait until the planned longitudinal monitoring yields insights regarding species presence, abundance, movements and habitat use, i.e., early construction phase. Cetacean conservation programs set up under the Action Program should be long-term initiatives, and so would extend well into the BCIB operation phase.
Responsible Parties	The program should be developed and implemented through a partnership between (at minimum) DPWH, the Bureau of Fisheries and Aquatic Resources (BFAR), the Marine Science Institute of the University of the Philippines, and local organizations already involved in cetacean rescue and cetacean conservation advocacy. Funding would be provided by DPWH, through the comprehensive Biodiversity Action Plan Fund for the BCIB project, as accounted for under the EMP cost estimate. Formation of the necessary partnerships and development of capacity building shall be spearheaded by biodiversity specialists in the employ of the Construction Supervision Consultant.
Accountability	It is recommended that a Biodiversity Offset Committee be established to provide oversight for all programs grouped under the BAP, to be chaired by ADB with representation from DPWH Environmental and Social Safeguards Divisions (DPWH-ESSD), DENR-Biodiversity Management Bureau (DENR-BMB), Bureau of Fisheries and Aquatic Resources under the Ministry of Agriculture (BFAR), the Marine Sciences Institute of the University of the Philippines (MSI), and a selection of nationally-recognized NGOs.
Verification	Verification of the biodiversity benefits of the action program will be applicable only in the event that an offset component (cetacean conservation programs, allowed for on a contingency basis) are developed in response to a finding of significant residual impact from pre/post monitoring results analysis. A means of verification tailored to the program or programs developed should be defined at that time. The approach to verification will need to be identified once this Action Program has been developed in dialogue with potential partner entities.

Plan Element	Explanation
Estimated Cost (Preliminary)	Due to uncertainty regarding the final set of actions that will be agreed by the partners in this Action Program, only a broadly indicative breakdown of costs for the Action Program is suggested at this early stage, as follows: Financial support and capacity-building for cetacean rescue and rehabilitation programs: PHP 50,000,000 Development and implementation of cetacean conservation programs: PHP 20,000,000 – 150,000,000 **Total: PHP 70,000,000 – 200,000,000**

In line with IFC PS6, a quantifiable net gain is required for all critical habitat qualifying trigger features. As the Draft CHA is likely to undergo significant revision once additional biodiversity baseline data is gathered, detailed action programs for the Project's CHA triggers are not in place.

As next steps however the Project is committed to the following steps to best ensure net gain is achieved for critical habitat qualifying trigger features:

- Once additional baseline is available, update the CHA,
- Develop a set of net gain actions (and identify responsible parties, means of verification, timing, cost, etc.) for all final CHA trigger features (and any biodiversity receptors subject to residual significant impacts),
- Confirm net gain actions with ADB and external stakeholders, and update and re-disclose BAP, and finally,
- Once the BAP is finalized, develop a detailed Biodiversity Offset Management Plan (BOMP) for offset delivery.

6 FUNDING PLAN

Due to uncertainty in the final set of actions that will be developed, a detailed breakdown of implementation costs and required funding amounts for the BAP cannot yet feasibly be produced. Indicatively, based on experience delivering similar BAPs elsewhere, an overall estimated cost range of PHP 1,000,000,000 to PHP 3,000,000,000 is suggested, and this amount has been accounted for in the cost estimate presented in the project EMP. It is to be emphasized that the program costs are being estimated at an early stage of BAP development, when understanding of some residual impacts and Critical Habitat determinations are still subject to considerable uncertainty, and before substantial expert consultation and dialogue with potential partner entities to scope program proposals has taken place. Accordingly, this estimate is preliminary and largely hypothetical.

It is proposed that a dedicated replenishable fund be established to support long-term implementation of the BAP, under a trusteeship approved by ADB. The BAP Implementation Fund should be segregated according to the agreed allocations for the action programs included in the BAP, to reduce the risk of unexpected or runaway costs on one action program affecting implementation of the others. The logistics of the fund's establishment and fiduciary oversight will be subject to negotiation between DPWH and ADB.

7 BAP UPDATES

As indicated above, this Preliminary BAP will need to be updated as additional information becomes available and relevant stakeholders and potential partners are engaged. Future development of the BAP will be led by professionals with appropriate expertise, including at a minimum:

- Over 15 years working in biodiversity management and offset development to international standards
- Expertise in relevant marine and terrestrial ecology (e.g., coral reefs and forest/grassland)
- Expertise in socio-economic considerations, sustainable livelihood development, ecosystem service risks and benefits

Detailed Terms of Reference will be drawn up separately.

Future iterations of the Preliminary BAP will be publicly disclosed, including on the ADB website.

8 MONITORING AND EVALUATION

The success of each Action Program in achieving its biodiversity aims will need to be verified through monitoring. A verification methodology and benchmarks will be formulated for each Action Program as it is developed, and monitoring requirements for all programs will be collected under a comprehensive Biodiversity Monitoring Plan. As most biodiversity benefits will accrue gradually over many years, the Biodiversity Monitoring Plan must be conceived as a long-term plan. Implementation of the Biodiversity Monitoring Plan would normally be contracted to one or more qualified NGOs or research institutes.

It is proposed that ADB should engage a monitoring and evaluation consultant to conduct an annual audit of overall BAP implementation, as well as mid-term and post-completion evaluations of each component action program. The timing of the mid-term and final evaluations of the action programs would be determined by the indicated operational lifespan of each.

Audits and evaluations should be conducted by an entity with substantial expertise in biodiversity management program implementation and oversight. Unfavorable findings emerging from annual audits and mid-term evaluations should be accompanied by proposals for action program adaptations, to be reviewed by ADB and implemented by DPWH and other partners as directed by ADB.

ANNEX 3: VISUAL IMPACT ASSESSMENT (NOVEMBER 2023)

Bataan-Cavite Interlink Bridge Project

Updated Visual Impact Assessment

8 November 2023

Prepared By:

TYLin PEC

A JOINT VENTURE

T.Y. Lin International | Pyunghwa Engineering Consultants Joint Venture

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2023-04-15	Issue for Coordination	00	Simeon Stairs (Renardet)	Jodi Ketelsen (TYLI)	Marwan Nader (TYLI/ PEC JV) [Signature]
2023-11-08	Issue to DPWH	01	Simeon Stairs (Renardet)	Jodi Ketelsen (TYLI)	Marwan Nader (TYLI/ PEC JV)

Table of Contents

List of Exhibits

1 INTRODUCTION

The Bataan–Cavite Interlink Bridge (BCIB) Project is a proposed new transportation link between the northern and southern parts of Luzon Island, Philippines. The project will entail construction of a 32-km, 4-lane roadway between the provinces of Bataan and Cavite, with a 26-km sea crossing near the mouth of Manila Bay. The project will establish a third major travel corridor through the central part of Luzon Island, thereby alleviating pressure on existing major travel corridors through Metro Manila, which suffer from heavy congestion. The BCIB project will be built over a span of 5.5 years, and will incorporate two land approaches, two high-clearance cable-stayed navigation bridges, a small nearshore navigation bridge, and approximately 22 km of marine viaducts. The project terminus on the Bataan side will be an interchange at the Roman Highway, in the Municipality of Mariveles, while the southern terminus in Cavite will be an interchange at the Antero Soriano Highway in the Municipality of Naic. The project location in shown in Exhibit 1.

The BCIB has been proposed under the umbrella of the Build, Build, Build Program of the Government of the Philippines, and will be implemented by the Department of Public Works and Highways (DPWH). The proposed BCIB project is being considered for financing by the Asian Development Bank (ADB), under its Infrastructure Preparation and Innovation Facility (Roads and Bridges Component) for the Philippines.

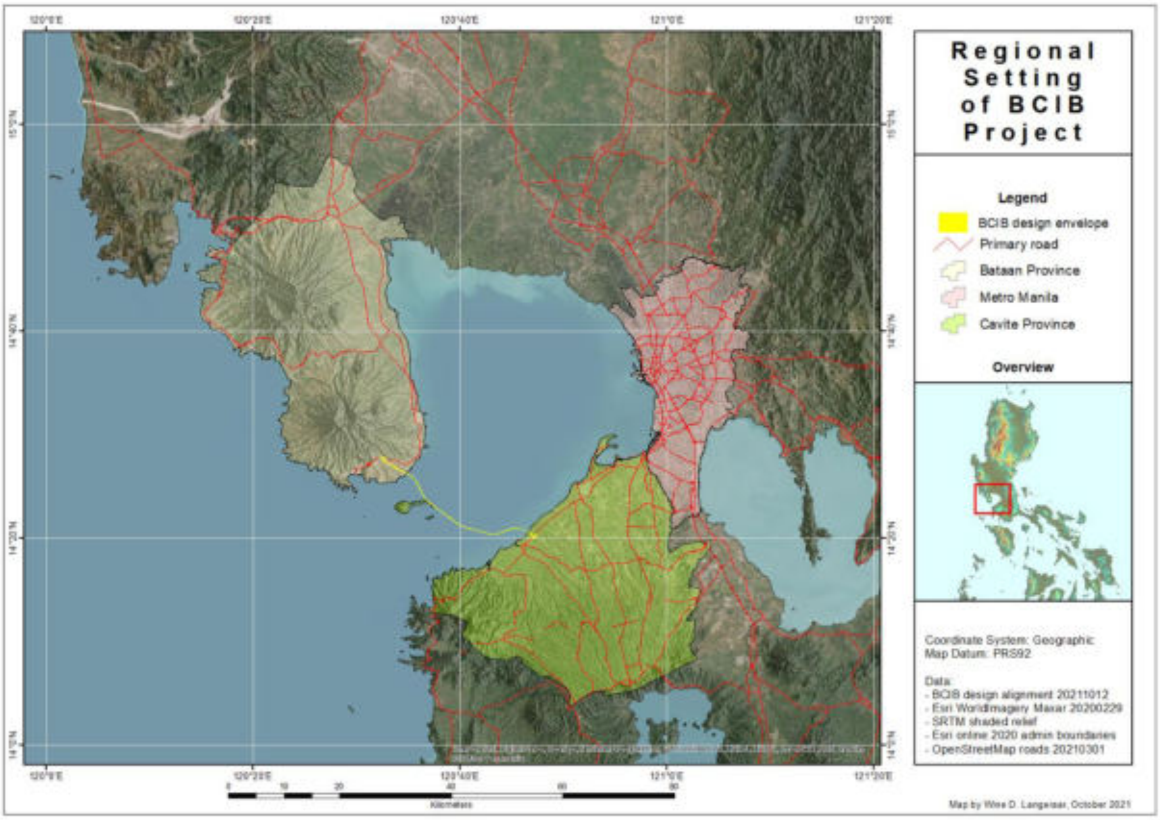


Exhibit 1: Location of Proposed BCIB Project

2 REQUIREMENTS AND GUIDANCE

This visual impact assessment (VIA) has been prepared in support of the environmental impact assessment (EIA) of the proposed BCIB project. Environmental impact assessment of infrastructure development projects is required under the Philippine Environmental Impact Statement System (PEISS), pursuant to Presidential Decree No. 1586 (1978) and further defined by a series of subsequent proclamations and administrative orders. As the proposed project is under consideration for financing by ADB, an EIA is also required in accordance with the Bank's Safeguard Policy Statement, 2009 (SPS). Under both the PEISS and SPS, visual impact assessment may be considered a necessary component of the consideration of potential impacts on socioeconomic and cultural aspects of a project's proposed environment, when the nature of the project and characteristics of the project's environment warrant it. The BCIB will be a large project with significant physical breadth and prominently visible infrastructure, implemented in an environment endowed with recognized scenic elements. Accordingly, a VIA is warranted in this case.

There are no laws or statutory standards stipulating criteria for visual quality in the Philippines, and there are likewise no international standards for visual quality that ADB would typically require adherence to in project development. However, DPWH has produced a set of aesthetics guidelines applicable to bridges, aimed at avoiding blandly utilitarian bridge designs and promoting visually pleasing, eye-catching ones.[1] The design of the BCIB infrastructure has been informed by these guidelines. Further, an aesthetics manual has been developed specifically for the BCIB project to articulate and guide the development of a visually coherent, consistent and attractive appearance for the varied infrastructure components that will make up the project.[2]

With respect to the conduct of VIA, neither the Government of the Philippines nor ADB specifies methodological guidance or standards regarding process or outputs. This VIA follows the methodology developed by the United States Federal Highways Administration (FHWA), as most recently articulated in its Guidelines for the Visual Impact Assessment of Highway Projects (January 2015).

3 METHODOLOGY

3.1 Assessment Steps

Following the methodology laid out in the 2015 FHWA guidelines, preparation of this VIA for the BCIB project has worked through four assessment phases: (1) Establishment; (2) Inventory; (3) Analysis; and (4) Mitigation. Each phase is outlined briefly below.

Establishment. The objectives of the establishment phase are to define the study area, considering topography, land cover and sight lines, and also to come to a clear understanding of the visual character of the proposed project based on available project design information. A key task of this phase of VIA is identifying and defining an area of visual effect (AVE), based on analysis of both viewsheds (areas visible from particular key

[1] Department of Public Works and Highways. 2018. Bridge Aesthetics Guidelines, 1st Edition. Bureau of Design, Bridges Division.
[2] Bataan–Cavite Interlink Bridge Project Aesthetics Manual, September 2021. TY Lin International – Pyunghwa Engineering Consultants JV.

vantage points) and landscape units (portions of the landscape with high-level homogeneity of features, characteristics and visual flavor that could be considered to have local cultural relevance or scenic value). Analysis of maps and satellite imagery is a key tool of the establishment phase.

Inventory. The objectives of the inventory phase are to characterize the salient components of the proposed project's environment and the characteristics of viewers (people who will take in the visual impacts of the project), and to consider the relationships between the environment and the viewers. In this phase of the assessment, attention is devoted to identifying the key visual resources involved (physical, cultural and project-derived), and delineating the various groups of people whose visual experiences could be affected by the project's implementation. The opinions and perspectives of people within each group regarding expected changes to the visual environment are also considered at this stage, based on both field research and professional judgement. The inventory phase is informed by map analysis, field reconnaissance, and stakeholder engagement.

Analysis. The objectives of the analysis phase are to assess the proposed project's impacts on both the existing visual resources in the project environment and the viewers of the proposed project infrastructure, and to synthesize the findings to assign the anticipated impacts to one of three categories: 'beneficial', 'adverse' or 'neutral'. Within these categories, further judgements can be made regarding the magnitude or significance of impacts, as well as the duration over which they will be experienced.

Mitigation. The objective of the mitigation phase is to define measures that could counter specific anticipated adverse visual impacts, and ultimately help to ensure that the proposed project ends up being a good aesthetic fit for its host landscapes and appreciated by the sectors of the population that will be in a position to experience its visual effects. The proposed mitigation measures can be recommendations for the project's ongoing detailed design, or as the basis for mitigation prescriptions in the Environmental Management Plan for the project.

3.2 Scope of Assessment

The VIA methodology just described has been applied to the BCIB project as known at the intermediate and late stages of the detailed design work. The physical footprint of the proposed project infrastructure was well understood and established at the time of assessment. The permanent infrastructure features are the focus of the VIA. The locations, scales and specific site uses of the numerous temporary work sites that will be necessary to support the project's construction (e.g., casting yards, construction worker camps, storage yards) were considered tentative, but have been referenced in the VIA where information about likely siting could be considered reasonably firm at the time of assessment, and where activities carried out on such sites could be considered likely to result in permanent impacts on a significant visual resource or have economic implications linked to impairment of visual amenity values. Support sites such as quarries, which may be expected to be at a considerable distance from the project location and outside the reference landscapes, were not included in the VIA.

4 VISUAL CHARACTER OF THE PROJECT

The visual character of the proposed project will vary according to the component infrastructure types, as well as location along the 32-km alignment. The on-land project infrastructure will comprise two road segments of length 5 km (Bataan side) and 1.3 km (Cavite side). Each of the segments will terminate at an interchange. The largest project component by linear length will be the assortment of marine viaducts and high bridge approaches that will carry the roadway for most of the 26-km crossing; included in the viaducts will be a turnaround interchange structure near Corregidor Island, which may in future enable development of a road link to the island. Two large, high-clearance cable-stayed bridges will span the major shipping channels that pass to the north and south of Corregidor Island near the bay's mouth; these high-towered components will be the centerpieces of the BCIB project. The visual character of each of these three classes of infrastructure is described in more detail below.

4.1 On-Land Road Segments

The two on-land approach road segments will generally follow the existing terrain, however somewhat raised. On the sloping hillside in Bataan, the roadway is designed to balance cut and fill, with structures to traverse ravines and deep gullies. On the flatter terrain in Cavite, the roadway is raised an average of 6.25 to 7 meters above grade for several reasons. It is raised to gradually meet the marine viaduct height, which must also be high enough to pass various boats and vessels under. It must be raised to pass existing roadways under through grade-separated structures since intersections are not compatible with this facility. Finally, storms and sea level rise threaten the Cavite shoreline due to the low profile of the land area. In Cavite, the BCIB will be raised on a sloped fill bank from the interchange with Antero Soriano Highway to 100 meters before the Timalan-Balsahan Road underpass. The sloped fill embankment transitions to a mechanically stabilized earthened wall for a total of approximately 300 meters, (100 meters upland of Timalan-Balsahan Road underpass and 200 meters towards water from this underpass). From the MSE retained fill embankment, the BCIB transitioning to land viaduct and then to the marine viaduct. The land viaduct is supported on piers made of two columns with a re-enforced coping beam to support the pre-cast box girder that forms the base of the roadway. The land viaduct will permit beach visitors to cross under the BCIB for approximately 80 meters in depth from the typical water edge.

The Cavite portion of the BCIB passes through residential and beach-front community buildings and small businesses. For this reason, noise barriers are recommended as mitigation for the future traffic noise that may affect the existing residential areas. Noise walls will increase the height and mass of the roadway embankment. The roadways will have overhead lighting, which can be expected to make them noticeable from nearby areas at night. It is expected that the rights-of-way will be vegetated where safety precautions allow. The vegetation will be developed to address wildlife impacts, climate change mitigation and erosion control, and this will tend to soften the visual character of the infrastructure on land, making it less prominently visible during both day and night.

Exhibit 2: Approach Road (Bataan Side)

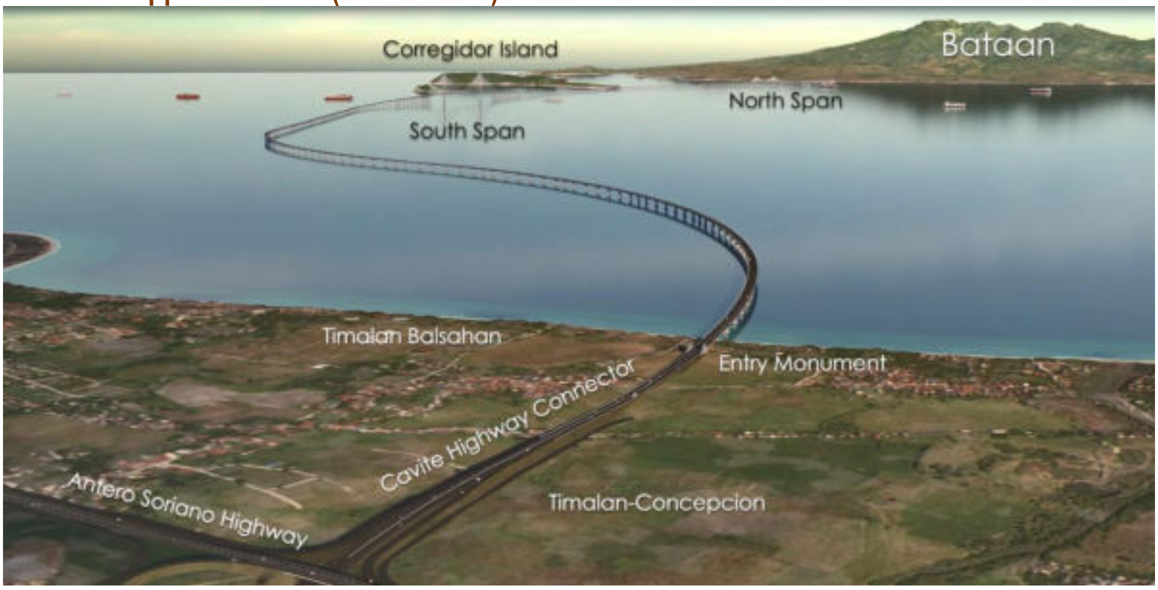


Exhibit 3: Approach Road (Cavite Side)

The approach road on the Bataan side will include a modest bridge monitoring and maintenance compound, comprising a minor 2-story administrative building, several smaller outbuildings, and parking areas. This compound will be just 5,000 m^2 in area and will be accessed exclusively from the approach road itself; the compound is not considered a significant visual feature of the project.

Source: Bataan–Cavite Interlink Bridge Aesthetics Manual, September 2021 (TY Lin International – Pyunghwa Engineering Consultants JV)

Exhibit 4: Proposed Bridge Maintenance and Monitoring Compound (Bataan Side)

4.2 Marine Viaducts

The visual character of the over-water components of the proposed project will be more striking than that of the on-land components. The project alignment, 85% of whose linear length of 26 km will be composed of viaducts and bridge approaches, will follow a moderately sinuous path across the bay, and the curvature of the long viaduct segments will be a noticeable aesthetic feature from many vantage points, both on the crossing and on nearby land. The marine viaducts and high-level bridge approaches will be constructed of light-colored concrete with some textured surfaces and decorative aquamarine-colored stainless-steel elements in the support piers. The deck will be about 20 m above mean sea level along much of the viaduct's length but will rise as high as 62 m to meet the navigation bridge structures. The piers will be spaced every 100 m in deeper waters and every 60 m in shallow areas. The viaduct segments and high-level approaches will be a visually semi-permeable component of the landscape, in that they will not constitute a solid barrier within the field of view.

Source: Bataan–Cavite Interlink Bridge Aesthetics Manual, September 2021 (TY Lin International – Pyunghwa Engineering Consultants JV)

Exhibit 5: Viaduct Curving Away Into the Distance (Cavite Shore)

Renderings of typical segments of the marine viaduct and high bridge approaches are shown in Exhibit 6 and Exhibit 7. The textured surface features and aquamarine-colored stainless-steel inlays, both aesthetic themes also reflected in the cable-stayed bridge structures, may be noted in these renderings.

Source: Bataan–Cavite Interlink Bridge Aesthetics Manual, September 2021 (TY Lin International – Pyunghwa Engineering Consultants JV)

Exhibit 6: Rendering of Typical Marine Viaduct Segment

Source: Bataan–Cavite Interlink Bridge Aesthetics Manual, September 2021 (TY Lin International – Pyunghwa Engineering Consultants JV)

Exhibit 7: Rendering of Selected High Bridge Approach Segment

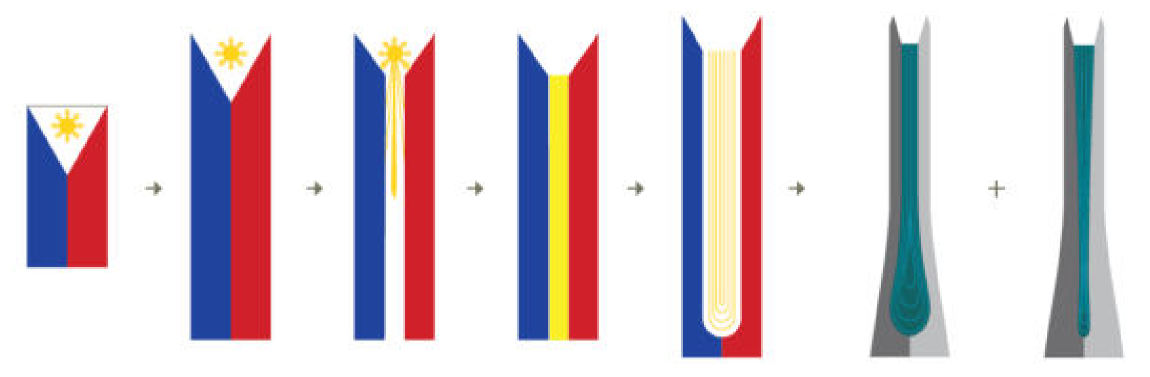
The turnaround structure will be a grade-separated interchange positioned on a pile-supported platform beneath the main alignment, just off the east coast of Corregidor Island. The interchange design will employ concrete styling consistent with the viaduct. A visual rendering of the turnaround structure is shown in Exhibit 8.

Source: Consultant's preliminary design renderings

Exhibit 8: Rendering of BCIB Turnaround Interchange

4.3 Cable-Stayed Navigation Bridges

The two cable-stayed navigation bridges are conceived as symbolic gateways to Manila and will be highly visible showpieces with tall light-colored monopole concrete towers, elegant sprays of support cables, and dynamic floodlighting. The proposed styling of the towers is inspired by the Philippine national flag when held in vertical orientation, with a complementary 'praying hands' motif (see Exhibit 9).



Source: Bataan–Cavite Interlink Bridge Aesthetics Manual, September 2021 (TY Lin International – Pyunghwa Engineering Consultants JV)

Exhibit 9: Symbolism of Proposed Bridge Styling

Vertical bands of aquamarine-colored stainless steel inlaid in the tower sides will provide a thematic element that will also carry through to the anchor piers, for overall aesthetic continuity. Sharp edges will be maintained to enable strong shadowing as light conditions change over the course of the day, enhancing the bridges' visibility from long distances.[3]

Source: Bataan–Cavite Interlink Bridge Aesthetics Manual, September 2021 (TY Lin International – Pyunghwa Engineering Consultants JV)

Exhibit 10: Rendering of Proposed North Channel Bridge

Although they will be situated at some considerable distance from land, the cable-stayed bridges will be a highly visible feature of the landscape when viewed from the water, and of course will be visually striking from the vantage point of vehicles passing along the BCIB crossing. The towers, stays and anchor piers of the two bridges will be equipped with LED floodlighting with the capability for color changes to enhance the visual prominence and attractiveness of the gateways after dark.

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[3] Bataan–Cavite Interlink Bridge Project Aesthetics Manual, September 2021. TY Lin International – Pyunghwa Engineering Consultants JV.

Source: Bataan–Cavite Interlink Bridge Aesthetics Manual, September 2021 (TY Lin International – Pyunghwa Engineering Consultants JV)

Exhibit 11: Rendering of Proposed South Channel Bridge

5 LANDSCAPE UNITS

A landscape unit is a spatially defined area with a more or less coherent character or identity, and definition of such units is an analytical building block of VIA. Definition of landscape units helps to conceptualize the values people may attach to their landscapes, and to scope the ways in which they are likely to perceive visual impacts on those values from new infrastructure. For the BCIB project, five partially overlapping landscape units can be delineated; these are described below and shown on the map in Exhibit 12.

5.1 Mariveles Coastal Slope

The portion of Mariveles that will host the interchange and approach road for the BCIB is a varied landscape with an overall southerly slope aspect, being part of the toe slope of the Mt. Mariveles volcano. The land mass is composed primarily of volcanic materials and alluvial deposits and has been incised over time by numerous streams running southward off the higher slopes of the mountain. The substantial valley of the Pangolisanin River borders the landscape unit to the east, and Mariveles Bay to the west. There are numerous minor gullies and washes dispersed across the landscape.

Present land use on the Mariveles Coastal Slope is characterized by low-intensity agricultural activities; there are numerous orchards, mixed homestead plantations and hedgerows, and expanses of grassy and scrub land that are periodically burned to bring on new growth of grasses for extensive grazing by cattle, sheep and goats.

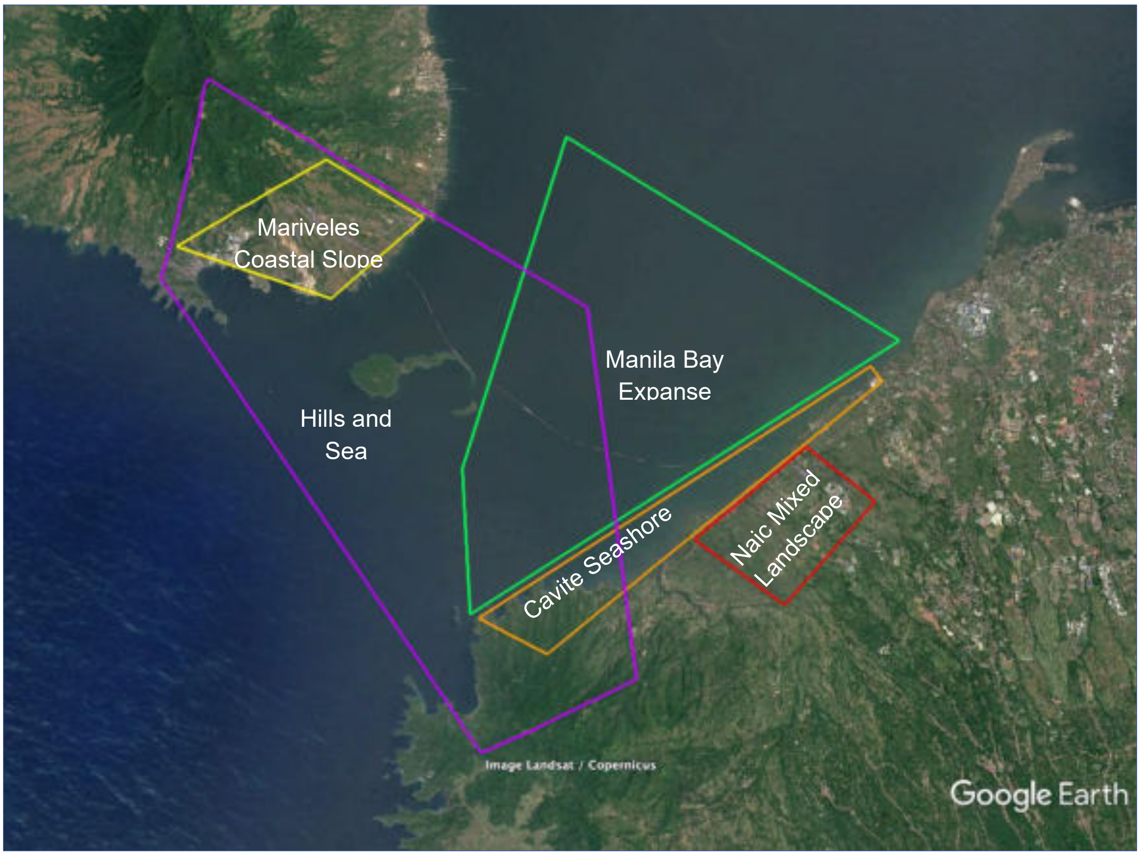


Exhibit 12: Landscape Units Defined for the BCIB Project Area

Exhibit 13: Pasture and Mango Orchards, Mariveles Coastal Slope

Non-agricultural uses have assumed increasing importance in recent decades, with growth in residential and commercial development in the barangays of Alas-Asin, Mountain View and Cabcaben. Major industrial facilities, including oil and gas terminals, a pair of large coal-fired power plants, port facilities, quarries, a solar farm and a cement plant have been developed, mostly near the shore. To the west, numerous manufacturing and import-export processing facilities have been established within the Freeport Area of Bataan, clustered around the north side of Mariveles Bay. Many locations within this landscape unit have views over Manila Bay and as far as the hills in western Cavite and northern Batangas, and Mt. Mariveles is a dominant backdrop feature of the visual landscape.

Exhibit 14: GN Power Generating Stations, Mariveles Shore

5.2 Hills and Sea

Roughly centered on the sea channel running between Corregidor Island and the Bataan landmass, Hills and Sea is a large landscape unit that overlaps with the Mariveles Coastal Slope. This broader landscape unit can be defined by its interesting maritime-orogenous flavor. Key landscape features include the volcanic formations of Mt. Mariveles and Corregidor Island on either side of the channel, a varied coastline that includes the photogenic cliff-ringed coves of the Five Fingers headland area, as well as a number of small pleasing beaches and the conical Mt. San Miguel that stands by the eastern entrance to Mariveles Bay at Barangay Sisiman. The shipping activity that takes place in and around the navigation channel is also a notable landscape feature.

Exhibit 15: Typical Open Scrubland, Mt. Mariveles in Background

Exhibit 16: North Channel and Mt. Mariveles as Seen from Corregidor Island

Most of Corregidor Island and the upper slopes of Mt. Mariveles are thickly vegetated, lending a hint of wild nature to the landscape despite the presence of significant industrial and shipping activity. On the southern side of Corregidor Island, where shipping and industrial activity are out of view, the sense of the natural is more predominant, with Caballo Island, the curving Corregidor Island coast, Mt. Mariveles and the hills of western Cavite and northern Batangas all on display. The landscape unit is also imbued with a powerful sense of history, as all of Corregidor Island is a protected zone commemorating the island’s role as a defensive military stronghold throughout history, most notably during WWII. As the island’s natural resources have rebounded following cessation of intensive military use and heavy bombardment, scenic, recreational and ecological values have increasingly been elevated alongside historical values in land use and development plans. The island's future development and management are now intended to balance historical commemoration and ecotourism, and the waters around the island have been proposed as a marine park, with zones dedicated to strict preservation, research, controlled water sport activities, artificial reef creation and limited seaweed farming.

Exhibit 17: Sisiman Bay and Mt. San Miguel, with Mariveles Bay and Five Fingers Beyond

Exhibit 18: Northwest Side of Corregidor Island As Seen From the North Channel

Exhibit 19: Caballo Island With Hills in Cavite and Batangas Beyond

Exhibit 20: Tail End of Corregidor Island With Hills of Cavite and Batangas Beyond

5.3 Manila Bay Expanse

The least diverse of the identifiable landscape units in the project area is the open expanse of Manila Bay between Corregidor and Caballo Islands and the Cavite shore. Bordered by the open ocean to the west and a long expanse of open water stretching some 40 km to the northeast, this zone has distant views of Mt. Mariveles, Corregidor and Caballo Islands, the hills of western Cavite and northern Batangas, and the low-lying Cavite shoreline. On clear days, the Manila skyline is also visible. In this context, the always changing state of the sea and cloudscape become dominant in visual character. This is a busy shipping zone and is also plied by local fishing fleets, and significant visual interest is supplied by these activities to viewers with a reason to visit or pass through the area.

Exhibit 21: Looking Out to South China Sea (Corregidor and Caballo Islands at RIght)

5.4 Cavite Seashore

At the interface of sea and land, the various stretches of beach along the Cavite coast in the municipalities of Naic, southwest Tanza and northeast Ternate constitute a distinct, if spatially limited, landscape unit. The dark sand beaches of this coastal zone are broken here and there by river mouths and their associated sandbar formations, including those of the Maragondon, Bucalan and Timalan Rivers. Established residential and light commercial areas are to be found within the 200–300 m coastal strip along much of the coastline. Inshore fishing fleets line several of the beaches, the boats typically pulled up on the sand rather than docked in port facilities. Along most beaches, low-key resort operations catering to local and regional clientele can be found; these are incongruously interspersed with small and apparently informal shipyards. There are also a few institutional and industrial facilities along this stretch of coast, and a recently constructed cargo shipping terminal (the Cavite Gateway Terminal in Tanza). The aesthetic character of the Cavite Coast is tied to the sea and the open space and views it engenders, and the community areas immediately inland reflect the beach town ambience. When atmospheric conditions permit, Mt. Mariveles and Corregidor Island can be readily seen, and lend a sense of perspective and aspect of visual interest. Looking westward along the coastline, the hills along the border of Cavite and Batangas can be seen rising up from prominent headlands.

Exhibit 22: Cavite Coast at Aroma Beach Resort, Naic (Looking East)

Exhibit 23: Cavite Coast near BCIB Landing Site (Looking West)

Exhibit 24: Informal Shipyard Flanked by Bathing Beaches, Naic Shore

5.5 Naic Mixed Landscape

The portion of the project area that lies landward of the coastal zone in Naic is a mixed agricultural and residential mosaic undergoing a rapid transformation. The rice paddies, pastures and plantations that once dominated the landscape are increasingly being converted to dense residential subdivisions and industrial estates. Modest residential and commercial strips have long occupied the roadsides in this area, but the green spaces between such roadside strips are becoming smaller and less evident as land development proceeds. The land is very gently sloped, with a general northerly slope aspect, and there is little in the way of topographical variability.

Exhibit 25: Pastureland With New Residential Units in Background, Naic

Exhibit 26: Rice Paddy With New Industrial Park in Background, Naic

6 AREA OF VISUAL EFFECT

The area of visual effect (AVE) is the area within which a proposed project would be easily visible. Project visibility is heterogeneous through time and space within the AVE, as topography, land cover, atmospheric conditions, light and distance all constrain the ability of viewers to perceive built infrastructure.

The AVE can be characterized with reference to both static and dynamic viewsheds. For transportation infrastructure, static viewsheds pertain mainly to viewers in the project's environment: what can the people who live and work near the proposed project see of it as they go about their lives? Dynamic viewsheds refer mainly to the proposed project's visibility to the users of the infrastructure: what visual experience will users of the infrastructure have as they move along it? Especially in the case of a bridge, there is also an element of dynamism for certain non-users, such as people approaching and passing beneath the infrastructure on watercraft of various types.

6.1 Static Viewsheds

6.1.1 Mariveles

The Mariveles portion of the BCIB project area is topographically variable; viewsheds are broad in elevated locations, and less so where the surrounding land is only moderately sloped. A limited number of populated on-land locations in Bataan have good views out over the portion of Manila Bay where the BCIB crossing will be located; some buildings in Alas Asin village have excellent views from their upper stories, as do some vantage points in grassland areas nearer the shore, but land cover prevents long views from most locations in the intervening spaces. The coastline itself is difficult to access in many places, and lightly populated except for the waterfront areas of Cabcaben (2 km northeast of the BCIB landing point) and Kamaya Point (2.5 km west of the landing point).

6.1.2 Naic

Due to very gentle topography and frequent hedgerows and buildings, viewsheds from inland locations on the Naic side of the bay are quite constrained. Few vantage points offer lines of sight longer than about 200–300 m. Buildings greater than 2-3 stories in height are rare and are thus not a prominent landscape feature visible from afar; similarly, broad viewsheds that might be enabled for viewers using the upper floors of tall buildings are non-existent.

The viewshed of most points along the Naic shore is a broad one, taking in a wide sweep of open water with the ocean to the west, the bay mouth to the north, and the long stretch up Manila Bay in the direction of Metro Manila; in clear conditions, Corregidor and Caballo Islands, as well as Mt. Mariveles, are readily visible in the distance. The proposed alignment of the marine viaduct will depart from the shore near a populated beachfront area, and curve to nearly parallel the shore for 2-3 km before extending offshore to meet the South Channel Bridge.

6.1.3 Corregidor Island

Corregidor Island is not permanently inhabited except by the staff of a small number of modest tourist sites and accommodations. The view from most tourist areas on the island takes in either the North Channel with Mt. Mariveles beyond, or Caballo Island with the

South Channel and hills of western Cavite and northern Batangas beyond. The viewshed from the eastern side of the island is more expansive, and includes the full throat of Manila Bay, in addition to the two navigation channels and Mt. Mariveles; however, this part of the island has long been a restricted military area with no tourist facilities, so these views go mostly unappreciated from land. From various elevated historic sites on the south and west sides of Corregidor, there are attractive views southeast and northeast to rocky headlands and islands of northern Batangas and western Bataan, and out to the open South China Sea.

6.2 Dynamic Viewsheds

The viewshed of BCIB users will include a number of visual highlights or marquee elements, encompassing views of both the infrastructure itself and the landscape along the alignment. As motorists proceed southwards from the proposed BCIB interchange on the Mariveles side, they will be on a 5-km incline towards the sea, with a vertical drop of approximately 200 m. Sweeping views of Manila Bay and Corregidor Island will open up in the last 1-2 km before reaching the shoreline. Drivers and passengers will be afforded increasingly clear views of Corregidor Island, as well as shipping activity through the North Channel, as their vehicles proceed out onto the marine viaduct and gradually upwards to meet the North Channel Bridge. The cable-stayed bridge will soon become the focus of attention; the visual experience of passing along the roadway beneath the dramatic cable sprays of a large bridge of this type is a stimulating one for most people. The expected day and night views from the bridge deck is shown in the renderings in Exhibit 27 and Exhibit 28.

Exhibit 27: Expected View Driving Southwards Over North Channel Bridge

On the gradual descent from the North Channel Bridge, BCIB users will get increasingly close views of the forested and topographically varied Corregidor Island, including its undeveloped rocky coastline. Caballo Island will come into view a few kilometers away to the right, and a wide-open view of Manila Bay will be appreciated to the left. A few kilometers on, the ascent to the South Channel Bridge—of similar design but significantly larger and higher than its counterpart over the north navigation channel—will dominate motorists' visual experience, and views of shipping activity in the South Channel will be afforded from the high bridge deck. Such views of ships entering and leaving Manila Bay will be a novel addition to many people's aesthetic experience, as marine traffic through this area is not easily observed otherwise.

For motorists and passengers coming from the Naic side, the multiple rim summits of volcanic Mt. Mariveles will come into view in the distance immediately upon leaving land behind and will remain visible on the right for several kilometers as the alignment curves westward to line up for the approach to the South Channel Bridge. Views of the bay and shipping activity will open up and improve with increasing elevation in the approach to the bridge. The descent from the South Channel Bridge will offer a direct and unimpeded view of Corregidor Island and Mt. Mariveles rising up beyond. Mt. Mariveles will increasingly catch and hold the viewer's eye for the rest of the trip, even while transiting past the coast of Corregidor Island and over the North Channel Bridge.

Exhibit 28: Expected Night View Driving South Over North Channel Bridge

For people viewing the BCIB infrastructure from the water, the viewshed will also be dynamic. The North Channel Bridge will be an additional feature of interest in an already varied visual landscape that includes Mt. Mariveles standing off to the north, the hills and shoreline of Corregidor Island, the rocky headlands around Mariveles Bay to the west, and the tall stacks of the GN Power Plants in Barangay Sisiman, as well as the active shipping in the area. Approaching and passing beneath the cable stayed bridge will be a visual milestone for people transiting through this part of the bay on passenger ferries, tourist boats, cruise ships, fishing boats and cargo vessels. Much the same may be said for the South Channel Bridge, although this structure will be set in a more isolated and less varied landscape, so passage up to and beneath the bridge will be an even more significant perceptual milestone in navigation of the landscape.

6.3 Existing Visual Resources of the AVE

Visual resources can be categorized as natural, cultural and project visual resources. Natural visual resources are existing features of the landscape that derive from geological and ecological processes, such as landforms, water bodies, forests, grasslands and seascapes. Cultural visual resources are landscape attributes that have been produced and regenerated by human activity through time, such as historical landmarks, distinctive land use patterns and stylistic consistencies in built form. Nature and culture are of course intertwined and inevitably combine in the shaping of the landscape (agricultural land use patterns are a classic example of this). Unlike natural and cultural visual resources, project visual resources are not pre-existing features, but features that will be introduced to the visual landscape when a project is built. Prominent local resources in each of these categories are identified below.

6.3.1 Natural Visual Resources

The project area is well endowed with natural visual resources, and some of these can be considered quite significant. The most prominent natural visual resource is Mt. Mariveles, which can be seen from virtually everywhere in the project area, except where the view from ground level is blocked by vegetation or buildings. This volcano provides strong visual interest to the landscape all around the mouth of Manila Bay, and it is likely to be considered attractive by anyone living in or visiting the area. Incidentally, Mt. Mariveles is also visible from the Metro Manila waterfront, and typically figures prominently in sunset photographs from that location (see Exhibit 29).

Corregidor and Caballo Islands are another major natural visual resource, with their thickly vegetated slopes, interesting topographical profiles, and varied (in some places dramatic) coastlines. The islands lend much visual interest to the waters around the mouth of the bay, and are visible from the Mariveles and Naic shores, as well as from the water. The visual interest contributed by these islands is amplified by the fact that they can be viewed from multiple directions, with a significantly different impression from each perspective. The priority placed by the Cavite City government on developing the touristic potential of Corregidor Island is in large part a testament to the perceived attractiveness of this visual resource.

Coastlines other than those of Corregidor Island and Caballo Island are minor visual resources in the project area. A handful of small pocket beaches can be found along the Mariveles shore in the vicinity of the proposed BCIB alignment's landing point, but these are less photogenic than the cliff-ringed coves of the Five Fingers coast, 10 km to the west of the proposed alignment, and are quite difficult to access. One very striking local feature of the North Channel is Mt. San Miguel, a 200-m crag that stands at picturesque Sisiman Bay, seven kilometers west of the BCIB project area (this was shown in Exhibit 17).

Exhibit 29: Sunset View from Malate, Manila (Mt. Mariveles at left)

The Cavite shore is low-lying and would not be considered conventionally attractive from the perspective of viewers out on the bay. The dark sand and murky waters found along this shore seem likely to guarantee that it will never attract the kind of tourist interest enjoyed by coastal areas in other parts of the country, with their clear blue waters. Nevertheless, the beaches of Naic and Tanza are attractive enough to support significant beach tourism, as is evidenced by the existence of multiple beach resorts strung out along the shore between Rosario and Ternate. These resorts are fairly low-key establishments and serve local and regional tourists.

Manila Bay is itself a significant visual resource, likely to be valued for the sense of space it affords, as well as for the contrast to more constrained views of sky and cloudscapes that prevail away from the coastline. The ever-changing sea surface and occasional sightings of dolphins, whales and sea turtles can also be considered as valued visual attributes. The visual qualities of the open waters of Manila Bay can be appreciated from many different vantage points, both on land and on vessels. Marine traffic is a major contributor of visual interest on the waters of Manila Bay.

On the Mariveles end of the BCIB alignment, the inland landscape is a patchwork of agricultural land, residential areas and industrial land. There are many orchards, fields, hedgerows and grassy fallow areas, and some dense riparian growth. The land itself has a pleasingly varied form dominated by ridges and stream valleys, but the landscape is otherwise not particularly remarkable, and the main natural visual resources are those which can be viewed *from* here: Mt. Mariveles, Corregidor Island and the North Channel, and the hills of Western Cavite and Northern Batangas beyond.

Exhibit 30: Beach Resort on Naic Shore

The Naic end of the alignment will traverse an inland landscape of fields used for pasture and wet rice, crisscrossed by residential and commercial strip developments, and increasingly hemmed in by residential subdivisions. The land is very slightly sloped, and natural visual resources consist of riparian vegetation along the three minor estuaries that wind through the landscape, and the vibrant green of young rice during part of the year.

6.3.2 Cultural Visual Resources

The major cultural visual resource in the project area is Corregidor Island, and the numerous remnants of military history that dot the island's landscape. A number of commemorative sites on the island also can be considered cultural visual resources. None of the historic or commemorative sites on the island are visible from any great distance, so the visual impact of these resources is very localized. Similarly, there are several mile markers on the Roman Highway within Mariveles that commemorate the Bataan Death March during WWII; these are cultural visual resources of very localized visibility.

Populated landscapes are partly a cultural expression, and the cultivation patterns and built features observed in the portions of the project area within Mariveles and Naic can be considered cultural visual resources. Neither is a particularly noteworthy or striking example of a significant cultural landscape type, however, with little in the way of distinctive architectural styling or cropping and irrigation systems indicative of any particular highly valued cultural heritage. Neither would be considered a crucial factor in visual impact assessment.

6.3.3 Project Visual Resources

As noted earlier, a substantial proportion of the proposed BCIB infrastructure will either have quite low visibility due to low physical profile and expected obstruction of views by land cover or be situated so far from land as to constitute a rather insignificant portion of the field of view from any on-land location. The visually impressive South Channel Bridge, for example, will stand approximately 11 km from the Mariveles shore, and almost 9 km from the nearest point of land on the Cavite shore in Ternate. Most of the marine viaduct segments' 22-km overall length will be effectively out of the visual reach of on-land viewers. The most notable exception is the North Channel Bridge, which will be much closer to shore than its larger south channel counterpart and will be visible at fairly close range from some coastal communities in Mariveles and from some vantage points on Corregidor Island. The North Channel Bridge will be the dominant project visual resource in relation to on-land viewsheds.

Visibility of the project infrastructure will be much greater from the water, and from the roadways themselves. The most visually significant components of the proposed project for on-water viewers and BCIB users will be the two high cable-stayed bridges. The marine viaducts and land approach roadways will be visible features connecting these soaring structures to each other and to land, but the eye will always be drawn to the towers and cable sprays. The cable-stayed bridges will be highly significant additions to the visual landscape, at least for viewers on vessels navigating along or near the two navigation channels, and for drivers and passengers in vehicles using the crossing. The visual prominence of the cable-stayed bridges will be most pronounced at night when their decorative floodlighting will make them stand out starkly against darkened surroundings.

While the cable-stayed bridges will naturally garner the most attention, the marine viaducts will not be without visual appeal from certain vantage points. The long curving, receding trajectory of the viaduct segments will be quite notable especially from high points such as the Mariveles slope and from the high bridge decks, but also from a number of locations on the low-level viaduct itself, where the eye will tend to seek out the way forward along the oblique sight line on the inside arc of the alignment.

6.4 Population Affected by Visual Change

The BCIB project will impinge upon the viewsheds of three broad groups: (1) viewers on land; (2) viewers on vessels; and (3) viewers using the infrastructure. These groups will encompass people who live locally, people from other areas passing through on their way to somewhere else, and people for whom the project area will be a destination in its own right (including local, regional and international tourists). It is to be expected that there will be some overlap between these groups (for instance, people who live near the approaches, and also use the crossing).

6.4.1 Viewers on Land (Project Neighbors)

Because of the fairly low physical profile of the finished land approaches and planted vegetation that will mostly obscure view of it from surrounding areas, the number of affected viewers in project-proximate areas on land will be quite limited during the operation phase. During the construction phase, the works will be visible to people living near the project sites (within about 250 m) and to those using the local roads that intersect the project alignment. The areas in which the two on-land road segments will be constructed are not heavily populated, being still partly agricultural, so the number of people with a direct view of the under-construction infrastructure will be quite small.

The Mariveles shore in the immediate vicinity of the proposed project alignment is mostly unpopulated, so very few people will have a close view across the water of either the works during construction or the completed infrastructure. Residents of the seaside portions of Mountain View and Cabcaben barangays will have a medium-range side view of the works and the completed infrastructure when looking west and south from the shore, and residents of the small community at Kamaya Point will have a similar view to the east.

Along the Naic beachfront, the viaduct will be visible on the near horizon (less than 3 km offshore). The Naic shore is almost continuously settled, and residents and visitors will be in a position to view nearshore portions of the marine viaduct at fairly close range, and the South Channel Bridge as a distant object. The proposed alignment will curve westward from the shore and roughly parallel the beach for a few kilometers, so people living along, working along, and visiting the coast in the 3–5 km stretch west of the landing point will have a view of the viaduct during construction and operation. Nearest the viaduct's shore landing, of course, the viaduct will be highly visible from shore, and will be an especially prominent visual feature for viewers on the inside arc of the alignment. The BCIB viaduct will also be within the viewshed for people on the nearby shorelines of the Municipality of Tanza and Municipality of Ternate, although at a greater distance. The people whose views will be thus affected will include residents of fishing communities and the staff and visitors of the resorts, which cater mostly to local tourists from central Luzon.

People living inland near the BCIB alignment in Cavite will experience views of the embankment, which will be approximately two stories high, and will run perpendicular to existing local roadways. Most of the embankment will be sloped and vegetated, but one section approximately 400 m long will be of mechanically stabilized earth (MSE) construction and will appear to the viewer as a wall. The embankment may only be visible from within 100-200 m, since the roadways are narrow and tree lined, but its height will be nearly double the height of many homes and other structures in the vicinity, and its presence may give the viewer the feeling of a barrier or division of the community. Viewers of the embankment will consist of residents, small business owners, and tourists traveling to and from the shoreline.

6.4.2 Viewers on the Water

The cable-stayed bridges and viaducts will be highly visible to people transiting the north and south navigation channels, or otherwise navigating in the project area. Viewers of the proposed project infrastructure from below will include local fisherfolk plying the local municipal fishing grounds; passengers on the inter-island ferries running between the Manila waterfront terminals and other ports around the country, as well as between Manila and the Corregidor Island and Mariveles Bay terminals; crew of freighters transiting in and out of Manila Bay; and recreational boaters. On-water viewers of the BCIB infrastructure will be a diverse group. On-water viewers will see the proposed infrastructure in various stages of completion over the 5 to 6-year construction phase, and for many years during operations.

6.4.3 Viewers Using the BCIB Infrastructure

Users of the BCIB will have up-close views of the project infrastructure, during the operation phase only. Such viewers can be expected to include motorists and their passengers in cars, passengers on buses, and truck drivers. People experiencing the visual appearance of the proposed infrastructure from the roadway will include both regular viewers (commuters, truck drivers and local residents of each side), as well as one-time and infrequent viewers (tourists, long-haul truck drivers, and long-haul bus passengers). Like the on-water viewers, people experiencing the visual impact of the BCIB infrastructure while using it will be a diverse group.

6.4.4 Viewer Perceptions

People experiencing the visual impact of a landscape and any infrastructure inserted into it can be expected to have differing perspectives that depend in part on their (mostly unexamined) background expectations for what a landscape should be and do, and how it should be allowed to evolve. Prospective neighbors and users of proposed infrastructure may diverge markedly in their reactions to it, and this is often linked to their perceived self-interests.

Residential neighbors of proposed infrastructure are often correctly assumed to value the landscape as it is and to be inherently skeptical that the proposed project will do anything but harm existing visual quality, although residents of marginalized rural localities in particular often associate new developments (roads especially) with progress and opportunity, and may be far less interested in preserving the status quo for the sake of visual continuity.

Commercial neighbors may be concerned about the effects of new infrastructure on the visual attractiveness of the public approaches to their establishments; entertainment and retail enterprises in particular may fear customers will be deterred by an unattractive milieu. Institutional entities may worry that their prestige and image of efficiency and competence will be damaged if favorable views of their buildings and grounds are compromised but may also be quite interested in the infrastructure's potential to enhance access by customers and suppliers to their properties. Some prospective neighbors may also perceive that the proposed infrastructure will help to correct existing visual 'eyesores', particularly when it would displace such things as abandoned industrial facilities, vacant and neglected lots, garbage dumps, or older infrastructure that is deteriorating, outmoded, disused or otherwise visually unattractive.

There will usually be substantial overlap between the opinions of prospective project neighbors in different categories, as even otherwise skeptical residential neighbors may perceive personal mobility improvements or expect increases in land values as a result of proposed infrastructure developments, and this may influence their judgement regarding both existing landscape values and the possible visual effects of proposed change. And business owners and employees of public institutions are often also local residents and may feel conflicting influences on their perceptions of the landscape.

FHWA guidance on visual impact assessment indicates that people almost universally make subconscious judgements about three aspects of a landscape's appearance while viewing and forming a reaction to it: natural harmony, cultural order, and cohesiveness. Natural harmony refers to whether natural systems are in some kind of healthy equilibrium; if something is disharmonic (e.g., an obviously polluted watercourse, dying or damaged trees, a gash on an otherwise attractive hillside), the assessment of visual quality will be less favorable.

Cultural order concerns the compatibility of landscape components—particularly built ones—with what might be considered the ‘normal’, ‘right’, or ‘prevailing’ way of organizing space into place. Structures that depart dramatically in style from what is around them (e.g., avant-garde or modernist annexes built onto classical heritage buildings); overwhelm their surroundings through sheer scale of intervention (e.g., a very tall building in an area with only low-rise development); or seem out of character (e.g., a ‘big box’ retail outlet building in a mixed commercial-residential district in which small family-run shops have traditionally predominated) typically are controversial. Zoning bylaws and aesthetic guidelines are often put in place specifically to prevent such breaches of the cultural order.

Cohesiveness refers to a proposed project and its spatial and functional integration with existing uses and flows in the landscape, including other infrastructure. Transportation projects that seem to stand alone, with poorly articulated linkages to other infrastructure or accommodation for anything other than the traffic they carry (e.g., urban expressways and interurban highways that effectively bisect the landscapes they cross, for lack of user-friendly rights-of-way to enable crossing from one side to the other) are unlikely to be considered attractive by viewers in the community. Also, projects that attempt to honor and nurture their host landscapes (e.g., highway projects that incorporate native plantings and public greenways linking natural areas along their rights-of-way are likely to be considered visually appealing.

To gauge the expectations of people in the project area regarding the visual impacts of the BCIB project, questions pertaining to aesthetics and visual impact were incorporated into a broader perception survey administered as one of the key stakeholder engagement tools used during preparation of the updated project EIA. The perception survey was administered in person in various venues around the project area during two field periods (February 2022 and May–July 2022) and was also made available in an online format from February–July 2022. In all, 650 people participated in the perception survey, with 350 from Mariveles and 300 from Naic; most respondents (621) participated in person rather than online. Respondents were 57% female and 43% male in Mariveles, and 46% female and 54% male in Naic. The median age of respondents was 32 in both Mariveles and Naic. In both Mariveles and Naic, 86% of respondents indicated that their highest level of educational attainment was either secondary school, college diploma or university degree.

Three survey questions pertaining directly to aesthetics and visual impact were included in the perception survey. Respondents were asked to look through a series of artistic renderings of the BCIB infrastructure before talking the survey, and to base their responses to the three aesthetics questions on the renderings. The renderings shown can be seen in Appendix 1.

The first question regarding aesthetic matters was as follows: *Based on the drawings in the handout, please rate your impression regarding the likely attractiveness of the bridge on a scale of 1 to 5, where 1 is "not very aesthetically pleasing" and 5 is "very aesthetically pleasing".* The survey results for this question are shown in Exhibit 31. The respondents expressed an unfavorable impression overall, but a marked contrast can be noted between perceptions of respondents in Mariveles and Naic. In the Mariveles results, the two most unfavorable rating categories together account for over 80% of responses, and 'not very aesthetically pleasing' is the leading category. Only 12% of Naic respondents, on the other hand, rated the BCIB infrastructure as 'not very aesthetically pleasing', and the two least favorable rating categories collectively accounted for just under 40% of overall responses there. Responses on the positive end of the scale were more prevalent in Naic than in Mariveles.

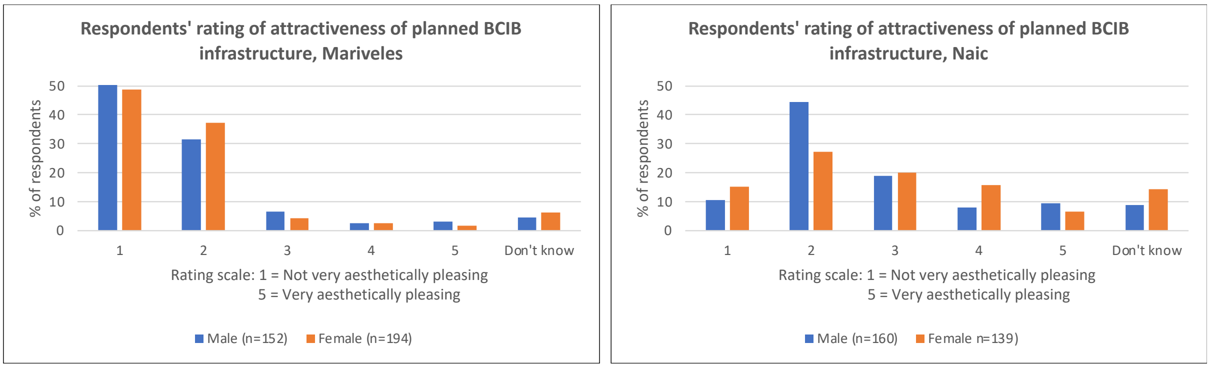


Exhibit 31: Perceptions of Likely Attractiveness of BCIB Infrastructure, Mariveles and Naic

A second survey question concerned respondents' expectations regarding the visual impacts the BCIB infrastructure will have on the host landscape, including on people's views: *Based on the drawings, please rate your impression of the likely visual effect of the bridge on the landscape and/or the view, on a scale of 1 to 5, where 1 is "not very aesthetically pleasing" and 5 is "very aesthetically pleasing".* The survey results for this question are shown in Exhibit 32. In a pattern nearly identical to that revealed in relation to the first question, responses skewed negative in general, but markedly less so in Naic than in Mariveles.

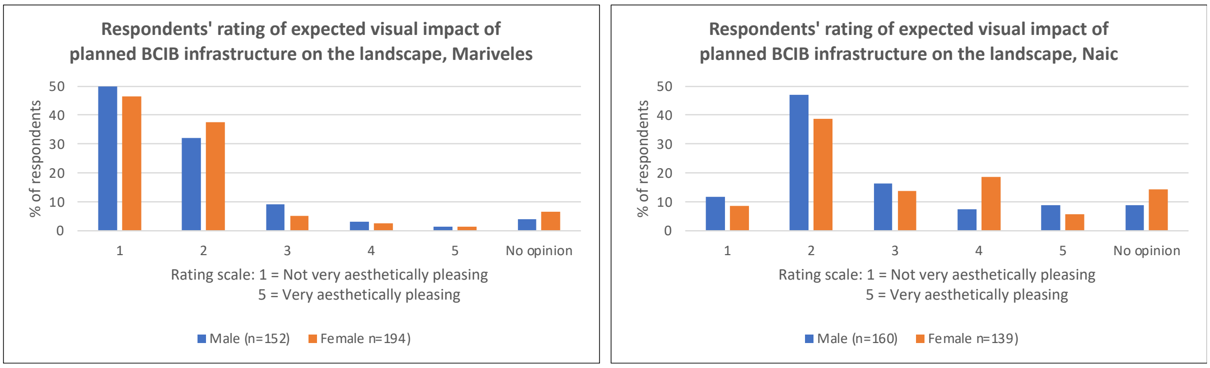
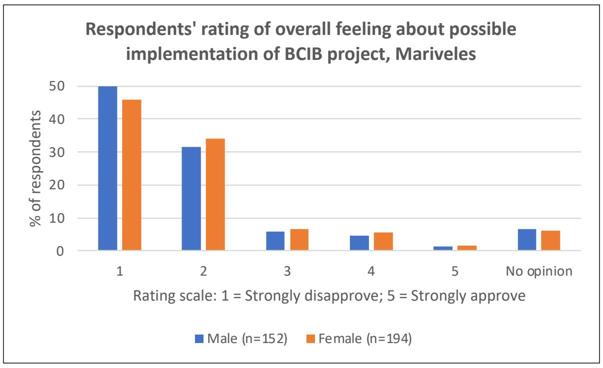


Exhibit 32: Perceptions of Likely Visual Impact of BCIB Project on Landscape, Mariveles and Naic

A third survey question attempted to identify specific concerns respondents might have regarding the possible aesthetic dimensions about the BCIB infrastructure: *Do you have any specific concerns about the appearance of the bridge or its visual effect on the landscape, and if so, what?* This survey question did not yield any significant insights, in either Mariveles or Naic, due to apparent misinterpretation by respondents; most responses were either non-responses such as 'None' or positive commentary not indicative of any concern. The few concerns noted by respondents were not relevant to visual impacts or aesthetics.

Absent any meaningful insights from responses to the third aesthetics question, there is not a strong basis for reflection regarding the underlying reasons for the generally negative ratings assigned, or the observed differences in perceptions between Mariveles and Naic respondents. It is possible that respondents on the Naic side of the project area are less strongly averse because the most visible project infrastructure will be quite far removed from the Naic shore. Greater proximity of the major bridges to Mariveles may be reflective of a more prevalent association of the project with a sense of disruption or imposition. Regardless, it seems likely that the respondents' opinions regarding aesthetics are influenced by broader views on the project as a whole; indeed, the pattern of stronger expression of favorability in Naic on the aesthetics questions mirrors survey results regarding respondents' overall feeling about the BCIB project. For the capstone survey question *On a scale of 1 to 5, where 1 is "strongly disapprove" and 5 is "strongly approve", how would you rate your overall feeling about the possible implementation of this project?*, the two least favorable rating categories accounted for 78% of responses in Mariveles, but only 35% of responses in Naic. Respondents indicating that they had no opinion were far more numerous in Naic than in Mariveles (see Exhibit 33).



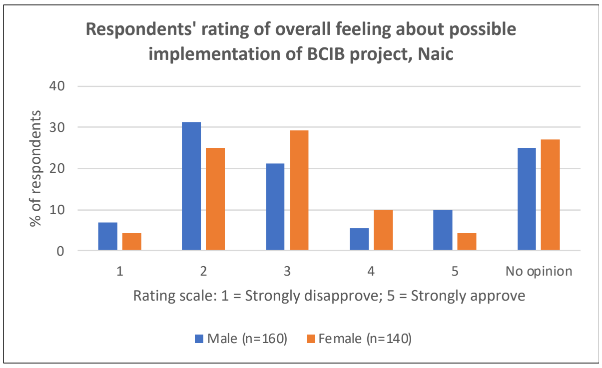


Exhibit 33: Overall Feelings About Implementation of BCIB Project, Mariveles and Naic

6.5 Anticipated Visual Impacts

6.5.1 Impacts on Existing Visual Resources in the Project Environment

Development of the BCIB project can be considered unlikely to severely affect existing visual resources, except for those closest to the Cavite land-side embankment. No significant visual feature or scenic visual corridor will be removed or degraded. The marine components will supplant an ‘open sea’ aesthetic along its path, but there is nothing about this aesthetic that is particular to the areas along the alignment, and there are many other nearby portions of Manila Bay where it will still prevail after the project has been developed. The BCIB itself will be a significant feature, worthy of admiration for its size and vivid design features. Around the world, bridges of the scale and stature of the BCIB draw attention and are commonly featured in tourist attraction brochures. The BCIB is likely to be a new draw of attention to both Cavite and Bataan for more viewing opportunities. This is a different aesthetic than the current low-key beachfront that currently prevails on the Cavite shore. The landside embankment in Cavite is anticipated to result in a sense of barrier or visual dominance over the otherwise low-profile buildings. This will result in a visual change to the character and experience of the community. Construction will affect local community areas mostly in Cavite, because the BCIB will result in displacement of homes and small businesses, and there will be years of construction equipment and lighting and dust associated with construction nearby residential areas. The potential for this is not as great in Bataan because the alignment is sparsely populated, the terrain is undulating, and the tree cover is more extensive. Viewers affected in Bataan are those who already experience the Roman Highway traffic, and can expected to be more accustomed to higher levels of activity.

6.5.2 Impacts on Viewers

The significance of anticipated impacts on viewers will vary by viewer group and location. The analysis that follows draws out the main affected viewer groups and reflects on the importance of location in shaping impacts within those groups.

6.5.2.1 Viewers on Land

Views of on-land infrastructure from the direct vicinity

Based on the visual characteristics and visibility of the project's on-land components, impacts on ground-level viewers in the near vicinity of the roadways can be expected to arise during the construction phase, as there will be no feasible way to shield the under-construction embankments and crossing structures from view. However, this impact will be temporary.

Regarding the operation phase, design elements and vegetation can be incorporated to soften the infrastructure's appearance and integrate it favorably with the residential character of community areas nearby , especially at underpasses. The BCIB will not interfere with scenic view corridors or block culturally significant features. The anticipated visual impact for people living and working along the roadways can be classified as 'adverse' (temporary and minor) for the construction phase, and with mitigation, 'beneficial to neutral' for the operation phase.

Seaward views from Mariveles

For on-land viewers in a position to regularly view the nearshore segments of the marine viaducts, the visual impact is likely to be mixed. Some people living at favorable higher-elevation vantage points on the Mariveles side (mostly in and around Alas Asin village) will be able to see the crossing curving away towards Corregidor Island and the distant Cavite shore, and this distant view is likely to be considered a pleasing one, as the infrastructure will add a relatively unobtrusive and complementary element of interest to the generally attractive visual landscape centered on the North Channel and Corregidor Island. It is to be noted that few people have clear views out over the bay, and those that do will see the bridges and viaducts at a distance of at least 5 km, so the infrastructure will occupy a small proportion of the viewshed. The anticipated visual impact of the proposed project for people in these upslope locations can be classified as 'beneficial', though of minor magnitude due to the distance factor. Also, visual impacts on these viewers' visual experience during construction will be negligible, and accordingly classified as neutral.

As has been noted previously, the shoreline in southern Mariveles is sparsely inhabited, and this lessens the potential for visual impact, whether positive or negative. The primary inhabited shore-level vantage points are in Cabcaben, 2 km northeast of the project alignment landing point, and the small fishing village at the base of Kamaya Point Road, 2.2 km southwest of the landing point.

From Cabcaben, the west- and southwest-facing viewshed is dominated by Corregidor Island (see Exhibit 34). The nearest part of the island is 6 km from Cabcaben, but the island is nevertheless a dominant landscape feature (more than the photograph in Exhibit 34 suggests). The BCIB project will be positioned between Cabcaben and Corregidor Island, and thus will alter residents' view of the island. The North Channel Bridge will have a fairly limited obscuring effect on the view to the islands, as it will occupy a narrow slice of the viewshed (see sight lines 1 and 2 in Exhibit 35), but the overall view to the islands will be screened by the supports of the bridge and the high viaducts. For perspective, it may be noted that the towers of the North Channel Bridge are to be 150 m tall, the same height as the highest part of Corregidor Island but will be approximately 50% closer to Cabcaben-positioned viewers, and so will appear to stand about twice as tall. The rugged Hooker's Point at the tip of Corregidor Island's Tail End, despite being several kilometers distant, is visually interesting as seen from the Cabcaben area, but most of the land here stands barely higher than the designed height of the viaduct and turnaround and will be mostly hidden behind them (sight line 3). These screening and blocking effects will represent a permanent impairment of residents' view of the island. This negative effect will be balanced, however, against the visual interest provided after dark by the North Channel Bridge's decorative lighting, a middle-distance feature that most viewers are likely to find pleasing. On balance, the visual impact of the BCIB project for residents of the Cabcaben waterfront can be considered neutral for the operation phase. Visual impacts at Cabcaben derived from construction activity are unlikely to be significant, given that all work sites will be at least 2 km away.

Exhibit 34: Corregidor Island from Cabcaben Waterfront

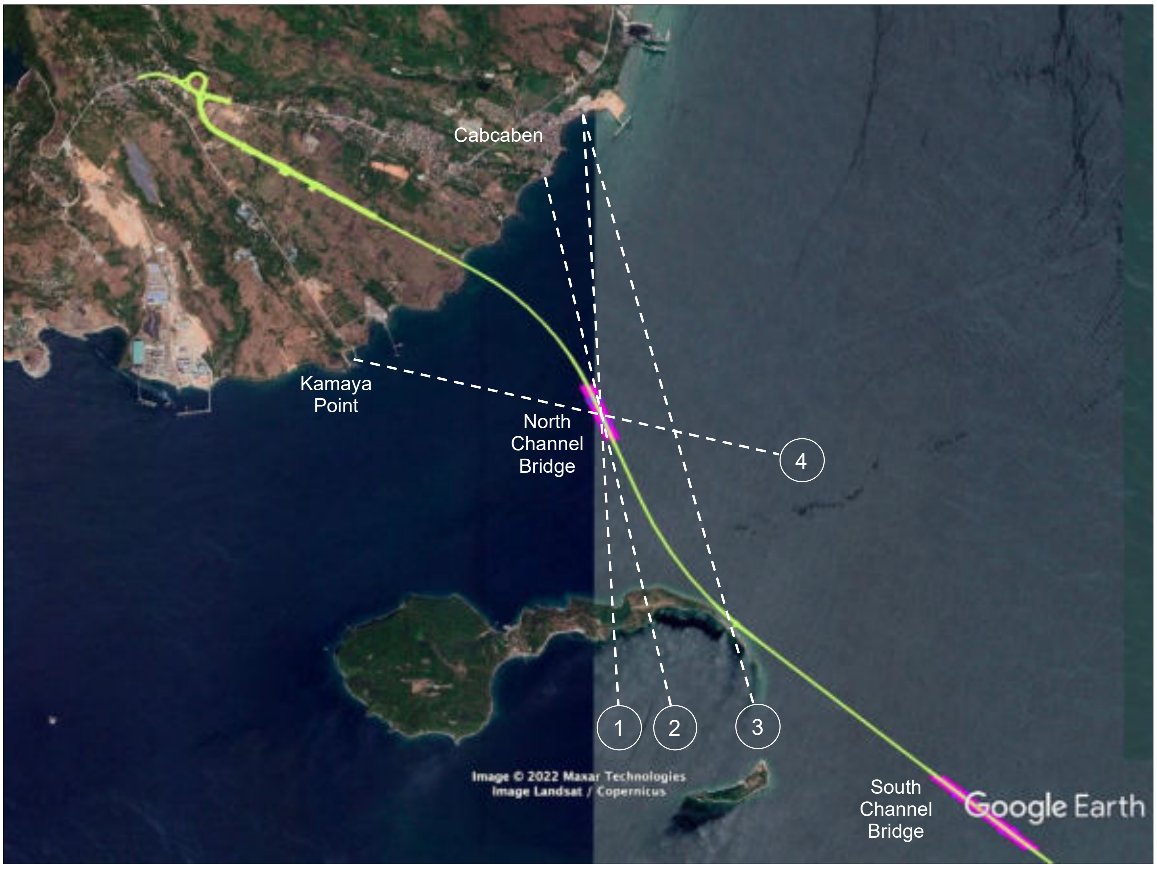


Exhibit 35: Sight Lines to Corregidor and Caballo Islands from Cabcaben Beachfront

For the residents of the small community at Kamaya Point, the BCIB project will not block any part of the view to Corregidor Island, which is closer than it is to Cabcaben, and therefore has even greater prominence in the south-facing viewshed. From this vantage point, the North Channel Bridge will be viewed from a less oblique angle, and it will be possible to see both towers and cable sprays distinctly (see sight line 4 in Exhibit 35). The bridge will be about 4 km from this location, about the same as the width of the North Channel, so the 150 m-bridge towers will appear to the viewer in proportions roughly commensurate with the height of the island (also about 150 m), and therefore should not be visually overwhelming (see Exhibit 36). In daylight hours, the substantial mass of the island is likely to remain the center of visual interest, balanced only partially by the visually permeable bridge and viaduct infrastructure. At night, the bridge lighting should provide a pleasing—and again not overwhelming—spectacle in the middle distance and will draw the eye to a much greater extent than will the mostly unlit island, effectively re-centering the viewshed. The bridge and viaduct will impair eastward views of the expanse of Manila Bay from this location, but this is not a particularly interesting seascape, so this negative effect can be considered negligible. On balance, the visual impact of the BCIB project for viewers in the Kamaya Point community is likely to be moderately beneficial for the operation phase. Construction-derived visual impacts for people at this location are expected to be minimal, given the distance of at least 2 km to the marine construction sites. The primary visual impact during construction will be derived from the substantial construction vessel traffic through the viewshed, transiting between the alignment and the drydock and casting yard, which will be located about 1 km west of Kamaya Point (those facilities themselves will be mostly or entirely outside the viewshed of the Kamaya Point community); this temporary visual impact is not likely to be significant, and may be considered to add visual interest for many viewers for the time it lasts.

Exhibit 36: North Channel and Corregidor Island from Kamaya Point Community

Seaward views from Corregidor Island

The potential for project impacts on views from Corregidor Island is limited by the island's highly varied topography, thick vegetation, and the locations of visitor facilities. There are currently few opportunities for close-range views of the nearshore and offshore areas through which the alignment will pass. Most tourist sites are located around former military installations in the western half of the island. Much of the island's Tail End has been a restricted military zone for decades, and no visitor access points have been established to the north or east of the airstrip, where direct, close range views would be possible. However, there are a number of vantage points from which the BCIB infrastructure will be visible; these are shown in Exhibit 37, and discussed individually below. All viewsheds discussed are static ones; although there are numerous roads winding around the island, thick roadside vegetation affords little more than the occasional fleeting seaward glimpse, thus dynamic viewsheds are not of any significance. There are no facilities for visitors on Caballo Island, which still houses significant stores of WWII-era munitions and is a restricted zone, so the view from there is not considered.

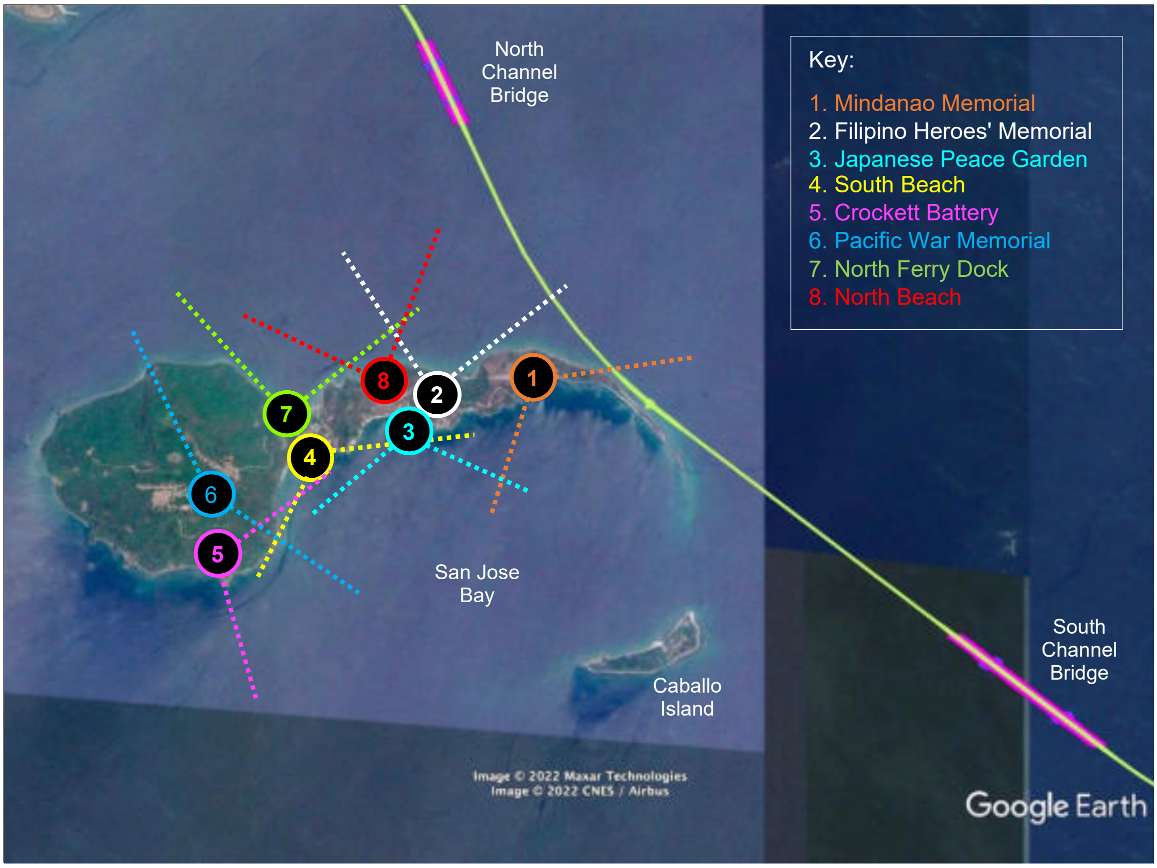


Exhibit 37: Vantage Points and Viewsheds on Corregidor Island

Mindanao Memorial

This memorial site (No.1 in Exhibit 37) is just south of the airstrip in the Tail End and has an overlook (30 masl) with open views over San Jose Bay to the southwest, south and southeast. The southeastwards view is along the rugged forested spine of Hooker's Point, and at present offers a strong 'unspoiled nature' aesthetic (see Exhibit 38). The viaduct and turnaround will impinge upon this nature-dominant scene, with the turnaround visible at a range of just 1.2 km across Hooker's Point, and the viaduct occupying the horizon across the visual gap between Hooker's Point and Caballo Island. It is likely that the addition of a four-lane elevated highway to the view here will be considered an unfavorable visual intrusion to many or most visitors.[4] The South Channel Bridge will be visible at a range of 5.3 km, and given the 305-m height of the bridge towers, will be a prominent new feature of the visual landscape. However, the bridge is unlikely to detract from the more locally scaled wild nature aesthetic to the same extent that the viaduct and turnaround will, as it will serve more as a backdrop than an intrusion. Many or most visitors to this viewpoint may well find the South Channel Bridge awe-inspiring and pleasant to behold, even at a range of 5.3 km. From this vantage point, the bridge will be seen almots end-on, so it will occupy a smaller slice of the viewshed than it would in the case of a full side view but may also be less visually interesting from this perspective. Considering the likely moderate to strong adverse impact on the near-range view and likely mild beneficial impact on the longer-range view, the probable visual impact of the BCIB infrastructure on views from this vantage point can, on balance, be considered mildly adverse for the operation phase. During

[4] This effect will be substantially worsened if a spur connection to the island from the turnaround involves an elevated roadway across San Jose Bay, as has been hypothetically postulated as one possibility by the BCIB design team. From a visual impact perspective, it would be preferable to find a land route for the access link. This is a matter for a separate EIA study of possible future development plans involving a link from the BCIB turnaround.

construction, the view from the Mindanao Memorial will be moderately degraded by the marine works; this adverse visual impact will be temporary, although of significant duration (more than two years for the components in the near distance).

Exhibit 38: Southeasterly View from Mindanao Memorial

Filipino Heroes' Memorial

This major memorial site (No. 2 in Exhibit 37) offers views to the north and southwest; the primary exposure to the BCIB infrastructure concerns the north-facing vantage point. The North Channel Bridge will be visible at a distance of 2.8 km and will figure prominently in the viewshed. As the viewpoint sits at about 50 masl, the view of the bridge and its high approaches will be mostly horizontal rather than upwards, which should make the structure seem less imposing than it would appear from a position at sea level. The North Channel Bridge will be seen from a deep oblique perspective and will not block sight lines to any significant visual resources (only the view of distant industrial facilities will be directly affected). A limited portion of the lower viaduct closer to the island will be visible at a range of 1.5–2.0 km, in a downward view. The visual impact of the BCIB infrastructure on the north-facing viewshed from the Filipino Heroes' Memorial seems unlikely to be considered strongly or even moderately negative by many visitors, and, at the same time, can be expected to elicit at least moderately positive reactions from viewers who find cable-stayed bridges interesting to behold. On balance, the probable visual impact from this vantage point is mildly beneficial for the operation phase. A moderate adverse visual impact can be expected during the construction phase, lasting for a period of three years or more.

Japanese Peace Garden

This commemorative site on a low headland beside San Jose Bay (No. 3 in Exhibit 37) is oriented more to contemplation than outward-looking visual experience, but does offer limited views over San Jose Bay, primarily in a southwesterly direction. A view to the southeast and the future location of the BCIB is possible from one part of the site for those who seek it out (see Exhibit 39), but the proportion of visitors who will do this is probably quite low. The South Channel Bridge will stand 5.6 km from the Japanese Peace Garden (approximately where the ship can be seen in Exhibit 39) and the high towers will be visible and even prominent, but given that they will not be 'front and center' in the viewshed, the effect on the vast majority of site visitors will be quite minimal. The visual impact of the BCIB infrastructure at this site can therefore be considered neutral.

Exhibit 39 Southeasterly View from Japanese Peace Garden

The same can be said for the beach recreation area to the immediate west of the Japanese Peace Garden, as southwesterly views from the beach are blocked by the headland on which the garden is situated. Given the distance from both sites to the marine construction works, the potential for visual impacts during the construction phase is expected to be negligible.

South Beach

South Beach is a mixed sandy/cobbly beach across a narrow saddle from the main ferry dock on the island's north side and is the most accessible beach on the island. There is a secondary ferry dock extending from the beach, which is used when wind conditions are unfavorable at the main dock. From South Beach, the BCIB viaduct will be visible on the horizon at a range of 4 km, where it will be seen to emerge from behind Hooker's Point and remain a horizon feature all the way to the South Channel Bridge. Although there are some visitor sites on the shore between South Beach and Hooker's Point, including the Japanese Peace Garden and adjacent beach area, these are out of view due to intervening forested headlands, and the southeastward view has a natural aesthetic. This natural aesthetic will be degraded by the addition of the marine viaduct to the horizon, particularly as the viaduct will, from this perspective, pass directly behind the picturesque cliff-bound islet that stands off the end of Hooker's Point. The 4-km distance will render the degradation less severe from the viewer's perspective than it will be at closer range, e.g., from the Minadanao Memorial. The South Channel Bridge will be quite noticeable to the left of the Caballo Island silhouette, but as the towers will stand 7 and 8 km, respectively, from the South Beach-positioned viewer and the structure will be seen from an oblique perspective, the visual effect is unlikely to be especially powerful.

Exhibit 40: Southeasterly View from South Beach

Neither appreciators of the wild nature aesthetic nor admirers of bridge architecture are likely to experience strong emotion upon viewing the BCIB infrastructure from the South Beach, and the overall operation-phase visual impact in relation to this vantage point can be considered effectively neutral on balance. No special additional visual impact is expected from construction activity, given the distance to the works sites.

Crockett Battery

From the roof of this ruined gun battery perched at 140 masl on the southeast side of the main body of Corregidor Island (No. 5 in Exhibit 37), a commanding view can be had eastwards over the Tail End, Caballo Island and the intervening waters of San Jose Bay, and also southwards to the hills of western Cavite and northern Batangas. The South Channel Bridge will be visible at a range of 8 km and will appear to rise out of the north side of Caballo Island, which lies between the battery and the bridge site. Although quite distant from the South Channel Bridge, this site will offer the least oblique view of the structure of any on-land vantage point on Corregidor Island, and viewers should be able to make out both towers and cable sprays with ease. Given the distance between the viewpoint and the bridge, the visual impact of the project at this location is unlikely to elicit any significant negative response from visitors, and positive response may also not be particularly strong. It is also worth mentioning here that many visitors to the Crockett Battery will not actually climb to the roof to take in the view. Taking account of all factors mentioned, the expected visual impact for the operation phase is appropriately classified as 'mildly beneficial'. It is not expected that construction activity will present any special visual impact, beyond the fact that the distant, partially completed infrastructure is unlikely to be visually pleasing. Given the substantial distance from this vantage point to the alignment, this adverse impact will be a mild one.

Pacific War Memorial

From the end of the open grassy area extending eastward from the Pacific War Memorial (elevation 160 masl), a wide vista can be enjoyed, taking in Mt. Mariveles, all of the North Channel, the long tail of the island winding its way off to the south, and Caballo Island. This vantage point has the most comprehensive visual exposure to the BCIB infrastructure of any point on the island. The North Channel Bridge will be seen 4.5 km away to the northeast, from an oblique perspective, and the South Channel Bridge, also an oblique view, 8 km to the southeast. Given their relative sizes and distances off, the two bridges are likely to make a similar impression on viewers from this location. Unlike all other vantage points, the Pacific War Memorial viewpoint will give the viewer a sense of the BCIB as a coherent infrastructural entity, as it will be possible to take in approximately 13 km of the project's overall length, from the Mariveles shore to the South Channel Bridge. Many viewers are likely to find this grand sweeping view of the bridges and viaducts linked together across the middle distance, together with the elegant curvature of the island's Tail End portion, impressive and pleasing. The visual impact of the BCIB project, as perceived from this location, can be considered moderately to strongly beneficial. In the construction phase, the same comprehensive view will be of partially completed infrastructure and will not be as impressive; this less attractive phase will result in a mildly adverse visual impact for a period of 4–5 years.

Exhibit 41: Easterly View (Composite Panorama) from Nearby Pacific War Memorial

North Ferry Dock

The main arrival and departure point for visitors to Corregidor Island, the north ferry dock offers a fairly broad view across most of the North Channel, including the North Channel Bridge site. The bridge will be 3.5 km from the dock area and will be visible from a perspective that is only moderately oblique, meaning that the full breadth of the bridge's cable sprays will be visible. As the vantage point is at sea level, the bridge will occupy a substantial space in the northeastward portion of the viewshed, despite being over 3 km away. Unlike many of the viewpoints on the island, the ferry dock may actually be frequented to some extent into the evening, giving visitors a full view of the bridge's night lighting. The BCIB infrastructure will not block views of Mt. Mariveles or any especially attractive view to the northeast, and it is quite likely that most viewers will find it a pleasing addition to the visual landscape of the North Channel.

Exhibit 42: Northeasterly View Over North Channel from North Ferry Dock

The visual impact of the finished project as perceived at this location is considered likely to be moderately to strongly beneficial. During the construction phase, which may endure for 3–4 years at this location, a moderately adverse visual impact is expected, on the assumption that few viewers will find partially completed infrastructure particularly attractive.

North Beach

An undeveloped beach separated from the north ferry dock by three headlands, North Beach is currently accessible only by walking trail and so is not heavily frequented, but there are plans to build a minor spur road down to the beach in the near term. This vantage point has views similar to those from the ferry dock, although the North Channel Bridge will be somewhat closer (2.8 km) and will be visible from a more oblique angle. Because of a prominent headland to the east of this beach, most of the viaduct south of the bridge will be out of sight for beach users. To the extent that individual viewers may enjoy looking at large bridges, the presence of the North Channel Bridge at medium range will offer an enjoyable visual experience, but otherwise it is not likely to invoke strong positive or negative reactions. Overall, the expected visual impact of the BCIB project at this location is classified as mildly beneficial. During the construction phase, a partially completed North Channel Bridge will stand in direct view for a period of 3–4 years, and this can be expected to constitute a moderately adverse visual impact.

Seaward views from Naic beachfronts

For viewers on the Naic shore, of which there will be many in the fishing communities and resorts lining the beaches, the visibility of the BCIB project will be high, even though the two most visually prominent project features will be far away. Here, the viaduct will extend out from the beach along a gentle arc from the landing site westwards to a point about 6.5 km linear distance, from where it will bend away to the northwest. This alignment places the viaduct directly in front of beach-positioned viewers, at distances ranging from 0–3,000 m (see Exhibit 43).

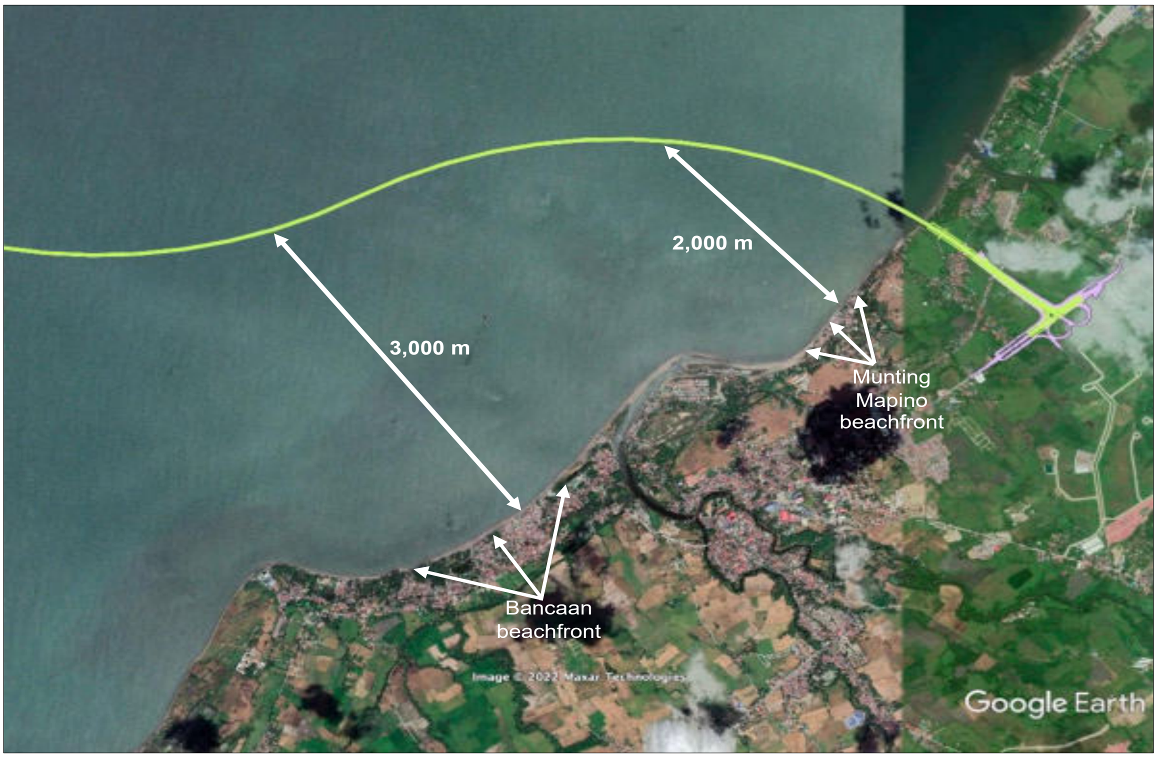


Exhibit 43: BCIB Alignment Near Naic Beachfronts

Nearest the landing point, where the viaduct will stand higher than the eye, the viewer will be required to look through the gaps between support piers to observe the open bay and the slopes of Mt. Mariveles in the distance, and the viaduct deck will obscure part of the normal view.

Further to the southwest, the viaduct will run parallel to the shore, 2.5–3 km from the beach; from vantage points on this part of the shore (mainly Barangay Bancaan), the viaduct structure will appear on the horizon as a thick whitish line on stilts. While this shore-parallel segment will not block the view of Mt. Mariveles from the shore, it will obscure views of the natural sea horizon, and modify the view of Corregidor and Caballo Islands. The South Channel Bridge will block views of Corregidor and Caballo Islands from Munting Mapino and Bancaan (see Exhibit 44), and this may be disappointing to some. It has to be acknowledged here that the view to Corregidor and Caballo Islands from the Naic beachfronts is a distant one (14–20 km, depending on the combination of vantage point and feature viewed) and is sometimes substantially obscured by haze, so the blockage may not be considered a severe loss by many people. For some, the addition of the 300 m-tall towers and cable sprays of the South Channel Bridge (especially when lit at night) may be a favorable substitution for the impaired views to the islands.

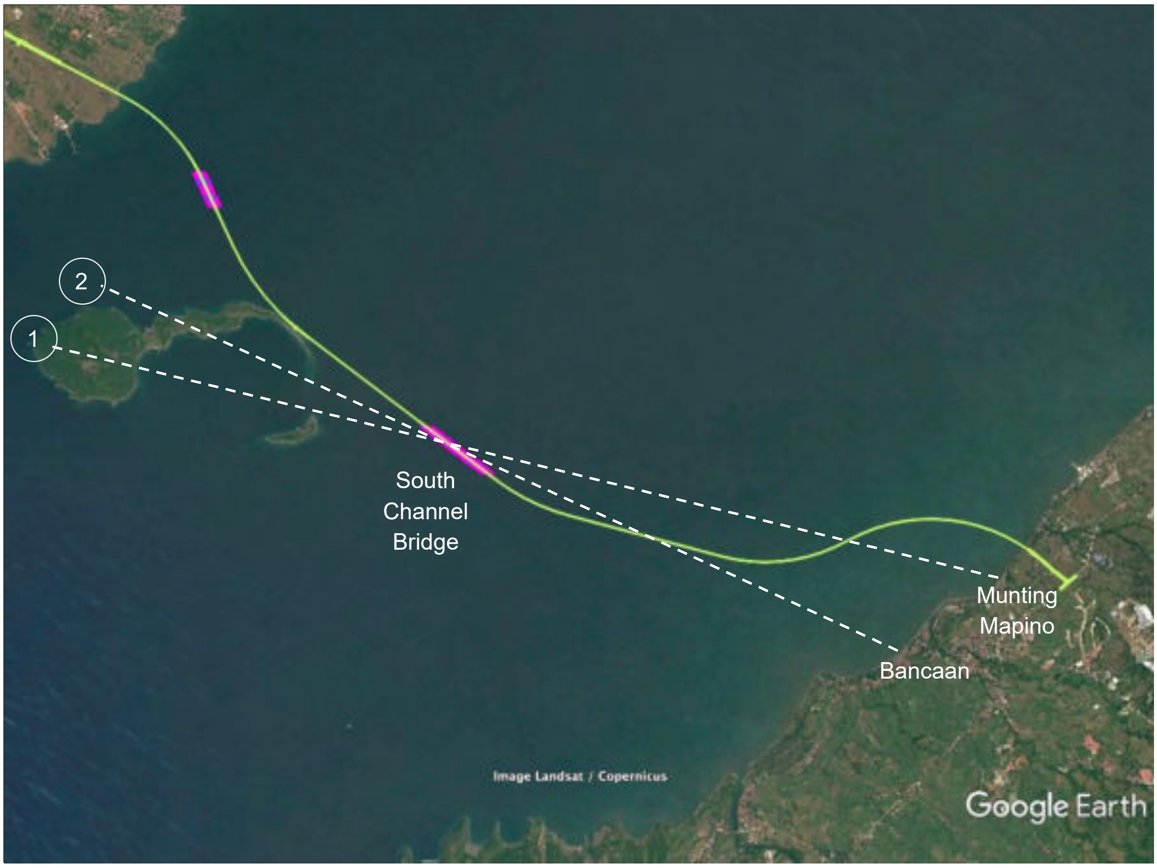


Exhibit 44: Sight Lines from Naic Beachfronts to Corregidor and Caballo Islands

The viaduct's nearshore presence will not noticeably alter the sea state or affect the sea breeze, but a subtle transformation in the aesthetic of the seascape is likely to take place in the beachfront areas of Naic, with the sense of wide-open sea being supplanted by a feeling of being within a more narrowly scaled protected embayment. At night, the running lights of vehicles moving along the roadway will be partially visible flickering through the barred railings. The addition of this feature to the visual landscape seems likely to be considered a mild annoyance by some amenity-seeking beach users, but others may find the viaduct visually enhancing to the sea view, in that it curves and will lead the eye to Corregidor Island as a far destination. Given the viaduct's distance from shore, neither adverse nor positive reactions are likely to be strongly felt.

During the construction phase, the daytime view of the works will include a series of structures in various stages of assembly. It is expected that construction lighting will be used to support around-the-clock work and materials transit in this area during at least part of the construction phase. These visual impacts can be considered broadly incompatible with the aesthetic values underpinning beach tourism, although they will be minimized by distance for most locations. The anticipated visual impact of the BCIB for residents and tourists on the Naic shore can be classified as adverse during the construction phase, with the severity of the impact being greatest in the first 1 km southwest of the alignment landing point, where the works will be closest to the beach. The mildly to moderately adverse construction phase visual impacts will be temporary and will diminish as the viaduct works proceed from the first works in the nearshore zone to locations further offshore.

6.5.2.2 Viewers on the Water

For on-water viewers, the proposed project will add an object of considerable visual interest to the landscape. People on vessels will have excellent side and oblique views of the cable-stayed bridges from multiple ranges, and when approaching or passing beneath the bridges and viaducts, a close look at the attractive styling of the piers and towers. Passing beneath the cable-stayed bridges will likely be a stimulating visual experience for passengers and crews alike. At night, the decorative lighting on the towers, cables and piers will enhance the experience significantly. The anticipated visual impact of the project for on-water viewers can be classified as ‘strongly beneficial’ for the operation phase.

The visual appearance of the project for on-water viewers during the construction phase can be expected to range from unpleasant to mildly interesting, depending on the personal interests of the viewer. At this stage, which will last for 4–5 years, the project will lack the visual cohesiveness of the finished product and will be unlikely to elicit strongly positive visual impressions from most viewers. At the same time, those who find the construction process interesting or inspiring to observe, passing near the area during the construction phase is likely to offer an enjoyable viewing experience. Taking these considerations together, the anticipated visual impact of the project for on-water viewers during construction can be classified as more or less neutral.

6.5.2.3 Viewers Using the BCIB Infrastructure

The visual impacts for users of the BCIB will be broadly positive. The project will open up an entirely new visual experience for the traveling public. A crossing of the bridge will give drivers and passengers evolving attractive views of Mt. Mariveles, Corregidor and Caballo Islands, and shipping in the north and south navigation channels. Passing between the cable sprays of the two navigation bridges will be a visual highlight, likely to be universally enjoyed. The anticipated visual impact for BCIB users can be classified as strongly beneficial. Visual impacts during construction are not applicable to this viewer group.

6.6 Mitigation of Visual Impacts

The visibility of a project as large and spread out as the proposed BCIB is difficult to modify in order to reduce adverse visual impacts, and it is fortunate that beneficial visual impacts are anticipated to be more numerous than adverse ones. In addition, for several affected locations, mild to moderate adverse visual impacts are appropriately balanced against beneficial ones at the same location. Operation-phase adverse impacts not fully offset by a corresponding beneficial effect have been identified above for viewers at one site on Corregidor Island (the Mindanao Memorial) and for viewers along the Naic beachfront (particularly the barangays of Munting Mapino and Bancaan). Adverse impacts derived from construction activity have been found for several sites, with the most severely affected being the Naic beachfronts. The scope for mitigation of the adverse impacts identified is discussed below in relation to each affected site or group of sites.

6.6.1 Operation Phase Impacts

6.6.1.1 Mindanao Memorial, Corregidor Island

The mildly adverse overall visual impact of the BCIB project on the views experienced by visitors to the Mindanao Memorial will be impossible to prevent or minimize, short of not building the infrastructure, and are not amenable to any form of compensation. In view of this, the impact is most appropriately accepted as a minor residual impact, to be balanced against positive visual impacts in other locations and factored into the overall weighing of risks and benefits associated with the project.

6.6.1.2 Naic Beachfronts and Nearby Community

While people in the resort communities may have mixed impressions of the BCIB, it is designed to be a signature bridge, including aesthetic design details to signify gateway to the Philippine capital of Manila. This scale of infrastructure warrants tourists' attention and may bring new visitors to the area. There may be some viewers who desire to maintain the low-key ambience of the beachfront, which may change under the influence of this significant infrastructure investment. The moderately adverse visual impacts for these viewers along the Naic beachfronts as a result of the BCIB project's development are largely unavoidable. The night-time views of the BCIB cable-stay bridges include decorative lighting design but BCIB roadway lighting will indicate luminaries configured with appropriate directionality and shielding to ensure that lateral light emissions are substantially which preserves the night sky views. BCIB designers have eliminated decorative undercarriage lighting, once considered an option for the viaducts. This will prevent unpleasant glare for people on the beach at night or staying in beachfront accommodations and limit the potential for the viaduct to appear as a line of lights across the horizon.

The more substantial visual impact will be experienced by inland residents and travelers on the local roadways progressing perpendicular to the BCIB, as the roadway will be approximately 6.5m above existing grade. The scale and visual barrier of roadway embankment will be a substantial visual change to the character of the community for nearby viewers. Mitigation elements integrated into the overall design to address this will include the following:

1. All hardscapes (MSE retaining walls, sound walls, and fences along the right-of-way) shall include patterns, colors and/or motifs that are congruent with the culture and heritage of the fishing and tourist community of Cavite and incorporate surfaces unfavorable for grafitti. Fencing should be durable and include full screening and thorny plantings to deter entry by grafitti artists.

2. Soil embankments will be vegetated to include native shrub species, compatible with maintenance and safety considerations. Where such plantings are not acceptable for drainage or maintenance reasons, columnar trees shall line the base of the embankment to the exterior of the drainage ditches to reduce the visual dominance of the embankment slope. Tall columnar and drought resistant trees shall be identified that can also mitigate residual lateral light leakage from the roadway. Native species selected shall not be ones known to have aggressive root systems, and careful planting details will restrict roots from intruding on adjacent property.

3. The facades of the underpasses shall be designed to connote a gateway, with night lighting and features to allow easy passage by pedestrians and cyclists in addition to vehicles, to reduce the sense of the BCIB embankment as a community barrier.

Mitigation through lighting design notwithstanding, some residual adverse visual impact associated with the project may continue to serve as a visual annoyance to some residents and resort operators along the Naic beachfront. This residual impact can probably be considered relatively minor for most locations, but may rise to the level of moderate for resort areas closest to the BCIB landing point, in Timalan Concepcion and Munting Mapino;

these residuals will have to be acknowledged in the overall balancing of benefits and risks for the project, which will also include possible increases in business for local tourism operators due to the crossing's development.

6.6.2 Construction Phase Impacts

6.6.2.1 Naic beachfront

In order to minimize degradation of touristic values on the Naic beachfront from construction activity, modifications could be made to the works lighting to reduce visibility and visual intrusion. The lighting arrays could be oriented to light the works from a landward direction, so no direct bright light would reach the shore. Shielding could also be used on the lighting to prevent leakage towards the beach. These measures would significantly reduce glare. Working hours could also be altered, at least for the works nearest to shore, to reduce the need for construction lighting.

With regards to the visual distraction derived from the incompatibility of close- to moderate-range, long-duration construction with beach tourism, contractors may be encouraged to prioritize local resorts in selecting accommodations for personnel, to offset any possible financial loss due to construction distractions to tourism. It is difficult to predict how significant the residual, if kept to relatively low nuisance level, would be for local tourism operators, and it may be more appropriate to address the matter through the grievance redress mechanism than through an *a priori* compensation scheme.

7 SYNTHESIS

The primary visual impacts of the BCIB project will be on static and dynamic viewsheds; no existing visual resources will themselves be degraded by the project's construction or operation. The visual impacts foreseen and discussed in the VIA are collected together in one place in Exhibit 45.

It will be noted from Exhibit 45 that the visual impact profile for the project is quite moderate, with few significant adverse visual impacts , and even fewer that are not balanced by beneficial impacts for viewers from the same location. Residual adverse impacts are foreseen for two locations in the operation phase: the Mindanao Memorial on Corregidor Island, and beachfront locations nearby the BCIB landing site in Naic. Significant residual adverse impacts are foreseen for the same two locations during construction, although these will be temporary.

Exhibit 45: Summary of Visual Impacts Associated With BCIB Project

Affected Viewshed	Construction Phase	Operation Phase
STATIC VIEWSHEDS		
Views of inland infrastructure from direct vicinity (Mariveles)	• Minor and temporary adverse impact on unremarkable visual landscape due to visual disturbance at works sites and staging areas	• No significant impact
Views of inland infrastructure from direct vicinity (Naic)	• Temporary adverse impact on beach-front community due to visual disturbance at works sites and staging areas	• Beneficial impact: A signature bridge of international magnitude, including aesthetic design details to signify gateway to the Philippine capital of Manila. • Adverse impact: The scale and visual barrier of roadway embankment is a substantial visual change to the character of the community from nearby views.
Seaward views from Mariveles	• No significant impact, due to distance of works sites from populated areas	• Beneficial but minor impact (upslope locations in Alas Asin) • Mix of mild to moderate beneficial and adverse impacts, thus neutral overall (Cabcaben waterfront) • Mildly beneficial due to added visual interest (Kamaya Point waterfront)
Seaward views from Corregidor Island	• Temporary mild to moderate adverse impact from all sites with views to works sites, substantially mitigated by distance	• Mix of beneficial and adverse impacts, on balance mildly adverse residual impact (Mindanao Memorial) • Neutral impact (South Beach, Japanese Peace Garden) • Mildly beneficial impact (Filipino Heroes' Memorial, Crocket Battery, North Beach) • Moderately to strongly positive impact (Pacific War Memorial, North Ferry Dock)
Seaward views from Naic beachfronts	• Minor to insignificant temporary adverse impact for most beachfront areas • Moderately adverse temporary impact for beachfront areas in Timalan Concepcion and Munting Mapino (closest to BCIB landing)	• Minor to insignificant adverse impact for most beachfront areas • Moderately adverse residual impact for beachfront areas in Timalan Concepcion and Munting Mapino (closest to BCIB landing)
DYNAMIC VIEWSHEDS		
Views for viewers using the infrastructure	• Not applicable	• Strongly beneficial impact
Views for on-the-water viewers	• Mix of mild to moderate beneficial and adverse impacts, thus neutral overall	• Strongly beneficial impact

APPENDIX 1: VISUAL RENDERINGS USED IN PERCEPTION SURVEY

PROPOSED BATAAN–CAVITE INTERLINK BRIDGE

(PRELIMINARY VISUAL RENDERINGS – 2021)

The proposed Bataan–Cavite Interlink Bridge (BCIB) is under consideration by the Government of the Philippines and the Asian Development Bank. The bridge would provide a four-lane highway link between the provinces of Bataan and Cavite. The proposed bridge link would connect to the Roman Highway at Brgys. Alas-Asin/Mountain View in Mariveles, Bataan, and to the Antero Soriano Highway at Brgys. Timalan Balsahan/Timalan Concepcion in Naic, Cavite. The bridge link would include two high-clearance cable-stayed bridges over the shipping lanes, and smaller local boats would be able to pass under the viaducts without any problem in other areas. This handout has been prepared to support a perception survey carried out as part of the Environmental Impact Assessment of the proposed project, and provides a basis for discussion of potential visual impact. ***Details of the project infrastructure are subject to change during the design process, so the 3D renderings shown below should be considered preliminary.***

Proposed alignment of Bataan–Cavite Interlink Bridge

Proposed Bataan–Cavite Interlink Bridge with Corregidor and Caballo Islands (looking out to sea)

Looking northwest from near Naic shore towards Corregidor Island and Bataan

Proposed South Channel Bridge over ship navigation channel between Naic and Corregidor Island

Proposed mid-span turnaround, with possibility of connection to Corregidor Island in future

Proposed North Channel Bridge between Corregidor Island (left) and Mariveles (right)

ANNEX 4: BRIDGE DECK DRAINAGE MAINTENANCE LETTER & MEMO

Document No.: 481714-BCIB-DJV-LTR-0286 March 16, 2022

Sharif Madsmo H. Hasim
Project Director
Roads Management Cluster II
Unified Project Management Office
Department of Public Works and Highways
2nd Street, Port Area, Manila

Attention: Ms. Teresita V. Bauzon
Project Manager

RE: Consulting Services for the Detailed Engineering Design of Bataan-Cavite Interlink Bridge Project under Infrastructure Preparation and Innovation Facility (IPIF)- Additional Financing ADB Loan No. 3886-PHI

Subject: Through-Deck Drainage on Marine Structures - 481714-BCIB-DJV-DQ-0033

Dear Director Hasim,

This letter responds to the request by DPWH to provide a discussion of environmental impacts and recommendations by the DJV environmental specialists regarding the use of through-deck drainage as presented in DQ-0033.

To address this, we include Attachment A “Environmental Brief on Bridge Deck Runoff Concerns” which examines the ecological risks and discusses recommended mitigative options to be considered with the use of through-deck drainage.

We note that many recent examples of major marine bridge crossings use through-deck drainage over environmentally sensitive waters, including: the San Francisco Oakland Bay Bridge (Skyway), the Hong Kong-Zhuhai-Macau Bridge (at 55km HZMB is the longest open-sea fixed link in the world), and the Panama Puente Centenario (see Attachment B).

Based on the this, the TYLI/PEC JV recommends the use of through-deck scuppers in the design of the Marine Viaducts, High-level Approaches, and Cable-Stayed bridges for the BCIB Project. We welcome a meeting with DPWH to further discuss these recommendations with our specialists.

Sincerely yours,

Marwan Nader, PhD, PE
Senior Vice President
Project Manager/Team Leader, Chief Bridge Engineer

ATTACHMENT A

BATAAN–CAVITE INTERLINK BRIDGE PROJECT

Environmental Brief on Bridge Deck Runoff Concerns

March 14, 2022

By: Jodi Ketelsen, BCIB Senior Environment Specialist
Gavin S. Stairs, PhD, BCIB Senior Environment Specialist

1. CONTEXT AND OBJECTIVES

Road runoff contains contaminants derived from pavement wear, vehicle wear, fluid leaks, exhaust, cargo leakage and spills, material tracked from off-road areas, and atmospheric deposition. Typical runoff contaminants include various heavy metals, volatile and semi-volatile organic compounds including PCBs and PAH, oil and grease, soil particles, fecal coliform, and the nutrients nitrogen and phosphorus. Bridge decks pose special challenges compared to on-land roads because of their position directly over water, which entails a direct pathway for contamination of aquatic or marine biota.

Structural options for managing bridge deck runoff are constrained by space, weight, strength, aesthetic and cost concerns. For short bridges, channeling deck runoff to land for remediation is the preferred solution, but this becomes less feasible as bridge length increases. As a very long bridge with multiple grade reversals and high clearance requirements at navigation channels, the BCIB presents limited potential for on-land remediation, and direct drainage of deck runoff has been proposed. The objectives of this brief are to scope the ecological concerns associated with direct drainage of bridge deck runoff to Manila Bay, and to identify potentially feasible mitigative options.

2. SCOPING OF ECOLOGICAL RISK

Bridge deck runoff presents four ecological risks: (i) siltation and sedimentation; (ii) chemical contaminant loading; (iii) nutrient loading; and (iv) bacteriological pollution. Three input scenarios also enter into the risk equation: (i) chronic low-level loading; (ii) short-duration elevated loading in storm events following prolonged rain-free periods; and (iii) sudden concentrated discharges from accidents involving trucks carrying large quantities of fluid material. Generally speaking, risk is a function of exposure and vulnerability.

2.1 Exposure

Exposure in this context is defined by the amount of contaminants that would be introduced to the environment in bridge deck runoff. Contaminant loading in road surface runoff may be positively correlated with traffic volume for some constituents, and the US Federal Highways Administration formulated a general benchmark in the 1990s on this basis. AADT of 30,000 vehicles per day was taken as a lower threshold, below which no effects of runoff would be discernible, and above which effects would begin to be expected, at least for freshwater environments. An upper threshold of 180,000 vehicles per day, above which severe impacts would begin to be expected, was also defined. [1,4] By this general metric, the projected traffic volume on the BCIB (AADT 37,000 passenger car units by the tenth year of operation) is suggestive of relatively low potential exposure. However, many factors contribute to concentration of contaminants in road surface runoff in addition to traffic volume (e.g., traffic composition, fleet condition, congestion factor, road surface material, road surface age and condition, location relative to regional air pollution sources, and precipitation patterns), so use of traffic volume as the sole indicator of exposure requires caution. Numerous studies have documented toxic levels of contaminants in runoff from road and bridge surfaces, and measurable elevations of a range of contaminants in aquatic environments credibly traced to runoff from nearby bridges, in both high-traffic and low-traffic contexts. [source 2,3,4] Direct drainage from the BCIB is thus characterized as a potentially new source of contaminants in the marine environment.

2.2 Vulnerability

Vulnerability in the BCIB context is defined by the sensitivity of the Manila Bay marine ecosystem to inputs of bridge deck contaminants. Inputs of particulates may elevate turbidity and reduce photosynthesis, limit respiration efficiency in fish and invertebrates, interfere with prey-finding, and in extreme cases, lead to burial of fish eggs and smothering of sessile benthic organisms. Elevated levels of heavy metals, PCBs, PAH and hydrocarbons in the water column and in bottom sediments may have harmful effects on bodily functions and reproductive success in marine animals, whether through direct contact and ingestion, or ingestion of other organisms in which bioaccumulation has occurred. The nutrients nitrogen and phosphorus play important roles in algal blooms and bacterial consumption of dissolved oxygen, and elevated levels affect the suitability of water as habitat for fish and invertebrates; proliferation of cyanobacteria linked to development of toxic compounds in certain fish and shellfish consumed by local people is also enabled by nutrient enrichment. High levels of fecal coliform put swimmers and consumers of shellfish at greater risk of gastro-intestinal illness.

Traffic volume and bridge runoff composition are weak predictors of ecological effects from bridge deck runoff, because the probability of effects is strongly determined by the characteristics of the receiving waters, e.g., volume, turbulence, dispersive capacity, background contamination, and presence of sensitive species and human uses. Water bodies with robust circulation, e.g., oceanic bays, estuaries and large, fast-moving rivers, are less vulnerable to toxicity effects than are small and enclosed ones with weak circulation, e.g., ponds and swamps. A 2002 study of the San Francisco–Oakland Bay Bridge provides an instructive example in this regard; despite traffic volume of 250,000 vehicles per day, and runoff shown through laboratory bioassays to have toxic effects for some local species, no bridge-associated elevation of heavy metal content was found in sampled sediments, and no ecological effect could be discerned based on habitat assessment or analysis of infaunal assemblages. The dynamism of the estuarine environment had prevented ecological effects that persistent inputs of significantly contaminated bridge runoff might have been expected to produce.[1] A comprehensive study involving upstream-downstream comparisons with respect to various ecological parameters at a series of 10 river bridges in North Carolina similarly failed to turn up compelling evidence of ecological effects from bridge runoff in aquatic environments, despite documented elevation of some contaminants in runoff samples and in the water column.[5] The large volume of Manila Bay and presence of tidal and wind-driven currents in the BCIB project area are likely indicative of low vulnerability to contaminated bridge deck runoff.

Dilutive and dispersive capacity notwithstanding, the BCIB alignment will pass through waters known to contain sensitive marine habitats such as coral reefs, some of which are included in a marine protected area (Corregidor Islands Marine Park). Several endangered marine species protected under national law have been documented in the project area. Local fisherfolk harvest fish and shellfish in waters close to the BCIB alignment, and this indicates potential human health vulnerability linked to bioaccumulated contaminants. In addition, analysis of water samples collected along the alignment indicates that national marine water quality standards are sometimes violated, including for parameters implicated in bridge deck runoff. Additional inputs of contaminants from the BCIB would tend to increase the frequency of standards violation, which is suggestive of increasing vulnerability to ecological change.

Regulators' interest in controlling bridge deck runoff in the United States and elsewhere is typically driven by the logical expectation that the runoff will contribute to the worsening of existing degradation or increase threats to natural resources considered particularly sensitive by stakeholders, rather than hard science indicating actual or predicted effects.[6] Manila Bay is perceived by many direct stakeholders, governmental agencies, non-governmental entities and the general public as an ecosystem under threat, and its cleanup has been a central concern of environmental policy in the Manila Bay region for at least three decades. The Continuing Writ of Mandamus issued in 2008 by the Supreme Court assigns responsibility for *improving* water quality in Manila Bay (i.e., not just preventing further degradation) to 14 government agencies.

2.3 Summary of Ecological Risk and Need for Mitigation

Modest expectations for overall contaminant production, coupled with large assimilative capacity, are suggestive of low direct ecological risk in relation to bridge deck runoff from the BCIB. However, the Manila Bay ecosystem is widely acknowledged to be impaired by existing stressors, and therefore vulnerable to addition of new sources of contamination. While direct drainage of BCIB runoff to the bay may not ultimately produce measurable ecological effects on its own, it would nevertheless contribute to the cumulative negative impact of development on a threatened marine ecosystem. In this context, it is appropriate for the project to reduce possible runoff impacts to the maximum extent practicable.

3. MITIGATIVE OPTIONS

Despite the challenges inherent in long bridge geometry, a number of structural and management options capable of reducing runoff contaminant releases to receiving waters are available, and some are potentially feasible in the BCIB context. Measures mentioned in the research literature are considered below.

3.1 Structural Options

3.1.1 On-land remediation (onsite)

On-land remediation in settling ponds and vegetated swales is the most widely adopted mitigation measure for bridge deck runoff, and some shore-proximate segments of the BCIB may be amenable to this. However, means of conveying water to shore over any significant distance (bridge deck gutters or enclosed piping) typically require significant modification of base designs to address needs related to space, extra weight, and routing, and therefore may add significantly to complexity and cost.[6] Additional land acquisition may be required near the landing sites to accommodate ponds and swales. As only a small portion of the BCIB deck runoff could feasibly be brought to shore, less costly mitigative options applicable to the entire bridge length are a more appropriate focus.

3.1.2 On-land remediation (offsite)

In terms of pollution reduction potential, it may be more effective to remediate runoff on an equivalent or longer length of road than to attempt remediation of runoff from a long bridge. A watershed approach is increasingly being adopted by road agencies in the United States, and remediation swaps—whereby remediation is pursued in one location where it is easy to implement, to compensate for remediation foregone at a more challenging location—have been formulated within that framework.[6] In the BCIB context, the applicability of the swapping approach is complicated by stakeholder concerns regarding specific marine resources in the direct vicinity of the BCIB alignment. Water quality gains realized elsewhere in the Manila Bay watershed as part of a remediation swap are unlikely to reassure stakeholders about the perceived direct threat from BCIB runoff to a marine protected area, endangered species or fishing ground from BCIB runoff. For this reason, offsite remediation is not recommended as a primary mitigation measure for the BCIB but should be applied to the project's on-land road segments as a supplemental measure.

3.1.3 Deck-integrated sediment traps

Many constituents of road runoff are either entrained solids or adsorbed onto such solids. Capturing particles in sediment traps at scuppers and inlets can be a practical means of limiting contamination in receiving waters, and this is often done for on-land roadways. Oil removal can be integrated by adding adsorptive inserts to the sediment trap design.[6] Prefabricated settling chambers set into bridge decks at scupper locations are thought to have some potential to capture solid contaminants before runoff is discharged, but this remains an untested approach. Potential interference with structural members and strengthening elements, increased construction cost, maintenance demands (regular cleanout of large numbers of traps), safety risks associated with maintenance activity carried out from an active bridge deck, and difficulty in sizing traps to handle a range of discharge volumes are seen as drawbacks of this concept.[7] Deck-integrated sediment traps are unlikely to be practical or cost-effective for the BCIB.

3.1.4 Pier-mounted treatment systems

Various natural filtration and remediation systems incorporating sand, biofiltering fibers, and wetland plants mounted at the base of bridge piers have been designed to treat bridge deck runoff but have not been widely tested or applied [6]. These may be substantial structures, and implementation in the BCIB context would likely require significant adaption of the pier designs. Crucially, maintenance of the treatment system has to be carried out from a vessel and would be a massive task in the BCIB context, given the number of bridge piers. These kinds of systems may have applications in protected waters but are likely to be subject to damage in the harsh open water marine environment and should not be considered for the BCIB.

3.1.5 Rumble strips

A portion of particulates present in bridge deck runoff is dropped from vehicle tires, undercarriages, bodies and cargoes, and one concept reportedly being explored by some road agencies in the United States is installation of rumble strips in the approach road segments to encourage loose particles to fall off before vehicles reach the bridge. It is suspected that drips of oil and other hydrocarbons from leaks in oil pans, gearboxes and exhaust pipes may also be amenable to such pre-emptive removal, as oil accumulation is often noted on road surfaces near expansion joints and frost humps [6]. It is not known how effective rumble strips are at reducing deposition on bridge decks, particularly as they target a limited range of deck contaminants, but they are inexpensive to install, and simple to maintain. This should be considered for the BCIB, as one measure amongst others.

3.2 Management Measures

3.2.1 Vacuum sweeping

Experiments conducted in the United States with street sweeping have established that regular removal of dry particulates (especially fine particulates) from the road surface can achieve very substantial reductions in contaminant loading of road runoff. Weekly removal of fine particles from the road surface using advanced vacuum-assisted sweepers and regenerative air sweepers (which loosen particulates from surfaces and crevices using air jets, and immediately vacuum them up) has been found to reduce total suspended solids concentration in runoff by up to 90% for residential streets and by up to 80% for major arterials.[1,4,6,7] A substantial reduction of dissolved metals also seems likely, since timely sweeping would prevent dissolution from occurring on the deck surface. A single sweeper unit (vacuum-assisted or air sweeper) would be sufficient to conduct a weekly sweep of all four lanes of the BCIB. Sweeping equipment would be necessary for maintenance of safe operating conditions anyway, so the incremental cost of more frequent sweeping should be modest. Weekly sweeping with a regenerative air sweeper is recommended as a priority mitigation measure for contaminants in BCIB deck runoff.

3.2.2 Accident prevention

The risk of spills occurring as a result of accidents involving vehicles with large fluid cargoes can be reduced by strict enforcement of limits on speed, tailgating and reckless driving. It may also be feasible to institute a safety inspection regime for heavy trucks at the pre-bridge weigh stations, to prevent potentially unsafe trucks from accessing the bridge. These kinds of measures should be adopted for the BCIB project for safety and transport efficiency reasons, in addition to pollution mitigation.

3.2.2 Spill response plans and crews

In the event of a spill somewhere on the bridge, the speed and effectiveness of cleanup would be major determinants of the extent to which marine contamination occurs. An appropriately equipped and trained spill response team should be considered an automatic requirement and will be stipulated as such in the EMP. Key elements of effective spill response include intensive monitoring via on-bridge cameras; at-the-ready personnel, vehicles and supplies; established protocols for cleanup of different classes of spilled material; and a clear chain of communication and command.

4. CONCLUSIONS

Bridge deck runoff presents non-negligible ecological risks to the marine ecosystem of Manila Bay, which already faces numerous other stressors. The BCIB alignment passes through ecologically sensitive marine environments, including a marine protected area. Runoff contaminants should not go unmitigated.

Five mitigation approaches are feasible in the BCIB context, and are recommended for implementation:

1. Weekly sweeping of all bridge deck surfaces with a regenerative air sweeper (weather permitting);
2. Active accident prevention, through monitoring, inspection and enforcement;
3. Well trained and equipped spill response crews, available around the clock;
4. Rumble strips placed across both incoming lanes of each approach road; and
5. Implementation of weekly sweeping and vegetated runoff infiltration swales on the full length of the on-land roadway segments to reduce the project's overall contribution of contaminants to Manila Bay (remediation swap approach).

Jodi Ketelsen
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T.Y. Lin International

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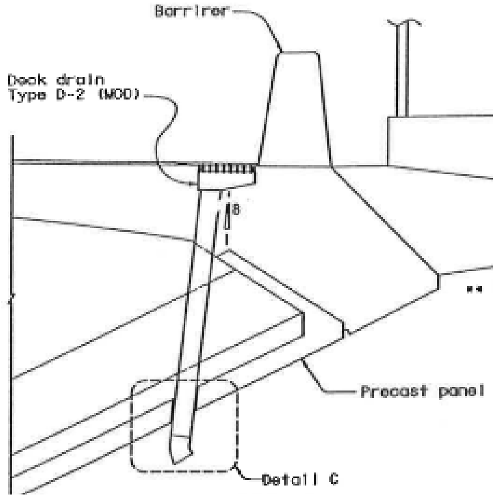
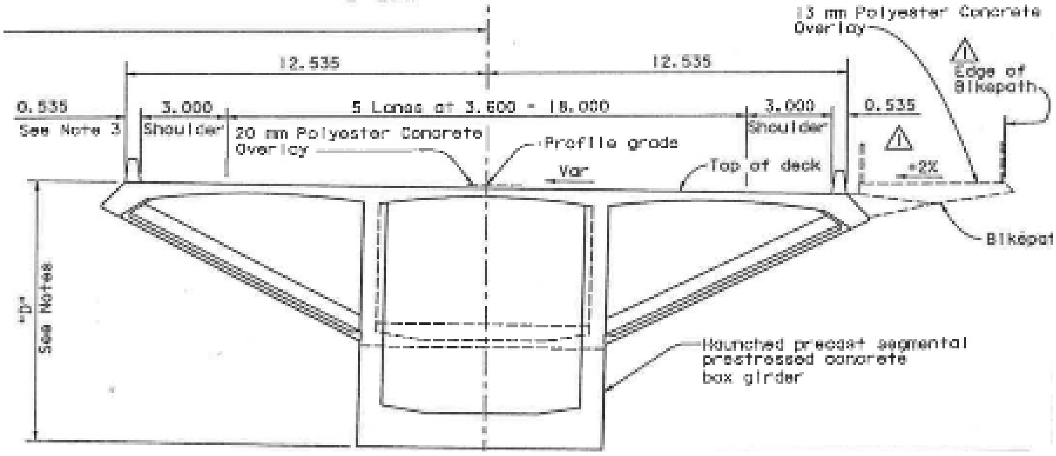
ATTACHMENT B

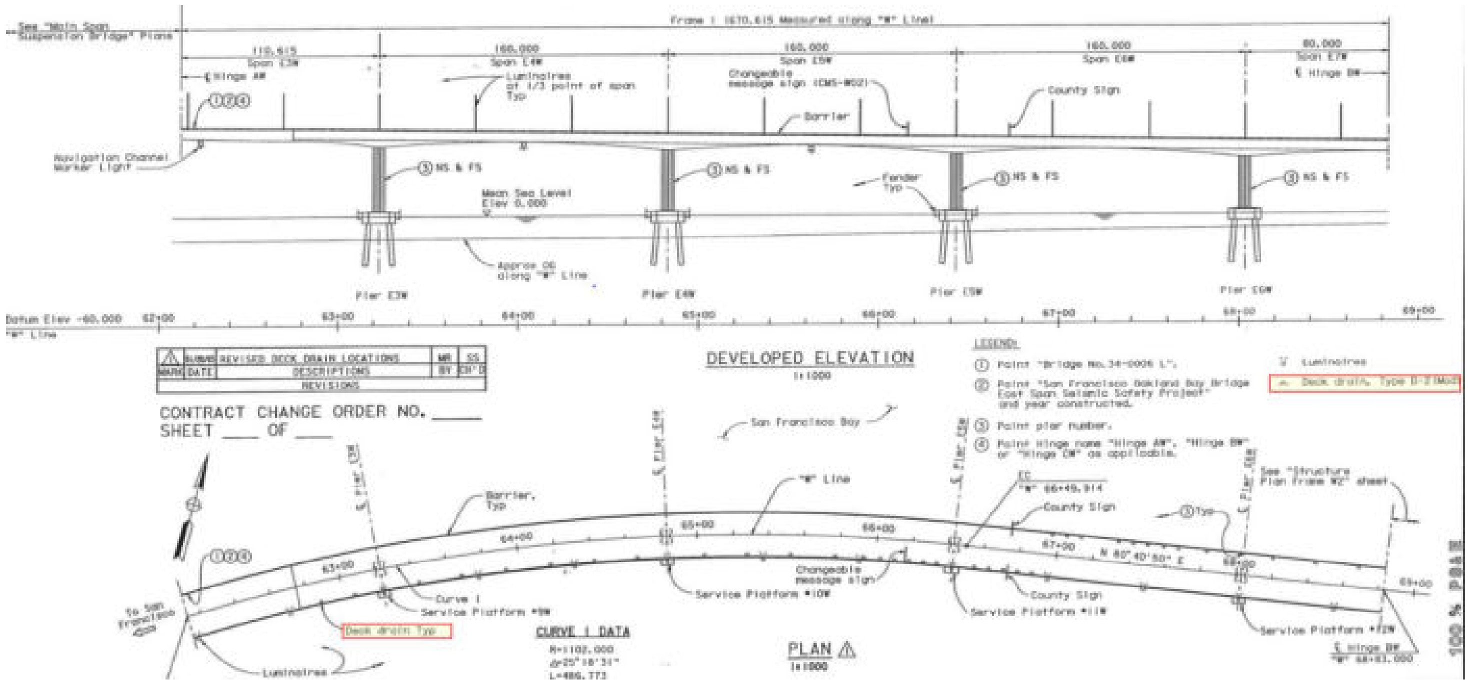
San Francisco Oakland Bay Bridge Deck Drain: Details/Cross Section/Plan & Elevation (Concrete box girder)



DETAIL

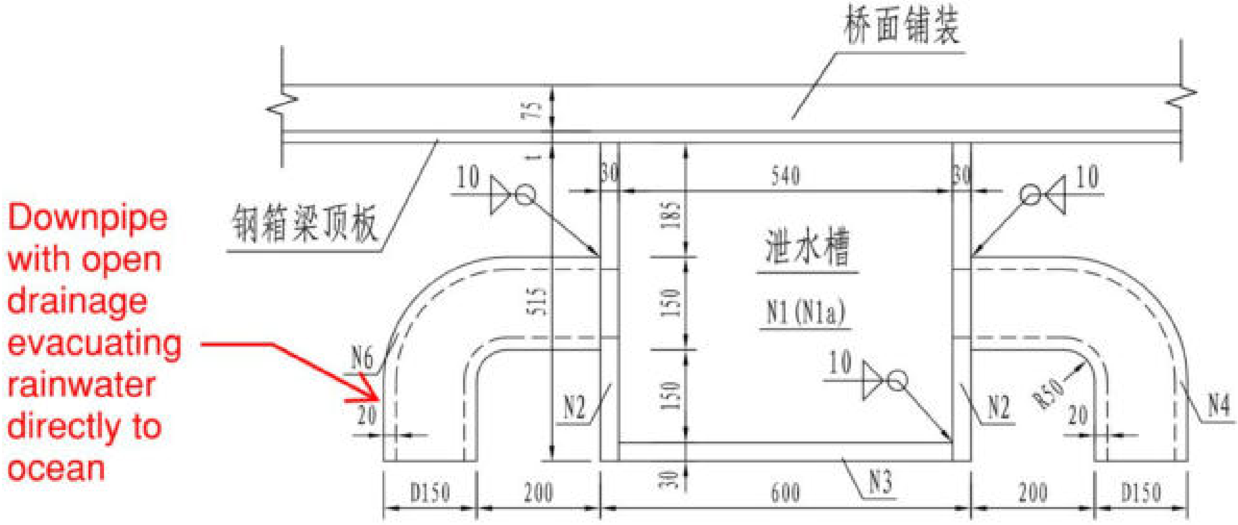


BRIDGE CROSS SECTION

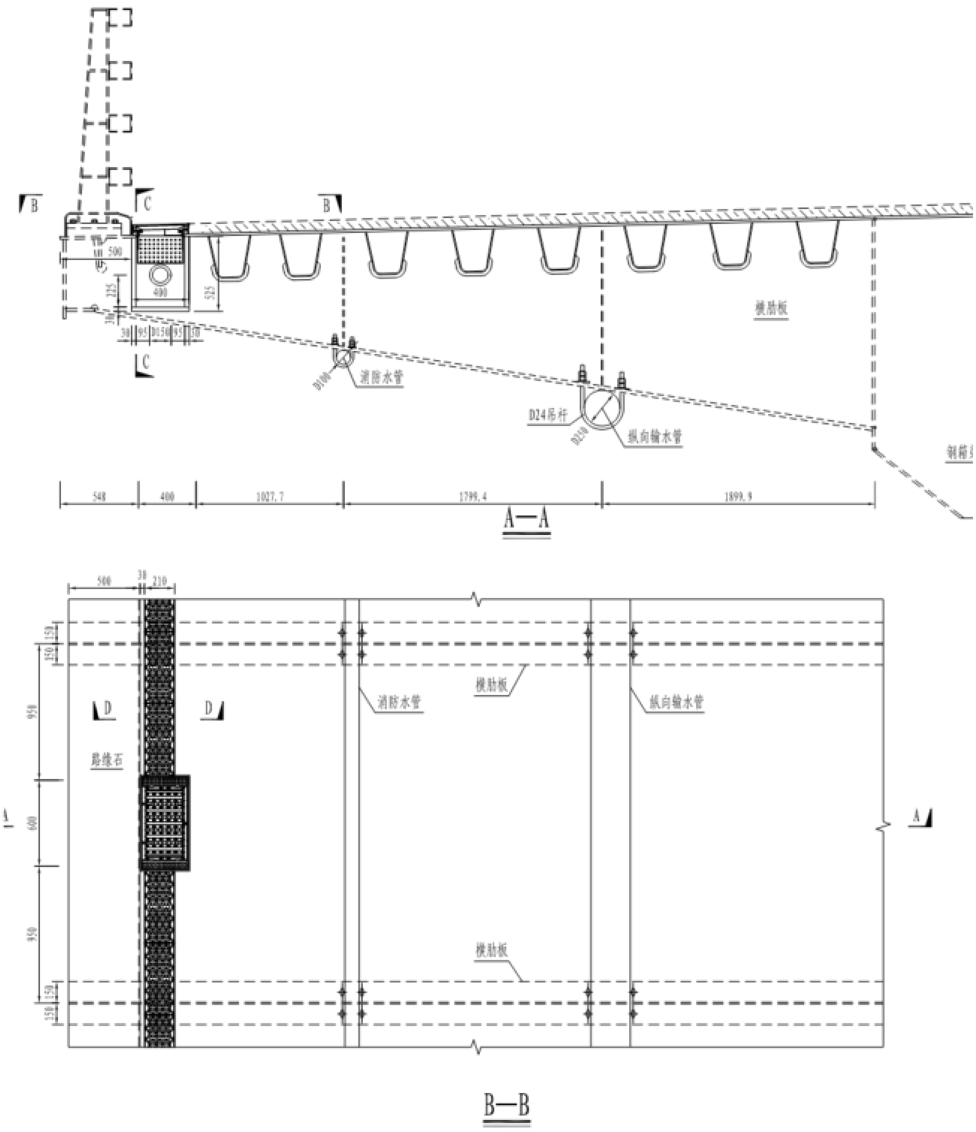


BRIDGE PLAN & ELEVATION

Hong Kong-Zhuhai-Macau Bridge Deck Drain: Detail and Plan & Section (Steel girder)



DETAIL



BRIDGE PLAN & SECTION

ANNEX 5: UNDERWATER ACOUSTIC ASSESSMENT (APRIL 2023)

Bataan-Cavite Interlink Bridge Project

Environmental Studies: Underwater Acoustic Assessment

April 24, 2023

Prepared By:

T.Y. Lin International | Pyunghwa Engineering Consultants Joint Venture

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Reference:
Task Order No. 16R1 “Environmental and Social Studies” Task 1 “Underwater Acoustic Assessment” Item No. 2 “Final Climate Change Study Report”

Revisions:

Date	Description	Revision	Originator	Reviewer	Approver
2023-04-21	Draft Report	00	Paul Donovan (Illingsworth)	Jodi Ketelsen (TYLI) Simeon Stairs (REN)	Marwan Nader (TYLI / PEC JV)
2023-04-24	Final Report	01	Paul Donovan (Illingsworth)	Jodi Ketelsen (TYLI) Simeon Stairs (REN)	Marwan Nader (TYLI / PEC JV)

ABBREVIATIONS

BCIB	Bataan-Cavite Interlink Bridge
NOAA	National Oceanic and Atmospheric Administration
MMPA	U.S. Marine Mammal Protection Act
ANSI	American National Standards Institute
NMFS	National Marine Fisheries Service
FHWG	Federal Highway Working Group
EFH	Essential Fish Habitat
HLA	High-level approach(es)
RMS	Root-Mean-Square Pressure
SEL	Sound Exposure Level
SPL	Sound Pressure Level
SSL	Single Strike Source Level
TL	Transmission Loss
TPP	Test Pile Program

TABLE OF CONTENTS

LIST OF EXHIBITS

1. INTRODUCTION

The proposed Bataan-Cavite Interlink Bridge (BCIB) will be a four-lane, median-separated roadway with total length of 32 km, of which 26 km will be over the waters of Manila Bay (Exhibit 1). The BCIB will connect to the Roman Superhighway at an interchange in Mariveles, Bataan, and to the Antero Soriano Highway at an interchange in Naic, Cavite. The bridge will be supported by 624 piers of which 101 of the piers will be by driven piles 2.8m and 3m in diameter as documented in Exhibit 2. This report is an assessment of potential underwater sound levels generated by planned construction activities for the BCIB project in the Manila Bay of the Philippines. Construction activities generating sound underwater of concern are the installation of piles to support the BCIB.

Exhibit 1 Plan View of BCIB Showing Navigation Channels

Exhibit 2 Estimated Number of Steel Piles for Each Bridge Segment

Estimated Number of Steel Piles by Project Area by Diameter (CISS & CIDH pile foundations)			
		2.8m	**3m**
Landside over/underpasses - Bataan	N/A (Concrete Drilled Shafts)		
Landside over/underpasses - Cavite	N/A (Concrete Drilled Shafts)		
Marine Viaduct - north			174
Marine Viaduct - central			450
Marine Viaduct – south, including nearshore bridge			414
North Channel Bridge High-Level Approaches		228	
South Channel Bridge High-Level Approaches		200	
North Channel Bridge		188	
South Channel Bridge		634	
Subtotal		**1,250**	**1,038**
Total Piles			**2,288**

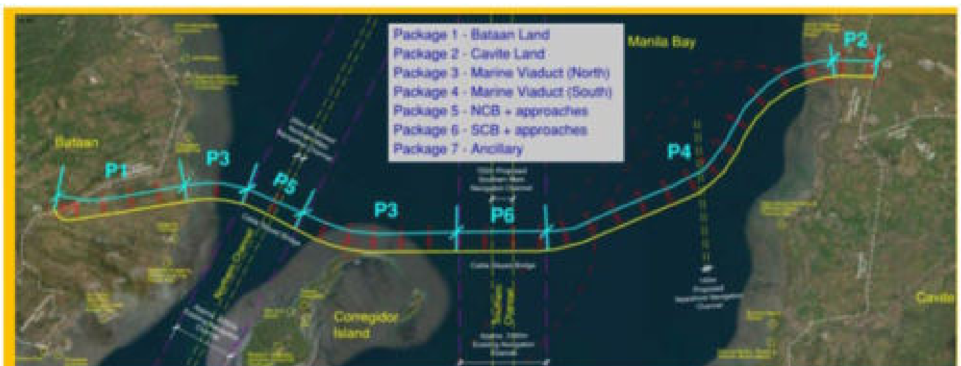
This report includes the prediction of underwater sound levels calculated based on the results of measurements for similar projects. Predicted underwater sound levels are compared against thresholds that have been accepted by the National Oceanic and Atmospheric Administration (NOAA) to protect marine mammals under the U.S. Marine Mammal Protection Act (MMPA)[1]. For fish, the predicted levels are compared to the Interim Sound Exposure Guidelines for Fishes developed under the American National Standards Institute (ANSI). To reasonably predict underwater sound levels from these activities, this analysis relies on acoustic data measured at similar projects. Available underwater sound data for projects involving the installation of similar piles were reviewed. The sound levels for pile driving activities proposed by the project were estimated using these data combined with an understanding of how and where these activities will occur. These predictions are the best estimate based on empirical data and engineering judgment and include a certain degree of uncertainty due to the site conditions and contractor means.

[1] Marine Mammal Protection Act Policies, Guidance, and Regulations, https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-protection-act-policies-guidance-and-regulations.

2. DESCRIPTION OF THE PROJECT

Geotechnical borings (2021 through 2023) throughout the BCIB alignment determined that much of the alignment underlain material contains rock or hard conglomerates that allows for a variety of pier construction options. Many construction methods are not considered to cause high degree of underwater disturbance, however pile driving has the potential to greatly affect marine life, resulting in a range from disturbance, to hearing loss and even fatality. The geologist recommendations reveal that the foundations for at least 20 and up to 101 piers of the 312 piers needed in the Manila Bay will need to be installed via pile driving methods.

The other piers will utilize spread piles or bored piles neither of which generate noise concerns. The driven piles will include 1,154 2.8m diameter piles and 1096 3m diameter. The construction is defined in packages as shown in Exhibit 3. The 2.8m diameter piles indicated in Package 5 on the high-level approaches (HLA) either side of the North Channel Bridge are currently planned to be bored steel piles, however, these could be later decided to be impact driven. The 2.8m diameter piles supporting the caissons for the North Channel Bridge (Exhibit 2) will be driven as shown. The South Channel Bridge will be supported by caissons which are in turn supported by piers consisting of multiple driven 2.8m diameter piles. The high-level approaches to the South Channel Bridge, Package 6 (HLA) are currently planned to be bored, however, could also be impact driven.



Construction Package	Works	Approximate length of works (km)
Package 1	Land approach, including interchange (Bataan)	5.0
Package 2	Land approach, including interchange (Cavite)	1.3
Package 3	Marine viaduct (North)	8.0
Package 4	Marine viaduct (South)	12.6
Package 5	North Channel Bridge and approaches	2.1
Package 6	South Channel Bridge and approaches	3.1

Exhibit 3 Planned Construction Packages

It is planned that pier construction will consist of driving 2 piles in a 24-hour period per pier with up to 4 piers being at a time. For this analysis, the distance between pile driving simultaneous driving at two piers will be either 2,000m or 4,000m. The plan for pile driving simultaneous driving at two piers will be either 2,000m or 4,000m. The plan for pile driving operations is shown in Exhibit 4 for 2025 and 2026 and for 2027 and 2028 in Exhibit 5. The orange bars in the chart denote when 2 piles are being driven in separate piers at the same time in the same package. The construction planning anticipates that installing a single pile to take up to a maximum of 7,000 pile strikes in a 24-hour period with 2 piles completed within 14,000 strikes per pier. The other piles for the BCIB will be installed by other, quieter means including boring or drilling or for some piers, the pier column will rely on spread-footing foundations.

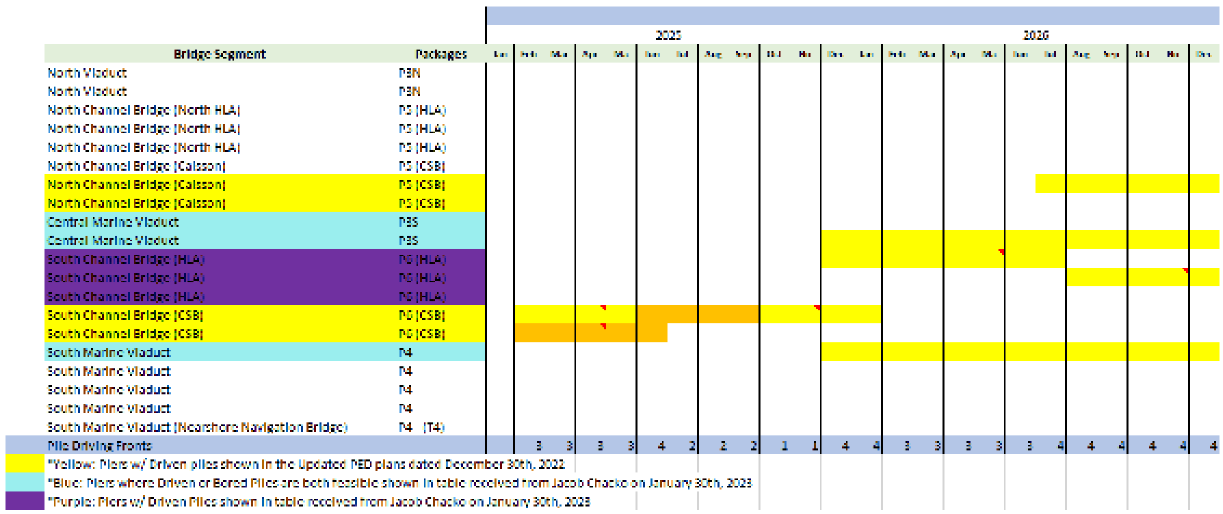


Exhibit 4 Pile Driving for 2025 and 2026

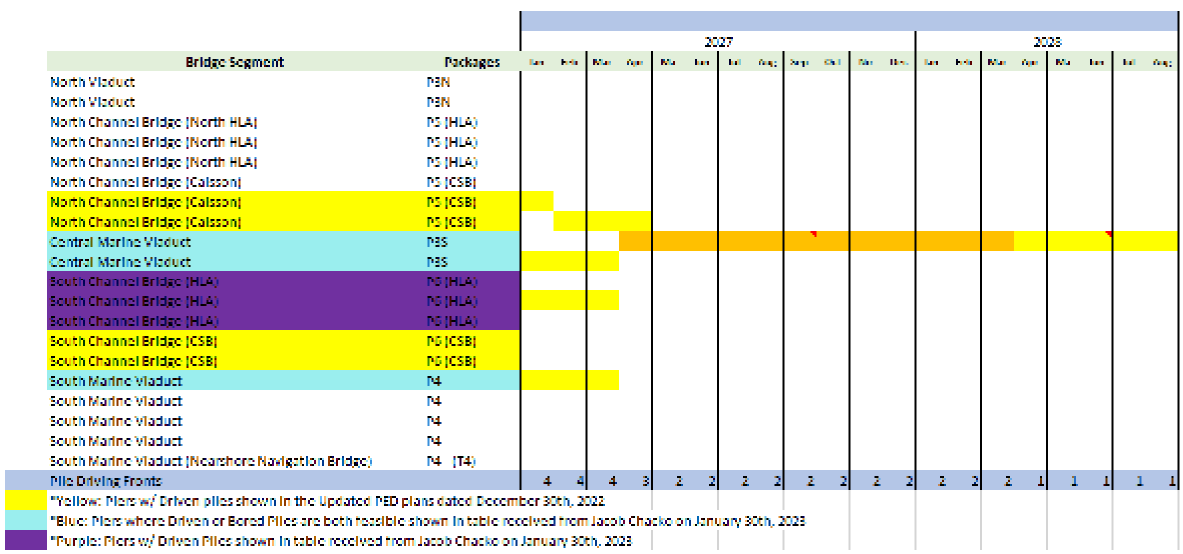


Exhibit 5 Pile Driving for 2027 and 2028

As shown in Exhibits 4 and 5, pile driving activities will endure as much as 42-months. Under the most intense period of pier foundation installation, there may be as many as 4 pile driving machines spread over the BCIB alignment for up to 1 year. Pile driving activities are assumed to be operating 24 hours per day. Due to some variabilities in the geotechnical results, some piles may be able to be bored or augured, however, a total of at least 1,460 and up to 2,288 piles are planned to be driven with hammers that create underwater acoustic impacts.

3. UNDERWATER SOUNDS FROM PILE INSTALLATION

3.1 Fundamentals of Underwater Noise

When a pile driving hammer strikes or excites a pile, a pulse is created that propagates through the pile and radiates sound into the water, the ground, and the air. The pulse amplitude and propagation are dependent on a variety of factors, including but not limited to pile size, hammer type, sediment composition, water depth, and water properties (conductivity, temperature, and pressure). Generally, the majority of the acoustic energy is confined to frequencies below 2 kilohertz (kHz) and there is little energy above 20 kHz.

Sound pressure pulse as a function of time is referred to as the waveform. In terms of acoustics, these sounds are described by the peak pressure in Pascals (Pa), the root-mean-square pressure (RMS), and the Poun. The peak pressure is the highest absolute value of the measured waveform and can be a negative or positive pressure peak. For pile driving pulses, RMS level is determined by analyzing the waveform and computing the average of the squared pressures over the time that comprises that portion of the waveform containing the sound energy.[2] The pulse RMS has been approximated in the field for pile driving sounds by measuring the signal with a precision sound level meter set to the "impulse" RMS setting and is typically used to assess impacts to marine mammals. In this report, peak pressures levels are expressed in decibels re 1 µPa. The total sound energy in an impulse accumulates over the duration of that pulse. Exhibit 6 includes the definitions of terms commonly used to describe underwater sounds.

Exhibit 7 illustrates the acoustical characteristics of an underwater pile driving pulse. The variation of instantaneous pressure over the duration of a sound event is referred to as the waveform. The waveform can provide an indication of rise time or how fast pressure fluctuates with time; however, rise time differences are not clearly apparent for pile driving sounds due to the numerous rapid fluctuations that are characteristic to this type of impulse. A plot showing the accumulation of sound energy over the duration of the pulse (or at least the portion where much of the energy accumulates) illustrates the differences in source strength and rise time.

[2] Richardson, Greene, Malone & Thomson, *Marine Mammals and Noise,* Academic Press, 1995, and Greene, personal communication.

Exhibit 6 Definitions of Underwater Acoustical Terms

Term	*Definitions*
Peak Sound Pressure Level, (dB re 1 µPa)	Peak sound pressure level based on the largest absolute value of the instantaneous sound pressure. This pressure is expressed in this report as a decibel (referenced to a pressure of 1 µPa) but can also be expressed in units of pressure, such as µPa or PSI.
Root-Mean-Square Sound Pressure Level (SPL), (dB re 1 µPa)	The average of the squared pressures over the time that comprise that portion of the waveform containing 90 percent of the sound energy for one pile driving impulse.
Sound Exposure Level, (dB re 1 μPa^2 sec)	Proportionally equivalent to the time integral of the pressure squared and is described in this report in terms of dB re 1 µPa2 sec over the duration of the impulse. Similar to the unweighted Sound Exposure Level (SEL) standardized in airborne acoustics to study noise from single events.
SEL_{cum}, or Cumulative SEL (dB re 1 μPa^2 sec)	Measure of the total energy received through an acoustical event such as a pile-installation event or multiple pile installation events (here defined as pile installation that occurs within a day).
Waveforms, µPa over time	A graphical plot illustrating the time history of positive and negative sound pressure of individual pile strikes shown as a plot of µPa over time (i.e., seconds).
Frequency Spectra, dB over frequency range	A graphical plot illustrating the distribution of sound pressure vs. frequency for a waveform, dimension in rms pressure and defined frequency bandwidth.
PTS	A noise induced shift in the threshold of hearing that persists after a recovery period subsequent to the exposure. In this assessment, PTS is assumed to be the onset of a noise induced permanent threshold shift that causes a PTS, or NIPTS.
TTS	A noise induced shift in the threshold of hearing that subsides to normal hearing after a recovery period subsequent to the exposure.

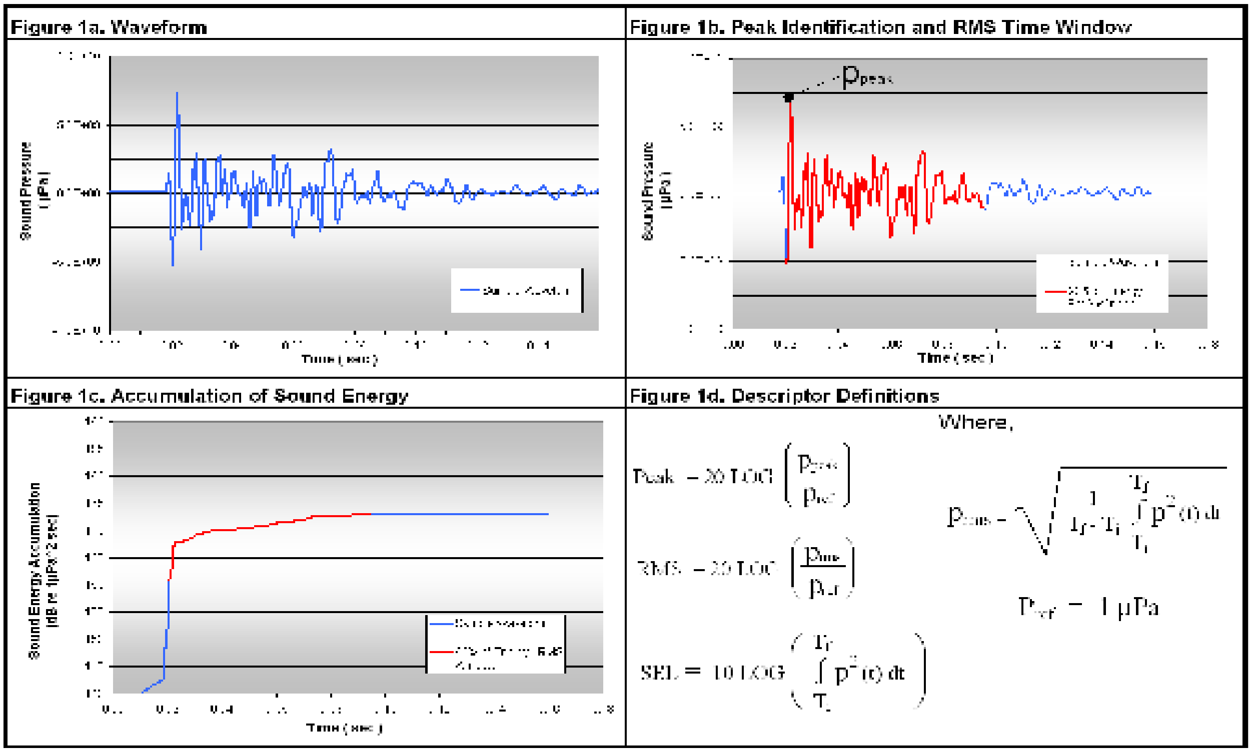


Exhibit 7 Acoustical Characteristics of an Underwater Pile Driving Pulse

SEL is an acoustic metric that provides an indication of the amount of acoustical energy contained in a sound event. For pile driving, the typical event can be one pile driving pulse or many pulses such as pile driving for one pile or for one day of pile driving. Typically, SEL is measured for a single strike and a cumulative condition. The cumulative SEL associated with the driving of a pile can be estimated using the single strike SEL value and the number of pile strikes through the following equation:

$$SEL_{CUMULATIVE} = SEL_{SINGLE\ STRIKE} + 10 \log (\#\text{ of pile strikes})$$

For example, if a single strike SEL for a pile is 165 dB and it takes 1000 strikes to drive the pile, the cumulative SEL is 195 dBA (165 dB + 30 dB = 195 dB), where 10 * Log10(1000) = 30.

3.2 Underwater Noise Mitigation Measures

There are several alternatives to mitigate the generation of underwater noise generated by impact driving of piles. These are enumerated in the updated (2020) version of the Technical Guidance for the assessment of Hydroacoustic Effects of Pile Driving published by the California Department of Transportation (Caltrans)[3]. These include air bubble curtains, cofferdams, isolation casings, and use of smaller piles, if feasible. More recent methods employ acoustic resonators to absorb the radiated sound close to the pile. Each of these have issues in regard to effectiveness, cost to deploy, and complexity, however, the use of bubble curtains is generally the most often deployed due to its simplicity. Exhibit 8 provides a conceptual drawing of a bubble curtain.

[3] Technical Guidance for the Assessment of Hydroacoustic Effects of Pile Driving on Fish, Division of Environmental Analysis California Department of Transportation 1120 N Street, MS-27 Sacramento CA 95814 www.dot.ca.gov/hq/env/, October 2020

Essentially air is supplied to perforated ring(s) surrounding the pile providing a "curtain" of bubbles as illustrated in the left side of the figure. Each ring is fed by a compressor(s). The bubbles provide an impedance mismatch with the water which acts like a cushion to reduce the sound being radiated by the pile. Multiple rings may be necessary in deep water to assure complete coverage of the pile.

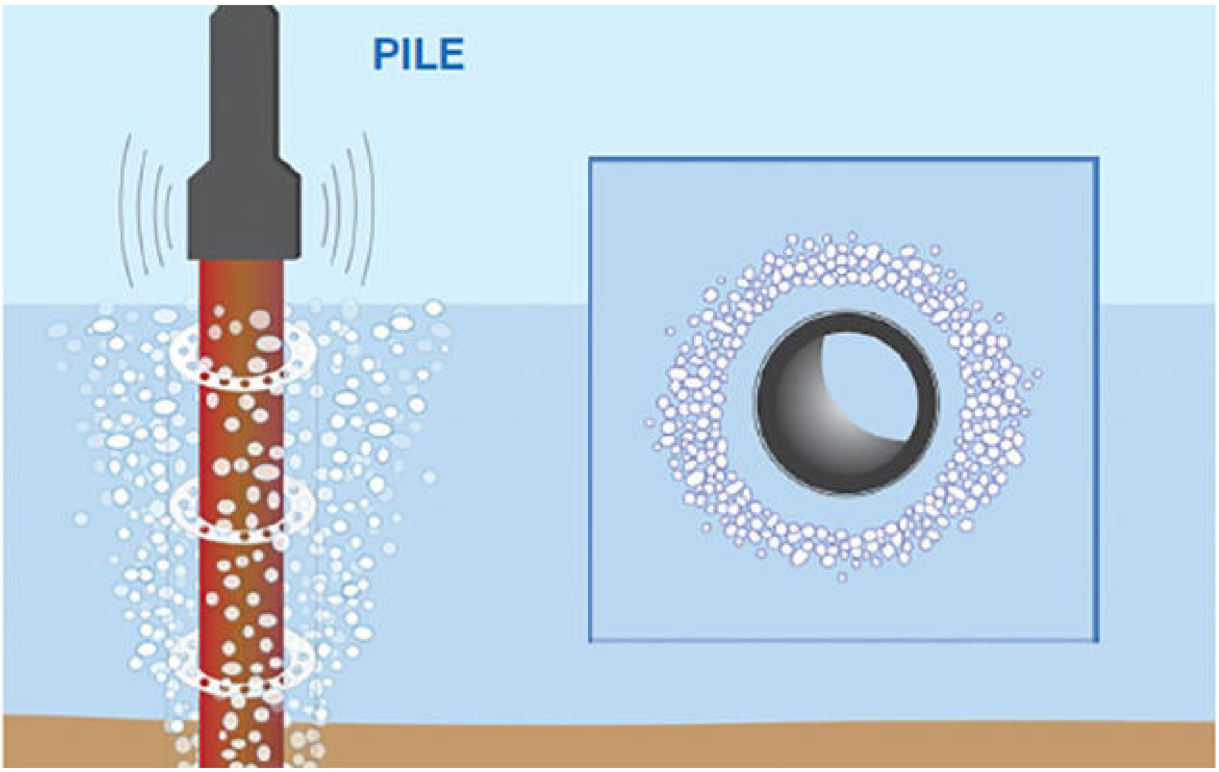


Exhibit 8 Bubble Curtain Concept for Reducing Pile Driving Noise

Additional measures can also be used such as shutting down the pile driving once a criteria noise level is reached in a 24-hour period or when marine mammals are spotted in the vicinity of the pile driving by spotters continually observing the entire Level A zone. For the BCIB, the zones will be large and may require many resources in terms of personnel and boats. Mitigation can also be provided by providing the greatest separation distance between piers where impact driving is occurring.

3.3 Underwater Sound Thresholds – Marine Mammals

Under the MMPA, the National Marine Fisheries Service (NMFS) has defined levels of harassment for marine mammals. Level A harassment is defined as "Any act of pursuit, torment, or annoyance which has the potential to injure a marine mammal or marine mammal stock in the wild." Level B harassment is defined as "Any act of pursuit, torment, or annoyance which has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including but not limited to migration, breathing, nursing, breeding, feeding or sheltering.

Current NMFS guidance[4] categorizes marine mammals into five hearing groups, low-frequency cetaceans, mid-frequency cetaceans, high-frequency cetaceans, Phocids, and Otariids as shown in Exhibit 9 along with their hearing ranges. Of these, only the low-, mid-, and high-frequency cetaceans are found in the BCIB project area. The sound thresholds for Level A and Level B harassment for these species are shown in Exhibit 10. Injury harassment (Level A) takes into consideration the onset of auditory injury thresholds as defined by permanent threshold shifts (PTS). Level A thresholds are distinct for each hearing group, based on the frequency-weighted hearing sensitivity of the associated species. Exposure to impulse sounds includes the evaluation of the Peak and SEL_{cum} as a dual criterion.

Exhibit 9 Definition of Marine Mammal Hearing Groups

Marine Mammal Functional Hearing Group	Functional Hearing Range[1]
LFC - Low-frequency cetaceans – humpback and minke whales*	7 Hz to 35 kHz
MFC - Mid frequency cetaceans – killer whales	150 Hz to 160 kHz
HFC - High frequency cetaceans – hourglass dolphins	275 Hz to 160 kHz
PP - Phocid pinnipeds - Crabeater, Southern Elephant, Leopard and Weddell seals*	50 Hz to 86 kHz
OP – Antarctic fur seals*	60 Hz to 39 kHz

Exhibit 10 Underwater Acoustic Thresholds used for Marine Mammals in the BCIB Vicinity

Species Hearing Group	Level A Dual Criteria		Level B dB (RMS)
	(dB Peak SPL)	(dB SEL_{cum})	
Low-Frequency Cetaceans (e.g., humpback whales)*	219	183	160
Mid-Frequency Cetaceans (e.g., killer whales)*	230	185	
High-Frequency Cetaceans (e.g., hourglass dolphins)	202	155	

Behavioral harassment (Level B) is considered to have occurred when marine mammals are exposed to sounds of 160 dB RMS or greater for impulse sounds (e.g., impact pile driving) and 120 dB RMS or greater for continuous sounds (e.g., vibratory pile driving). It should be noted that the Level B criteria impact pile driving apply only to one pile strike and does not accumulate as SEL_{cum} does. Further, it is not additive when multiple impact pile driving is occurring.

[4] NMFS. 2018 *2018 Revision to: Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing Underwater Acoustic Thresholds for Onset of Permanent and Temporary Threshold Shifts*. April.

3.4 Underwater Sound Thresholds – Fish

NOAA currently has no general policy on underwater noise limits for fish. Interim criteria were developed in 2008 by a Federal Highway Working Group (FHWG) to address the needs in assessing the noise impact on endangered fishes on the West Coast of the United States where endangered species were present. The FHWG consisted of representatives from the state Departments of Transportation (California, Oregon, and Washington), Federal Agencies, and technical experts. The criteria have been applied to all pile driving projects on the west coast including those in Alaska ever since. Revised sound exposure guidelines for fishes were developed in 2014 under the American National Standards Institute (ANSI) to update those developed in 2008 as Interim Criteria. Based on more recent research, the older criteria were found to be excessively conservative[5]. The FHWG criteria were based only on fish weight while the 2014 guidance is grouped by anatomical characteristics which is thought to be more generally applicable to the variety of fishes that would be in the Manila Bay. The 2014 sound exposure guidelines for mortality, recoverable injury, and temporary threshold shift are shown in Exhibit 11.

Exhibit 11 2014 Sound Exposure Guidelines for Fishes exposed to impact pile driving developed under the American National Standards Institute (objective criteria only)

Fish Hearing Type	Mortality or Potential Mortal Injury	Recoverable Injury	Temporary Threshold Shift
No swim bladder (detects particle motion); e.g., flatfishes, eulachon	>219 dB SEL_{cum} or >213 dB peak	>216 dB SEL_{cum} or >213 dB peak	>>186 dB SEL_{cum}
Swim bladder not involved in hearing (detects particle motion); e.g., Pacific salmon	210 dB SEL_{cum} or >207 dB peak	203 dB SEL_{cum} or >207 dB peak	>>186 dB SEL_{cum}
Swim bladder involved in hearing (primarily detects pressure); e.g., walleye pollock and cod	207 dB SEL_{cum} or >207 dB peak	203 dB SEL_{cum} or >207 dB peak	>>186 dB SEL_{cum}
Eggs and larvae	>210 dB SEL_{cum} or >207 dB peak		
Source: American National Standards Institute (ANSI) 2014.			

[5] Port of Alaska Modernization Program Essential Fish Habitat Technical Report – Cargo Terminals Replacement Project, Attachment 2 Essential Fish Habitat (EFH) Technical Report, prepared for the Municipality of Anchorage/Port of Alaska, CH2M Hill, Inc., February 2023. Available from the National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Washington, DC.

3.5 Underwater Sound Thresholds – Sea Turtles

Recently, there has been increasing concerns about underwater noise impacts on sea turtles. NMFS and the U.S. Navy[6] have developed criteria relative to impact pile driving that need to be considered for the Manila Bay and the BCIB. NMFS has developed user guidance spreadsheet which incorporates these criteria in 2022 version of the marine mammal sheet. The guidance addresses the onset of permanent hearing loss and behavior effects. For the onset of PTS, it provides peak sound pressure and SEL_{cum} of 232 dB and 204 dB. It also provides a behavior threshold in RMS sound level of 175 dB. These criteria apply to unweighted sound pressure levels.

4. PREDICTION OF UNDERWATER SOUND LEVELS

4.1 Relevant Data

The prediction of sound levels from pile installation for this project relies on empirical data collected from other sites with similar conditions and pile sizes. Unfortunately, there is only limited data on large diameter piles similar to those planned for BICB. The most relevant is from the hydroacoustic monitoring report done for the Port of Alaska Modernization Program from 2021.[7] This monitoring included impact driven steel piles 3.66m (144 inches) in diameter. Using this data along with that from the Caltrans Compendium of Pile Driving Sound Data[8], estimated single strike SEL and other metrics could be developed for unattenuated levels. This analysis indicated that single strike SEL values for the 3m diameter piles would be 2 dB lower than the 3.66 m piles and 3 dB lower for the 2.8m piles as shown in Exhibit 12. For estimating bubble curtain attenuated levels, the results of the impact pile driving from the Port of Alaska were used for the 3.66m piles adjusted for the 2.8 and 3m diameter piles to be used in the BICB project. The single strike source level (SSL) for a pile with a bubble curtain in the Port of Alaska project was 193 dB. This yields SSLs of 191 dB for the 3m diameter piles and 190 dB for the 2.8m piles. The other parameter necessary to estimate the SELs at distance is the rate at which the levels reduce with distance or transmission loss (TL). For modeling the SEL at distances beyond the 10m distance, the TL from the Port of Alaska of 18.3 dB per doubling of distances was used. The TL result of the Port of Alaska monitoring is shown graphically in Exhibit 13. For the BICB, the equation for the average level versus distance is:

$$y = -18.3 \log (x) + 208.56$$

[6] Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis (Phase III), Technical Report, June 2017

[7] Port of Alaska Modernization Program Petroleum and Cement Terminal Phase 2 Hydroacoustic Monitoring Report, prepared for the Port of Alaska by James Reyff, Illingworth & Rodkin, Inc., published by CH2M Hill, Inc. Anchorage, Alaska, August 2021.

[8] Technical Guidance for Assessment and Mitigation of the Hydroacoustic Effects of Pile Driving on Fish, California Department of Transportation, Report CTHWANP-RT-15-306.01.01, November 2015

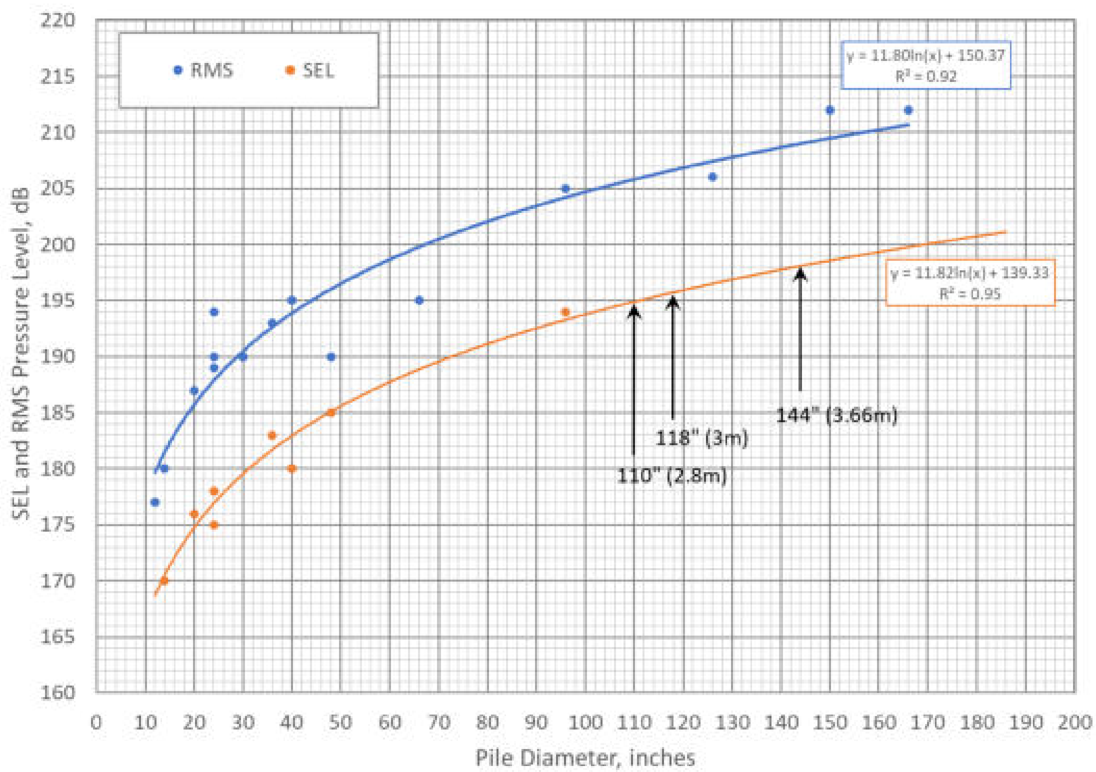


Exhibit 12 SEL and RMS Sound Levels as a Function of Pile Diameter Based on the Caltrans Compendium of Pile Driving Sound Data

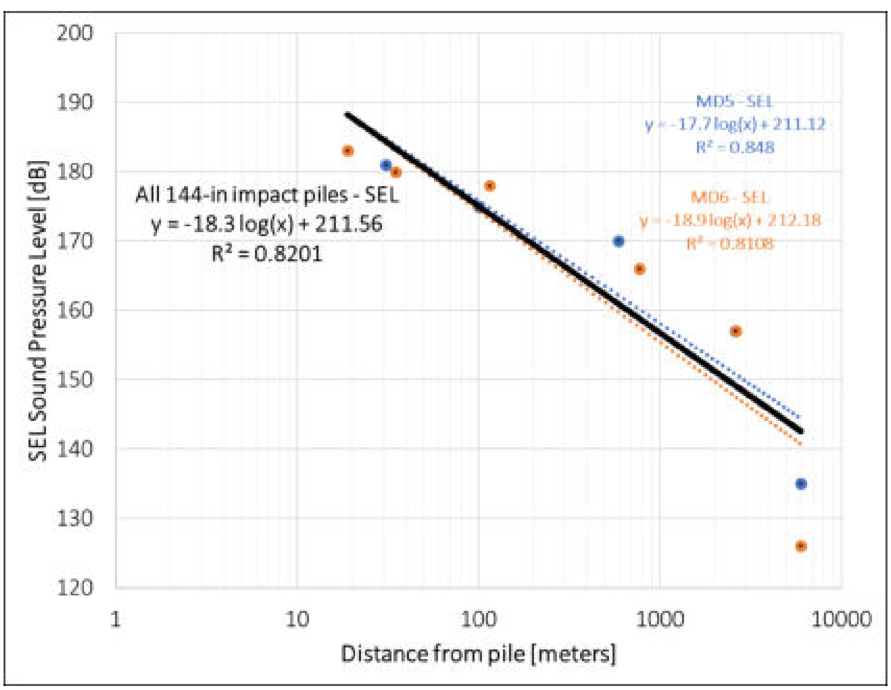


Exhibit 13 Single strike SEL vs. Distance from Port of Alaska Monitoring

4.2 Predicted Impacts to Marine Mammals

The simplest case to consider is that of impact pile driving at one pier only. For this case, the piles are assumed to be close enough to each other in the pier that the small separation between them is insignificant compared to the distances at which the thresholds are not exceeded. The construction planning is that it will take up to 7,000 strikes to set each pile or a total of 14,000 strikes at one pier in a 24-hour period. An example of calculated cumulative SELcum as function of distance is shown in Exhibit 14 for 14,000 strikes occurring at a single pier for the LF weighted marine mammal species. In this case, the distance to the threshold is reduced from 14km to 4km with the bubble curtain and the zone in which permanent hearing threshold shift (Level A criterion) is expected to occur is reduced from 645 sq km to 50.

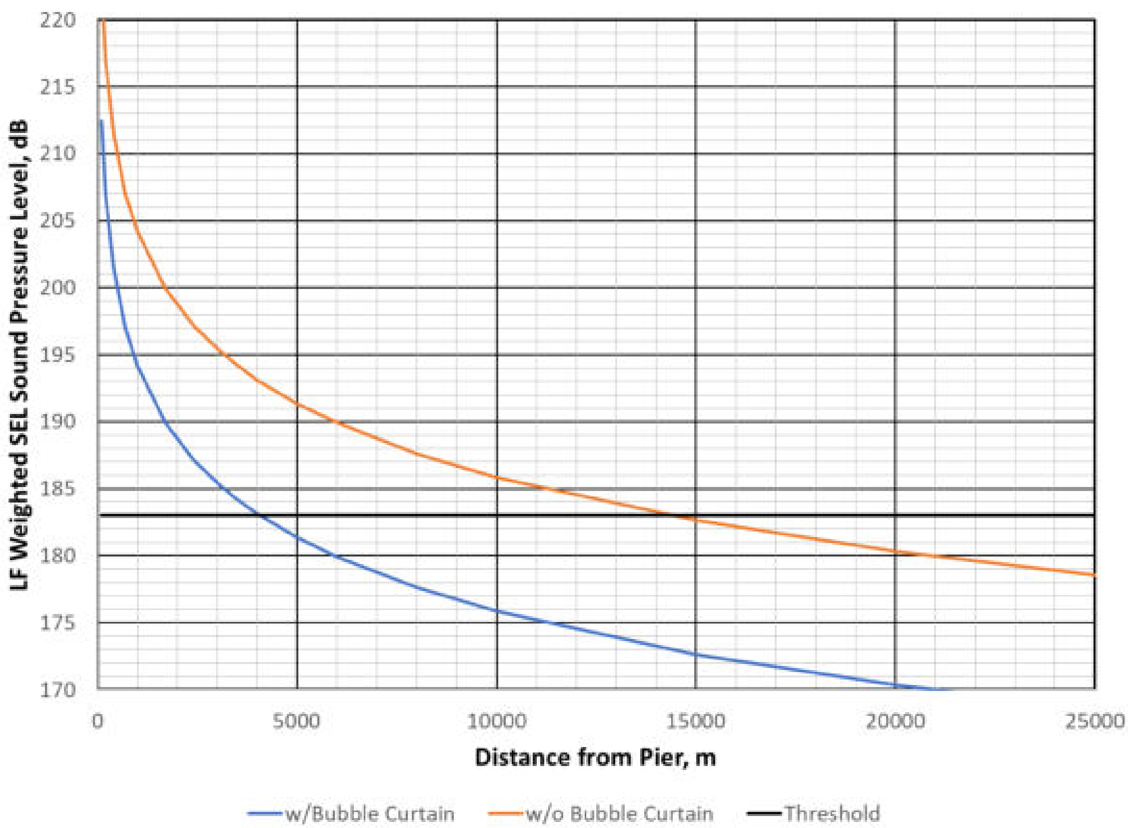


Exhibit 14 Calculated SELcum vs. LF Weighted Distance for a Single Pier (2 piles) with the Threshold Distance for the Level A Criterion

For the purposes of this assessment, the primary concern is the Level A criteria as it applies to the five marine mammal categories. The distance to the Level A and Level B criteria for the single pier case is provided in Exhibit 15 for all of the species with and without the use of a bubble curtain.

Exhibit 15 Distance in Meters to Marine Mammal Level A and B Criteria for Driving Two Piles in One for One Pier in 24-Hour Period With and Without Bubble Curtains (BC)

Species	Level A Criteria		Level B Criterion	
	With BC (m)	Without BC (m)	With BC (m)	Without BC (m)
HF	2,225	7,830	3,667	21,464
MF	106	373		
LF	4,071	14,324		

As shown in Exhibit 5 and 6, the number of simultaneous piles driving operations can be as high as four at given times. However, these are all not necessarily in close proximity to each other. These are expected to be separated by 2,000m or 4,000m. From Exhibit 15 with the bubble curtains, overlapping zones for a 2,000m separation would occur for the HF and the LF species. For the 4,000m separation, only the LF species would have some small overlap. For the with-bubble-curtain case with a pier separation of 2,000m, MF would not overlap, and they would be considered as one pier producing the zone as shown in Exhibit 14. For the zones that do overlap, in the area of overlap, the levels will be higher than they would be for than the case presented in Exhibit 14.

For the cases where two piers have two piles being driven with overlapping zones, the sound field becomes more complex. Along the line between the piers, they do not overlap. As the prediction moves toward the centerline between the piers and zones overlap, the presence of the second pier combines with the other increasing the sound level. To understand this effect, the case of LF weighted levels for two piers separated by 2,000m can be considered graphically. Exhibit 15 illustrates the case where the measurement point is on the centerline between the piers and then moves closer to Pier 2.

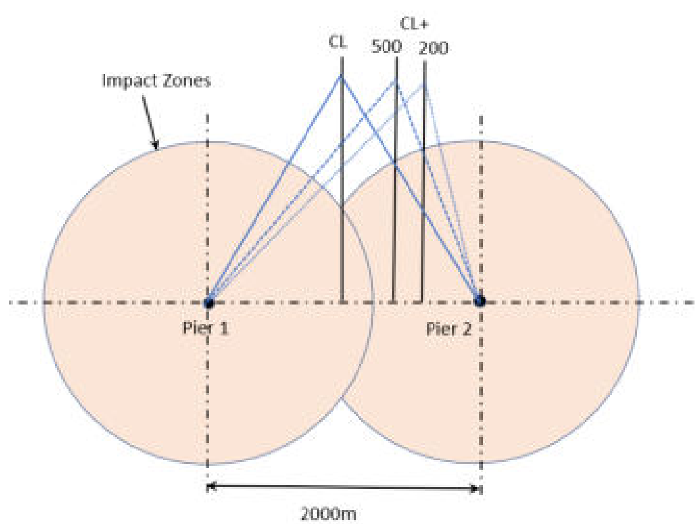


Exhibit 16 Geometry for Analysis of Two Piers Separated by 2000m

The calculated LF SEL is shown in Exhibit 16 for the CL measurement line. Since the levels from both piers are identical, the individual pier levels from P1 and P2 are identical in the plot and the total is consistently 3 dB greater than the individual piers. The falloff in level, however, does not follow the shape of a logarithmic curve (indicated by the dashed line) as would occur for a single pier. Moving further to the right in Exhibit 15 where the measurement line is offset from the centerline by 500m producing LF SEL shown in Exhibit 17. In this case, closer to the piers, the levels are separated and then begin to merge as separation between the piers becomes insignificant compared to the distance from the piers' centerline. The total of the piers also becomes about 3 dB greater than the individual piers. The falloff rate for the farther Pier 1(P1) does not follow a typical logarithmic rate. The same trends from Exhibit 17 are also seen in Exhibit 18 when the measurement line is offset from the centerline by 200m. It should be noted that the lines for the total SEL in all three Exhibits cross the threshold line slightly below 6000m.

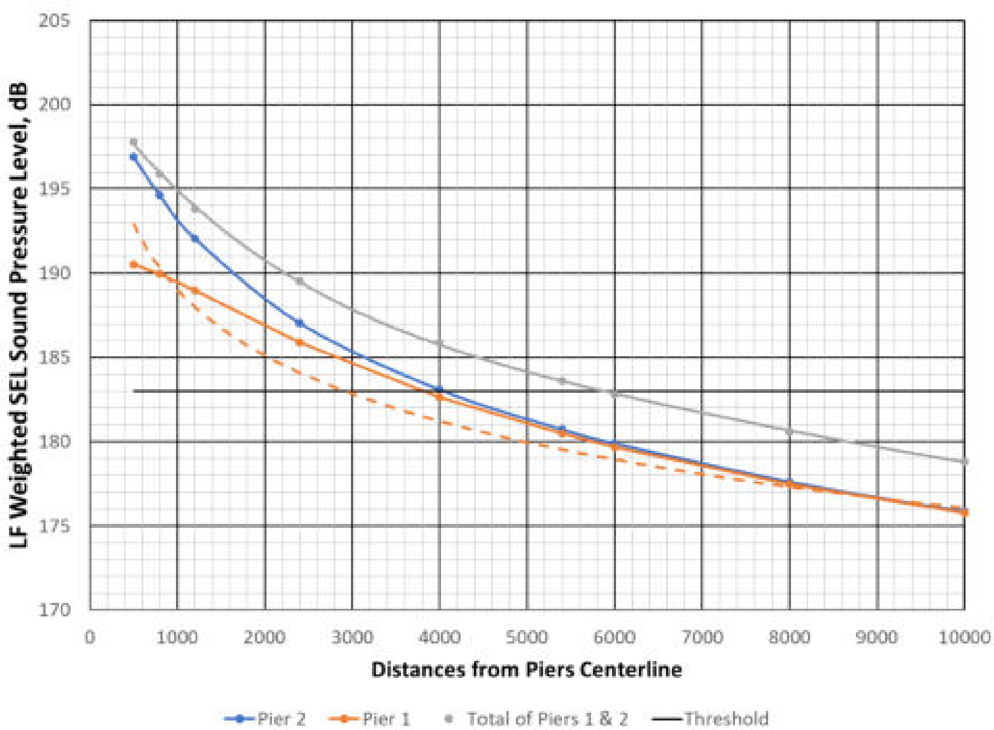


Exhibit 17 SEL Versus Distance From the Two Piers Separated by 2,000m Along a Line Offset 500m From the Centerline Between the Piers

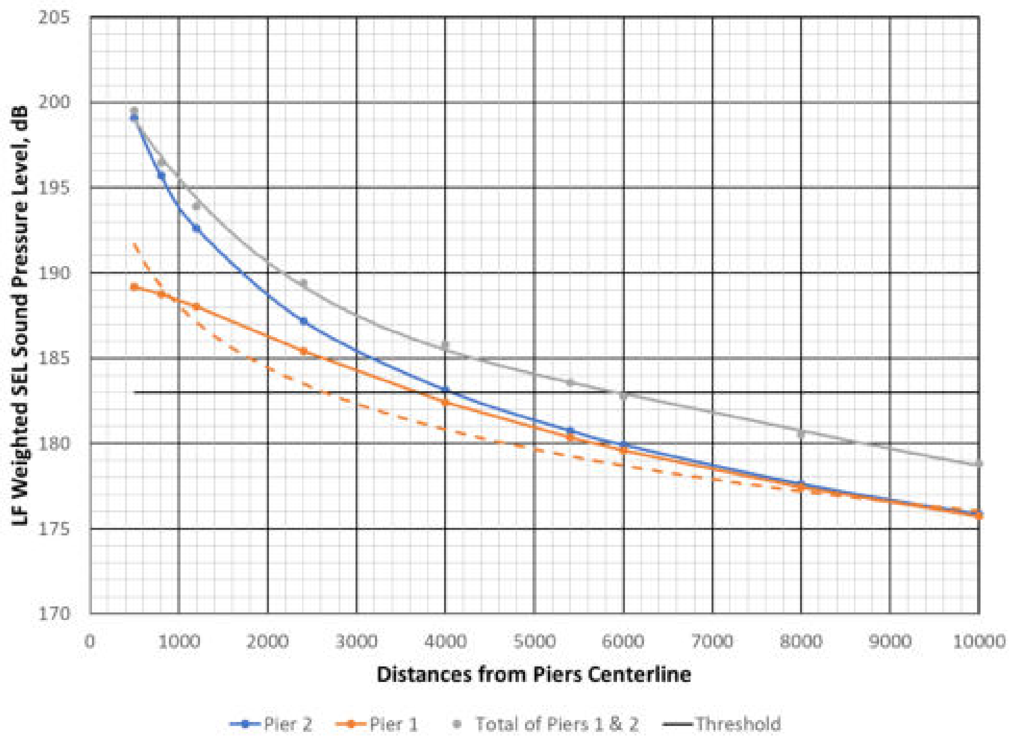


Exhibit 18 SEL versus Distance From the Two Piers Along a Line Offset 200m From the Centerline Between the Piers

The distances to marine mammal thresholds for all three species were calculated for the piers separated by 2,000m along the offset lines shown in Exhibits 16-18. These are presented in Exhibit 19. In Exhibit 20, the distances for the piers are separated by 4,000m.

Exhibit 19 Distance in Meters to Marine Mammal Level A Criteria for Pile Driving at Two Piers Separated by 2,000m in a 24-hour Period with Bubble Curtains

Offset from Center line	Level A Injury Zone (m)		
	HF	MF	LF
0m	3,130	0	5,800
500m	3,050	0	5,850
800m	3,070	0	5,895
1000m	3,000	0	5,900

Exhibit 20 Distance in Meters to Marine Mammal Level A Criteria for Pile Driving at Two Piers Separated by 4,000m in a 24-hour Period with Bubble Curtains

Offset from Center line	Level A Injury Zone (m)		
	HF	MF	LF
0m	2,610	0	5,700
1000m	2,650	0	5,500
1500m	2,620	0	5,170
1900m	2,620	0	5,350

The extent of the impact zones was also evaluated along the axis of the two pier configurations (see Exhibit 15) for the 2,000 and 4,000m separations between simultaneous impact pile driving. The extent of the zones in that direction are presented in Exhibit 21.

Exhibit 21 Distance in Meters to Marine Mammal Level A Criteria for Pile Driving at Two Piers Separated by 2,000 and 4,000m in a 24-hour Period with Bubble Curtains

Pier Separation	Level A Injury Zone (m)		
	HF	MF	LF
2000m	2,460	0	4,600
4000m	2,450	0	4,600

From these results, it is seen that the zone at the end of the array does not extend further than those to the sides of the array for all of those cases. Using the results of Exhibits 17 through 19, the area of impact can be determined.

4.3 Predicted Impacts to Fishes

For assessing the potential impact on fishes in the Manila Bay due to the project generated underwater sound, the ANSI criteria presented in Exhibit 10 were used. The results of these calculations with and without a bubble curtain are shown in Exhibit 22 for impact pile driving at two piers separated by 2,000m. For Recoverable Injury with bubble curtains, the zones from the piers would not overlap, however, without bubble curtains the zones would overlap. For Mortality/Mortal Injury, no overlapping of zones would occur for a 2,000m separation between piers.

Exhibit 22 Distance to Thresholds Under 2014 ANSI Guidelines for Fish Exposure to Underwater Sound with and without Bubble Curtains

Fish Hearing Type	Mortality or Potential Mortal Injury (m)		Recoverable Injury (m)		Temporary Threshold Shift (m)	
	With BC	Without BC	With BC	Without BC	With BC	Without BC
No swim bladder	54	191	79	279	3,458	12,171
Swim bladder not involved in hearing	169	594	407	1,433	3,458	12,171
Swim bladder involved in hearing	246	867	407	1,433	3,458	12,171

Fish Hearing Type	Mortality or Potential Mortal Injury (m)		Recoverable Injury (m)		Temporary Threshold Shift (m)	
	With BC	Without BC	With BC	Without BC	With BC	Without BC
Eggs and larvae	169	594				

4.4 Predicted Impacts to Sea Turtles

In Exhibit 23 the unweighted SEL_{cum} levels are plotted for a single pier and two piles being impact driven with and without a bubble curtain along with the 204 dB criterion for Level A. The criteria are also shown. Exceedance of the criteria without a bubble curtain occurs at a distance of 1270m. With a bubble curtain, this distance is reduced to 360m. At this distance, there would be no overlap with other piers.

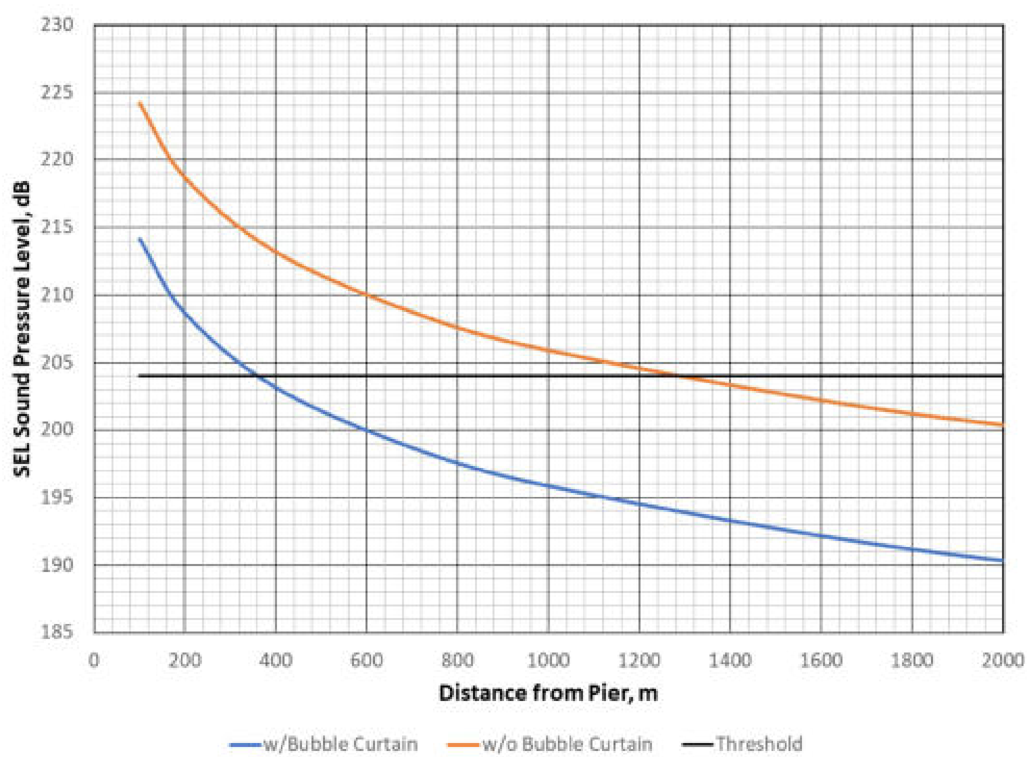


Exhibit 23 Calculated SELcum vs. LF (Sea Turtle Hearing) Weighted Distance for a Single Pier (2 Piles) with the Threshold Distance for the Level A Threshold Level

5. RECOMMENDATIONS

The overriding recommendation of this report is that noise mitigation measures be implemented to reduce the size of the impact zones. Of the possible mitigation measures, the use of bubble curtains is recommended. As the analysis provided in this document is based primarily on the results of previous pile driving measurements and results, to fully develop a noise assessment of the BCIB project, it is recommended that a Test Pile Program (TPP) be conducted prior to embarking on the full construction project. The purpose of the TPP would be to collect site-specific information on noise reduction of impact pile driving noise as a function of distance (falloff rate) which is crucial to determining the actual size of the noise impact zones. It would also provide actual source levels for the piles which is also needed to determine the size of the zones. Additionally, it would be used to determine the effectiveness of mitigation measures, in particular, bubble curtains. The performance of bubble curtains can then be optimized prior to the actual start of production pile driving. TPPs have often been use in major bridge construction projects.

6. SUMMARY CONCLUSION

Geotechnical borings (2021 through 2023) throughout the BCIB alignment have determined that much of the alignment contains rock or hard conglomerates that allows for a variety of pier construction options. Many of the techniques are not considered to cause high degrees of underwater disturbance, however impact pile driving has the potential to greatly affect marine life, resulting in a range from disturbance, to hearing loss and even fatality. The geologist recommendations reveal that the foundations for at least 20 and up to 101 piers will need to be installed via pile driving methods. The results in a total of at least 1,460 and up to 2,288 piles will be installed via impact pile driving over a 42-month period. Under the most intense period of pier foundation installation, there may be as many as 4 pile driving machines spread over the BCIB alignment for up to 1 year. These are assumed to be operating 24 hours per day.

Impact pile driving during construction of the BCIB would result in the generation of underwater sounds that could affect marine mammals and fishes that may be present in waters at or near the project. The National Oceanic Atmospheric Administration's National Marine Fisheries Services (NMFS) provides guidance for assessing underwater impacts to marine mammals based on potential for permanent hearing loss (considered Level A harassment) and behavioral responses (considered Level B harassment). For impact pile driving at a single pier including two piles in a twenty-four-hour period, the use of bubble curtains would reduce the radius of the Level A impact zones from over 14,324m to 4,071m for the most sensitive marine mammal species. The Level B impact radius would be reduced from 21,464m to 3,667 with bubble curtains. At times during the construction, it is anticipated that pile driving would occur at two or more piers in the same day. Providing separation between the piers is also a means of mitigation as shown by this assessment.

7. REFERENCES

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ANNEX 6: STAKEHOLDER ENGAGEMENT RECORDS UPDATED (2019–2023)

Bataan-Cavite Interlink Bridge Project

Stakeholder Engagement Records (2019–2022)

March 27, 2023

Prepared By:

T.Y. Lin International | Pyunghwa Engineering Consultants Joint Venture

Document Code: 481714-BCIB-xxx-xxx-xxx-xxx-00xx

Revision: 0x

Information, Education and Communication (IEC) Activities for the Proposed Bataan-Cavite Interlink Bridge (BCIB) Project

Brgy. Alas-asin & Brgy. Mt. View, Mariveles, Bataan;

Corregidor Island (Brgy. 53B), Cavite City; and

Brgy. Timalan Concepcion & Brgy. Sabang, Naic, Cavite

PUBLIC PARTICIPATION ACTIVITIES

DENR Administrative Order (DAO) No. 2017-15 provides the guidelines on public participation under the Philippine EIS system. In line with this guidelines, initial stakeholder identification and IEC meetings were done.

1.1. INITIAL STAKEHOLDER IDENTIFICATION

Stakeholders, as defined by DAO 2017-15, are people (natural or juridical) who affect or are affected by the project or undertaking, such as, but not limited to members of the local community, industry, local government units (LGUs), national government agencies (NGAs) and non-government organizations (NGOs) and people's organizations (POs).

A preliminary stakeholder identification and analysis was done to come up with a list and analysis of stakeholder groups that have interest in or stand to be affected by the project given its potential impacts. Note that stakeholder mapping is an iterative process that is informed by the conduct of site visits, observations, and validations by the study team.

Based on initial site visits, preliminary interviews, initial IEC meetings, and desk research done, the following were the identified stakeholders for the project:

- Local Government Units
- Owners and operators of commercial sea vessels
- National government bodies
- Tourism association
- Transport sector
- Business sector
- Fisherfolk sector
- Senior citizens
- Youth
- Residents
- NGOs/POs

1.2. IEC MEETINGS

1.2.1. MUNICIPALITY OF MARIVELES

An initial IEC meeting was conducted with the Municipal Government of Mariveles in 22 October 2019 at the Mayor's Office. A total of 18 participants attended said meeting, including the Municipal Mayor, key officials and representatives from the Municipal Planning and Development Office, Municipal Environment and Natural Resource Office, Muinicipal Assessor's Office, Municipal Agriculturist's Office, Municipal Engineer's Office, and Municipal Agrarian Reform Office. Also present in said meeting were the Municipal Administrator and

the barangay chairpersons of Alas-asin and Mt. View as the primary impact areas of the project in the Bataan side.

Among the issues and concerns raised during said meeting were the following:

- Accuracy of the project maps shown and the barangays that will be affected;
- Impact of the project on fisherfolk;
- Identification of those who will be resettled;
- Resettlement plans for those who will need to be relocated and the accompanying compensation scheme;
- Installation of toll fees on the proposed bridge; and
- Impact on Bataan's security (public safety) concerns given the accessibility that the bridge will provide and the lack of toll gates on the bridge.

Figure 5 show photos taken during the IEC meeting in Mariveles, Bataan.

Figure 1: Photos taken during the IEC Meeting in Mariveles, Bataan.

Mariveles Mayor during the IEC meeting.

	Barangay Alas-asin Chairperson articulating concerns and issues for his constituents during the open forum.
 Project Director of EcosysCorp providing details and clarification regarding prescribed guidelines pertaining to the affected community.	 EcosysCorp presenting the process of Environmental Impact Assessment and Resettlement Action Plan.

1.2.2. MUNICIPALITY OF NAIC

A separate IEC meeting was also held in Naic in 21 October 2019 at the Mayor's Office. A total of 16 participants were present in said meeting, including the Municipal Mayor and officials and representatives from the Municipal Planning and Development office, Municipal Engineer's Office, Municipal Assessor's Office, Municipal Agriculturist's Office, and Muniicpal Environment and Natural Resources Office. Also present in said meeting were the barangay chairpersons of Timalan Balsahan and Sabang.

Among the issues and concerns raised during said meeting were the following:

- Accuracy of the project maps shown and the barangays that will be affected;
- Impact of the project on fisherfolk;
- Identification of those who will be resettled; and
- Resettlement plans for those who will need to be relocated and the accompanying compensation scheme.

Figure 6 show photos taken during the IEC meeting in Naic, Cavite.

Figure 2: Photos taken during the IEC meeting in Naic, Cavite

 Presentation during the IEC meeting.	 IEC meeting attended by the municipal mayor, municipal department heads, and barangay chairpersons.
 The Municipal Mayor of Naic actively participating during the IEC meeting.	 Naic Barangay Chairpersons actively participating during the IEC meeting.

1.2.3. CITY OF CAVITE

Another IEC meeting was also set with the City Government of Cavite in 11 November 2019 at the Mayor's Satellite Office. A total of 15 participants took part in said meeting, including the City Mayor and officials and representatives from the City Planning and Development Office and City Environment and Natural Resources Office. Also present were the City Administrator and chairperson of Barangay 53B for Corregidor Island.

Among the issues and concerns raised during said meeting were the following:

- Number of posts that will be erected on Corregidor Island;

- Clarification on the optional ramp leading to the Island; CPDO clarified that the latest information on the airstrip in the Island is that it will be maintained for its historical value but will not be operational;
- Project's alignment with the Sangley viaduct leading to Cavitex;
- Clarification on whether the alignment will directly lead to Cavite City;
- Clarification on whether the alignment will be connected to Calax; and
- Timeline for commencing the project; Mayor Paredes is anxious to witness the project since it is already his last term as mayor.

Figure 7 show photos taken during the IEC meeting in Cavite City, Cavite.

Figure 3: Photos taken during the IEC meeting in Cavite City, Cavite.

Cavite City Mayor requesting the expeditious implementation of the project during the open forum.

ARUP presenting the project details during the IEC meeting.

1.3. OTHER PUBLIC PARTICIPATION ACTIVITIES

The conduct of other public participation activities are in line with the aim of conducting IEC activities to share information about the project to stakeholders. The conduct of other public participation activities will also provide the Proponent with initial feedback on the perceived positive and negative project impacts from the community. Both activities will be done separately for Mariveles, Naic, and Cavite City.

A sectoral consultation will be set for each of the affected municipalities and cities as part of the IEC campaign. In said sectoral consultations, participation of leaders and/or representatives from the abovementioned sectors will be sought.

A household survey in the primary impact areas will also be done to collect data on demographics, income and employment, living condition, health and sanitation practices, as well as perception about and suggestions for the project.

Information, Education and Communication (IEC) Activities for the Proposed Bataan-Cavite Interlink Bridge (BCIB) Project

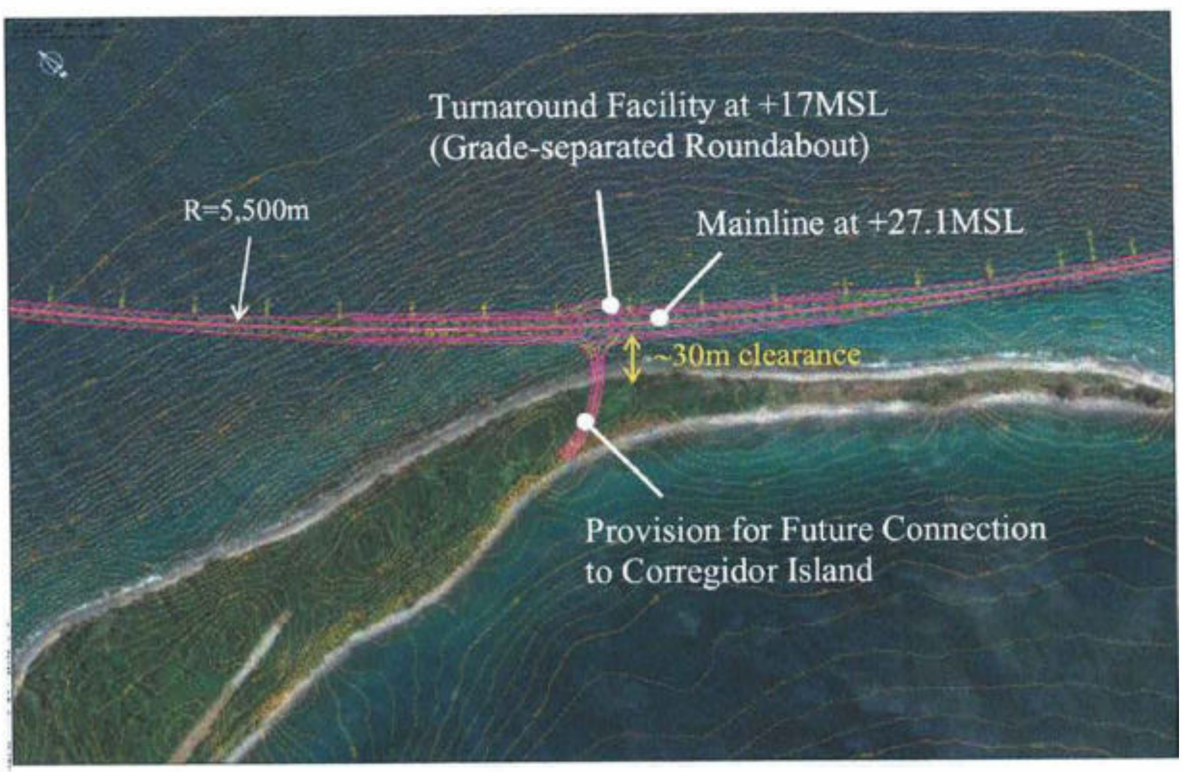
Brgy. Alas-asin & Brgy. Mt. View, Mariveles, Bataan;
Corregidor Island (Brgy. 53B), Cavite City; and
Brgy. Timalan Concepcion & Brgy. Sabang, Naic, Cavite

ANNEXES

Annex 1: Project alignment in Mariveles, Bataan

Annex 2: Project alignment in Naic, Cavite

Annex 3: Project alignment along Corregidor Island



Annex 4: Minutes of Meeting in Naic, Cavite

Date	21 October 2019
Time	2 PM
Venue	Mayor's Office, Naic Municipal Hall
Attendees	**DPWH :** John Eric Arevalo **Arup :** Winfred Liwanag Cristina Villaraza **Ecosys :** Ronnie Manipol Theresa Casuyon Mary Joy Maraat Frederick Esternon Elenor de Leon Lean Ramilo **Naic LGU :** Junio C. Dualan- Municipal Mayor Marissa S. Pabilon Elma T. Valenzuela Eva P. Pangilinan Antonete S. Asturias Rona M. dela Cruz Joel D. Antonio Carolina E. Espineli Christopher Cabuhat Noel H. Catubig Beverly N. Perdon
Particulars	Ms. Maraat introduced the team. She explained that the DPWH is the proponent and that Arup and Ecosys have both been contracted to provide technical assistance to the project. Mr. Liwanag presented the project. He began by situating the project in the context of President Rodrigo Duterte's Build, Build, Build Program. He shared basic information about the project, including brief profiles of its proponent and consultant before presenting the project in more details. He explained the rationale for the project and how it will be beneficial for the economy. He also shared the project alignment, showing maps of landing sites in Bataan and Cavite, including the potential connection to Corregidor Island. He provided an overview of the bridge layout and showed a rendering of the proposed bridge. Finally, he shared the project timeline. Ms. de Leon talked about the EIA process. She first explained what the EIA is and why it needs to be done before sharing the process required for the IEC meeting as one of the important components of the process. She shared the lists of other IEC activities that the Ecosys team will further conduct as well as the other on-site data gathering activities that will also be done in support of the EIA process. Ms. Casuyon discussed the RAP process. She explained what RAP is and why

	it needs to be done. She cited examples of how RAP applies to those who will be affected by the project and what these project-affected persons stand to expect. She discussed the activities that will be conducted in support of RAP before presenting the list of documents or information/data that will be needed to inform and complete the process. In closing, Ms. Maraat presented the contact details of the focal persons from DPWH and Arup for any concerns regarding the project. <u>Open Forum:</u> The participants commented that the current meeting is similar to the one previously held in Naic on the same topic, BCIB. The study team explained that the current meeting is part of the required series of IEC meetings for the conduct of environmental impact assessment (EIA). The participants also commented on the accuracy of the map used in the presentation. Winfred Liwanag asked for a correct map and the Municipal Planning and Development Coordinator (MPDC) promised to provide it. The Municipal Agriculturist raised concern over the fisherfolk who will be affected by the project. Theresa Casuyon explained the RAP process and how compensation will be determined for those who will be adversely affected by the project. On the area that will be traversed by the project, the participants said that the residents in said area have already been considered as living in danger zones, making it better for them to be relocated. They said that the resettlement component of the project is aligned with the municipal government's plan when it comes to addressing the plight of families living in said area. Ms. Casuyon said that they will be identified and tagged and will later on be included in the resettlement action plan.

Annex 5: Minutes of Meeting in Mariveles, Bataan

Date	22 October 2019
Time	10 AM
Venue	Mayor's Office, Mariveles Municipal Hall
Attendees	**DPWH :** John Eric Arevalo **Arup :** Winfred Liwanag Cristina Villaraza **Ecosys :** Annabelle N. Herrera Ronnie Manipol Nesah Jariel Theresa Casuyon Mary Joy Maraat Cyrenne Pelayo Frederick Esternon Elenor de Leon Lean Ramilo **Mariveles LGU :** Jocelyn P. Castaneda - Municipal Mayor Angel V. Peliglorio Fernando V. Bello III Ildefonso G. Tarreza Jr. Susan M. Murillo Jeff Penaloza Roberto M. Arcenal Sr. Daisy Miranda Verdin R. Villareal Corazon M. Palomar Ed R. Escabillo Leoncio A. Lungcay Jose E. Yambao Hannah Micah D. Madrid Cynthia P. Olare Madonna Navata Nicole Santillan Reshell B. Concepcion Chito L. Riego de Dios Carlos Burlas Ruth Badilles Ma. Cristina Magnampo Ronald Arcenal
Particulars	A prayer was said before the start of the meeting. Ms. Maraat introduced the team. She explained that the DPWH is the proponent and that Arup and Ecosys have both been contracted to provide technical assistance to the project. Mr. Liwanag presented the project. He began by situating the project in the context of President Rodrigo Duterte's Build, Build, Build Program. He shared basic information about the project, including brief profiles of its proponent and consultant before presenting the project in more details. He explained the rationale for the project and how it will be beneficial for the economy. He also

	shared the project alignment, showing maps of landing sites in Bataan and Cavite, including the potential connection to Corregidor Island. He provided an overview of the bridge layout and showed a rendering of the proposed bridge. Finally, he shared the project timeline. Ms. de Leon talked about the EIA process. She first explained what the EIA is and why it needs to be done before sharing the process required for the IEC meeting as one of the important components of the process. She shared the lists of other IEC activities that the Ecosys team will further conduct as well as the other on-site data gathering activities that will also be done in support of the EIA process. Ms. Casuyon discussed the RAP process. She explained what RAP is and why it needs to be done. She cited examples of how RAP applies to those who will be affected by the project and what these project-affected persons stand to expect. She discussed the activities that will be conducted in support of RAP before presenting the list of documents or information/data that will be needed to inform and complete the process. In closing, Ms. Maraat presented the contact details of the focal persons from DPWH and Arup for any concerns regarding the project. <u>Open Forum:</u> Alas-asin barangay chair said that the affected area in his barangay is mostly populated by cogon grass. Mt. View barangay chair asked about the project's impact on fisherfolk. They clarified if people would still have access to fishing after the project and if fishermen could stay/standby under the bridge. Mr. Liwanag said that access to fishing areas will only be limited during construction but afterwards, during operation, fishermen can resume their activities. On the question on whether fishermen could stay/standby under the bridge, the study team clarified that for safety purposes, such will not be allowed. The LGU representatives also asked about the identification of those who will be resettled. In response, Ms. Casuyon explained the resettlement action planning process and how project-affected persons and families will be identified and tagged. She explained that those who will be tagged will be considered for the resettlement. There was also question on whether users of the proposed bridge will be asked to pay toll fees. To this, the study team said that use of the bridge will be for free; there will be no toll fees for users. To this, the participants expressed concerned about safety. They feared that

	having no toll fees/gates would make the bridge and Mariveles as well very accessible to everyone. The study team explained that the plan not to collect toll fees is only being contemplated at the current stage and that the final decision on whether to collect or not will depend later on the proponent and for whomever will be operating and maintaining the bridge.

Annex 6: Minutes of Meeting in Cavite City, Cavite

Date	11 November 2019
Time	10 AM
Venue	Mayor's Satellite Office, Cavite City Hall
Attendees	**DPWH :** Junnel Baustista Mary Cris E. Samson-Utod Erlynrose Mari L. Sacote **Arup :** Faustino Abad Lorraine N. Chavez **Ecosys :** Theresa Casuyon Mary Joy Maraat Frederick Esternon Elenor de Leon **Cavite City LGU :** Bernardo Paredes - City Mayor Jose Malumay Beatriz Rosal A. Dimaano Florinda C. Santiago Allyson B. Santiago Daryl R. Solis
Particulars	Mr. Esternon greeted the participants and thanked them for coming over to the IEC meeting. Mr. Abad presented the project. He began by situating the project in the context of President Rodrigo Duterte's Build, Build, Build Program. He shared basic information about the project, including brief profiles of its proponent and consultant before presenting the project in more details. He explained the rationale for the project and how it will be beneficial for the economy. He also shared the project alignment, showing maps of landing sites in Bataan and Cavite, including the potential connection to Corregidor Island. He provided an overview of the bridge layout and showed a rendering of the proposed bridge. Finally, he shared the project timeline. Ms. de Leon talked about the EIA process. She first explained what the EIA is and why it needs to be done before sharing the process required for the IEC meeting as one of the important components of the process. She shared the lists of other IEC activities that the Ecosys team will further conduct as well as the other on-site data gathering activities that will also be done in support of the EIA process. Open forum: CPDO asked about the number of posts that will be erected in Corregidor. Faustino Abad showed again the alignment in Corregidor and explained that there is a junction that can later be developed to connect to the island. Representatives from the city government said that Corregidor Foundation, Inc. (CFI) has a development master plan that was shared to the city government.

	Mr. Abad further explained the considerations for the design of the viaduct in Corregidor, pointing out the presence of an airstrip in the island. To this, CPDO said that the airstrip will be maintained for its historical value but will not be operational. She explained that the decision to just maintain the airstrip without making it operational is based on recommendations from the Civil Aviation Authority of the Philippines (CAAP). She said that the CAAP made such recommendation in light of the potential damages that taking off and landing aircrafts might cause to the road and other structures. Representatives from the city government explained that CFI is in charge of the management aspect but it is the Philippine Veterans Affairs Office (PVAO) that is in charge of preservation. Representatives from the city government also clarified if the project is aligned with the Sangley Point viaduct. Mr. Abad explained the process undertaken by the technical team in coming up with the preferred option. He also explained that the project cannot link to the Sangley Point viaduct project because its proponent is a private entity. He reminded the participants that the BCIB is under the DPWH. Representatives from the city government clarified if BCIB will connect to CALAX. Mr. Abad confirmed the link between BCIB and CALAX. He also mentioned the possible link to the proposed Cavite-Tagaytay-Batangas Expressway (CTBEX). City Administrator asked if the project alignment will connect to Cavite City. Mr. Abad showed again the alignment and explained that the landing site for Cavite will be in Naic. He pointed out, however, that with BCIB, traffic congestion in the area will be eased and that other points in Bataan and nearby areas will become more accessible. Mayor Paredes asked about the project timeline. He said he is eager to witness the completion of the project. Mr. Abad explained project timeline and explained the work that each stage entails. Mayor Paredes said he is already on his last term and that he can no longer seek another one. He expressed support to the project and shared his wish for the construction to immediately start.

Annex 7: Attendance sheets

MARIVELES

Bataan-Cavite Interlink Bridge (BCIB) Project
Information, Education, Communication (IEC) Meeting
Office of the Mayor, Municipal Hall Building,
Roman Super Highway, Mariveles, Bataan
22 October 2019, Tuesday, 9:00 A.M.
ATTENDANCE SHEET

IPIF ARUP

No.	Name	Gender F	Gender M	Designation / Title	Organization / Address	Contact No(s).	E-mail Address	Signature
1	[illegible]		✓	[illegible]	[illegible]	[illegible]	[illegible]	
2	Cristina Villaverde	O		Transport Planner	Arup	[illegible]	[illegible]	
3	WILFRED UMANAG II							
4	MADONNA NAVATA	O		DRAFTSMAN III	ASSESSOR	0926 2050 574	ch.no.vata@yahoo.com	
5	Angel V. Peligloria Jr.			Administrator	Admin	[illegible]	[illegible]	
6	NICOLE SANTILLAN		✓	[illegible]	Engineering	09159777323		
7	RUSHELL B. CONCEPCION	✓		ADMIN AIDE III	NURSING	[illegible]		
8	[illegible]		✓	ASSESSOR	MAO (Assessor)	09778052095		
9	CARLOS BURLAS		✓	ADMIN AIDE	ADMIN			
10	Ruth Badilles	✓		[illegible]	MHO (Agri)	[illegible]		
11	[illegible]	✓		ADMIN AIDE IV	[illegible]		[illegible]@yahoo.com	
12	RONALD R. ARCENAL		✓	SB MEMBER	SB			

EcosysCorp, Inc.

Bataan-Cavite Interlink Bridge (BCIB) Project
Information, Education, Communication (IEC) Meeting
Office of the Mayor, Municipal Hall Building, Roman Super Highway
Municipality of Mariveles, Bataan
22 October 2019, Tuesday, 2:00 P.M.
ATTENDANCE SHEET

IPIF ARUP

No.	Name	Gender F	Gender M	Designation / Title	Organization / Address	Contact No(s).	E-mail Address	Signature
13	ILDEFONSO G. TARRAZA JR		✓	MUN. ENGR	LGU - Mariveles	09390262071		
14	Susan M. Murillo	✓		SB	LGU Mariveles	[illegible]	[illegible]@yahoo.com	
15	JEFF PENALOZA			E CONSULTING	"	09306385182		
16	~~ROBERTO~~ M. ARCENAL SR		✓	P. BARANGAY	LGU	[illegible] 09205068058		
17	[illegible]	✓		LGU	LGU			
18	VERDIN R. VILLAREAL		✓	ADMINISTRATIVE AIDE	MIS	[illegible]		
19	Corazon M. Palma	✓		Admin staff				
20	Eleanor de Leon	O		[illegible]	ECOSYSCORP			
21	Frederick Esteban		O	Head, [illegible]	EcosysCorp	09175326772		
22	EDR. ESCABILLO		✓	[illegible]	LGU	[illegible]		
23	LEONCIO F. LUMBCAY		✓	PUNONG BRGY.	BRGY. MT. VIEW	09176244417		
24	VERA E. YAMBAO			PUNONG BRGY	CAMAYA	09487580847		
25	CYNTHIA P. [illegible]			Mayor's Office	MUN. BATAAN	[illegible]		
26	Hannah Micah D. Madrid	O		Mayor's Office	Bataan	09778875704		

EcosysCorp

Bataan-Cavite Interlink Bridge (BCIB) Project
Information, Education, Communication (IEC) Meeting
Office of the Mayor, Municipal Hall Building,
Roman Super Highway, Mariveles, Bataan
22 October 2019, Tuesday, 9:00 A.M.
ATTENDANCE SHEET

27	Fernando V. Bello II		✓	Administrative Aide	MPDC	0919[illegible]	mpdc_[illegible]@bataan.gov.ph	[illegible]
28	Atty. Jo Castañeda			Mayor	Office of the Mayor	0917[illegible]	attyjo[illegible]@gmail.com	[illegible]
29								
30								
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40								

EcosysCorp, Inc.

NAIC IEC Attendance Sheet

Bataan-Cavite Interlink Bridge (BCIB) Project

Information, Education, Communication (IEC) Meeting

Office of the Mayor, Municipal Hall Building,
Brgy. Ibayo Silangan, Naic, Cavite
21 October 2019, Monday, 2:00 P.M.

ATTENDANCE SHEET

IPIE ARUP

No.	Name	Gender F	Gender M	Designation / Title	Organization / Address	Contact No(s).	E-mail Address	Signature
1	Cristina Villanueva	O		Transport Planner	Arup	[illegible]	cristina-m.villanueva@arup.com	
2	Wilfred Cuaresma II		O	Proj. Coor.	Arup	09953937586	[illegible]	
3	Arevalo, John Earl		O	[illegible]	[illegible]	[illegible]	[illegible]	
4	Elence De Leon	O		PTL	Ecosyscorp			
5	Noel H. Catubig		O	Brgy Chairman	Brgy Sabang	09[illegible]		
6	Frederick Esternon		O	Head Environmental	Ecosyscorp	09176326122	[illegible]	
7	Beverly N. Pardo	O		C.O.S.	LGU-Naic	0917[illegible]	[illegible]@yahoo.com	
8								
9								
10								
11								
12								

EcosysCorp, Inc.

Bataan-Cavite Interlink Bridge (BCIB) Project

Information, Education, Communication (IEC) Meeting

Office of the Mayor, Municipal Hall Building,
Brgy. Ibayo Silangan, Naic, Cavite
21 October 2019, Monday, 2:00 P.M.

ATTENDANCE SHEET

IPIE ARUP

No.	Name	Gender F	Gender M	Designation / Title	Organization / Address	Contact No(s).	E-mail Address	Signature
1	Junio C. Dualan		/	Mun. Mayor	LGU-Naic	0977-[illegible]	mayorjcd@yahoo.[illegible]	
2	Marcus S. Pabelton			Brgy Capt	Timalan Con	0995[illegible]		
3	Elma T. Valenzuela	/		Mun. Agriculturist	LGU-Naic	0917-813[illegible]		
4	Eve P. Pangilinan	/		MENRO	LGU-Naic	0917[illegible]	[illegible]@yahoo.[illegible]	
5	[illegible]	/		[illegible]	LGU-Naic	0917[illegible]	[illegible]	
6	[illegible] Cruz	/		Mun. Engr.	LGU-Naic	[illegible]	[illegible]	
7	[illegible]		/	[illegible]	[illegible]	[illegible]	[illegible]	
8	Carolina E. Espineli	/		[illegible]	LGU-Naic	0917-130[illegible]	[illegible]	
9	Christopher Cabuhat		/	P.B	Tim. Balsahan	09[illegible]785		
10								
11								
12								

CAVITE CITY

Bataan-Cavite Interlink Bridge (BCIB) Project
Information, Education, and Communication (IEC) Meeting

IPIF ARUP

Office of the Mayor
Cavite City, Cavite
11 November 2019, Monday, 10:00 A.M.

ATTENDANCE SHEET

No.	Name	Gender F	Gender M	Designation / Title	Organization / Address	Contact No(s).	E-mail Address	Signature
1	Beatriz Rosal A. Dimaano	✓		Barangay Chairman	Barangay 35	09186733637	[illegible] @yahoo.com	
2	Jose J. [illegible]			CENRO - DESIGNEE	CITY-ENRO	09364718535	cenrocavitecity@gmail.com	
3	Lorraine U. Chavez	✓		[illegible]	ARUP	09174461561	lorraine.chavez@arup.com	
4	Mary [illegible] E. [illegible]	✓		Engr. II	DPWH	304 3237	[illegible]@gmail.com	
5	[illegible] L. Sacote	✓		ENGR III	DPWH	304823	[illegible]	
6	Junnel Ray C. Bautista		✓	[illegible]	DPWH		junnelraybautista@gmail.com	
7	Faustino Abad				ARUP		faustino.abad@arup.com	
8	Theresa G. Cosuyon	✓		[illegible]	ECOSYSCORP, INC	[illegible]	tes_[illegible]@yahoo.com	
9	Mary Joy [illegible]	✓		[illegible]	EcosysCorp	[illegible]	[illegible]@gmail.com	
10	Elenor de Leon	✓		[illegible]	EcosysCorp	09178569015	[illegible]@gmail.com	
11	Florinda C. Santiago	✓		CPDC	CPDO-CC	(046) 431-0879	cavitecity.cpdo@gmail.com	
12	Allison [illegible] Santiago		✓	ATTY/ADMIN	CMO-CAVITE CITY	(046) 431 0462	[illegible]@gmail.com	

EcosysCorp, Inc.

Bataan-Cavite Interlink Bridge (BCIB) Project
Information, Education, and Communication (IEC) Meeting

IPIF ARUP

Office of the Mayor
Cavite City, Cavite
11 November 2019, Monday, 10:00 A.M.

ATTENDANCE SHEET

No.	Name	Gender F	Gender M	Designation / Title	Organization / Address	Contact No(s).	E-mail Address	Signature
13	[illegible]		✓	CITY MAYOR	CITY MAYOR	046-431-1655	[illegible]	
14	Frederick J. [illegible]		✓	EIA Team	EcoSys	[illegible]	[illegible]@gmail.com	
15	[illegible]		✓	Sr. Resident	CAVITE CITY	[illegible]	[illegible]@gmail.com	
16		F	M					
17		F	M					
18		F	M					
19		F	M					
20		F	M					
21		F	M					
22		F	M					
23		F	M					
24		F	M					
25		F	M					
26		F	M					

EcosysCorp

Annex 8: Photo documentation

MARIVELES

Figure 1 Mariveles Mayor Atty . Jocelyn P. Castaneda discussing the project with the EIA study team headed by Frederick Esternon

Figure 2. BCIB project presentation in Mariveles Municipal Hall in, Bataan.

NAIC

Figure 3. The study team as they listen to Naic Mayor Junio C. Dualan.

Figure 4. The study team presenting the project details.

CAVITE CITY

Figure 5. Cavite City Mayor Bernardo S. Paredes as he listens to the presentation of the project alignment.

Figure 6. Faustino Abad of Arup as he shares details of the project.

Information, Education and Communication (IEC) Activities for the Proposed Bataan-Cavite Interlink Bridge (BCIB) Project

Barangay Level

Highlights of the 1st Barangay Consultation Meeting (BCM) Meeting
BATAAN-CAVITE INTERLINK BRIDGE (BCIB) PROJECT
Preliminary Engineering Design (PED)

Timalan Concepcion Covered Court
Brgy. Timalan Concepcion, Naic, Cavite
21 January 2020, Tuesday, 1:00 P.M.

Project Presentation - ARUP

EIA and Environmental Activities - EcosysCorp

Open Forum:

Presented in the matrices are the summary of issues, concerns, comments, and suggestions raised during the 1st BCM in Brgy. Timalan Concepcion, Naic. Responses to the queries are also included in the matrices.

Please see the attached attendance sheets for the list of participants during the meeting.

Summary of Issues, Concerns, Comments, and Suggestions Raised during the 1st SCM in Brgy. Timalan Concepcion, Naic, (1/1)	
Queries/Concerns/Suggestions/Comments	**Responses to Queries**
• Asked where the boats shall dock once the construction of BCIB Project has started (**MR. ROELAN JIMENEZ,** *Boat Operator, Brgy. Timalan Concepcion,* Naic, Cavite)	• The project will diffidently coordinate with the Bgy and BFARMC to address that concern • There will be a separate meeting that will tackle the Right-of-Way Action Plan (RAP); • This meeting will only tackle the Environmental Impact Assessment (EIA) as well as the Perception Survey of the stakeholders (**MR. FREDERICK ESTERNON**, *EIA Team Leader*, EcosysCorp, Inc.)
• Raised concern regarding effect of the BCIB Project in their elementary school **(MS. NANCY C. LOMAT,** *Teacher III*, *Brgy. Timalan Concepcion,* Naic, Cavite**)**	• If the project is relatively far from the alignment there will be no impact on the elementary school. There will be a separate group to identify the affected structures and residents. • The project will conduct Air and Noise Sampling Study to determine the baseline data of Noise and Air Quality of the area. The data will be used to monitor the impact of the project during construction in terms of Noise and Air Pollution. • This project is funded by the Asian Development Bank (ADB) which is a strict organization that ensures just compensation to those Project Affected Persons (PAPs) and Sectors; • Reiterated that a separate meeting will be conducted that will tackle the Right-of-Way Action Plan (RAP) **(MR. ESTERNON)**
• Raised concern regarding the safety of the students during the project's construction **(MS. LOMAT)**	• For every construction site there is a environmental manager, environmental officer, safety officer, and engineers who will be incharge for that safety concerns' • For possible impact to the students in terms of noise and air pollution, based on the presented material, the project will be gathering and monitoring the noise and air quality prior, during, and after the project has been constructed;

	• Environmental baseline sampling will be conducted to gather the baseline condition of the area to ensure that the environmental quality of the surrounding areas will not change **(MR. ESTERNON)**
• Suggested to let all the fisher-folks attend the meeting not just representatives **(MR. REYNANTE ANATAN,** *Fisherman, Brgy. Timalan Concepcion,* Naic, Cavite**)**	• For the next meeting, a Public Scoping will be conducted where all potential Project Affected Persons (PAPs) shall be invited **(MR. ESTERNON)**
• Asked what are the allowed transportation vehicles on the bridge **(MS. LOMAT)**	• All types of vehicles are allowed to enter except bicycles **(ENGR. WINFRED LIWANAG,** *Engineer,* ARUP**)**
• Asked if the residents from their barangay will be prioritized for employment upon the start of construction **(NAME OF ATTENDEE UNKNOWN)**	Based on guidelines, Priority of employment shall be given to the qualified local residents and will be prioritized during the hiring process. Adequate public information for jobs available to local residents in the affected areas will be posted to the Barangay. The project will comply to the conditions and requirements of the labor code of the Philippines **(MR. ESTERNON)**

Photo No. 1 **Mr. Roelan Jimenez**, a Boat Operator from Brgy. Timalan Concepcion, asks where the boats shall dock once the construction of BCIB Project has started.

Photo No. 2 **Ms. Nancy C. Lomat,** *Teacher III* from from Brgy. Timalan Concepcion, raises concern regarding the effect of the BCIB Project to their elementary school.

Photo No. 3 **Mr. Reynante Anatan**, a *fisherman* from Brgy. Timalan Concepcion, suggesting to let all the fisherfolks attend the meetings and not just a few representatives.

Bataan-Cavite Interlink Bridge (BCIB) Project

Barangay Consultation/ Information, Education, Communication (IEC) Meeting

Timalan Concepcion Barangay Hall
Municipality of Naic, Cavite
21 January 2020, Tuesday, 2:00 P.M.

ATTENDANCE SHEET

IPIF ARUP

No.	Name	Gender F	Gender M	Designation / Title	Organization / Address	Contact No(s).	E-mail Address	Signature
1	Eusie D Aclisy	F		member	TODA			Euarisy
2	Fermina Vazquez	F			Senior	0920-[illegible]		F Vazquez
3	Rosalina Petruca	F			Senior			R. Petruca
4	JESSSA LINGAT	F		BHW	BRGY-TIMALAN	09261362347		[illegible]
5	Belen L Zabala	F		BHW	Senior	09555702065		B. Zabala
6	[illegible]	F		BHW		[illegible]		[illegible]
7	Rama C Dung	F		[illegible]	timalan	[illegible]		[illegible]
8	RUBY F. BAUTISTA	F		BHW	TIMALAN	09050975049		[illegible]
9	Lucena A Bonato	F		Senior	Timalan	09266095544		[illegible]
10	Clita A Buendia	F		B-H-W	Timalan	09051373593		P Buendia
11	Norman L Bigalbal		M	Brgy Kag	Timalan	09269677225		[illegible]
12	Reynaldo L Chino		M	Brgy Kag	Timalan	[illegible]		[illegible]
13	Amante Bigalbal		m	Brgy Kag	Timalan	09277712587		[illegible]
14	Rigolin OCHEZ			Boat operator	Timalan			[illegible]
15	Rolando dela Cruz			Mangingisda	Timalan			Rdela Cruz

EcosysCorp, Inc.

Bataan-Cavite Interlink Bridge (BCIB) Project

Barangay Consultation/ Information, Education, Communication (IEC) Meeting

Timalan Concepcion Barangay Hall
Municipality of Naic, Cavite
21 January 2020, Tuesday, 2:00 P.M.

ATTENDANCE SHEET

IPIF ARUP

No.	Name	Gender F	Gender M	Designation / Title	Organization / Address	Contact No(s).	E-mail Address	Signature
16	ROBLAN JIMENEZ		✓	boat owner	TIMALAN			[illegible]
17	Pablo Zamora		✓	Brgy Council	"			
18	ERWIN BAUTISTA		✓	Boat operator	"			
19	Sharmelyn Bautista	✓		Boat operator	"			
20	EDGAR VALENZUELA		✓	Boat pilot	"			[illegible]
21	Alexander Bautista		✓	Brgy tanod	"			
22	Marissa L. Pabaton	✓		P.B.	"	09950787010	timalan concepcion, naic cavite	D Pabaton
23	Rody L. BORRE		✓	BPSO				R.B.
24	RODOLFO MARALAN							R Maralan
25	Arlene D. Maralan	✓			"			[illegible]
26	Esmeraldo Maralan		✓		"			
27	Ma. Rosa Sulapas			owner				[illegible]
28	Roderick Cardinal							RC
29	NANCY C. LOMAT	✓		[illegible]	DEPED/TIMALAN ES			[illegible]
30	[illegible]	✓		[illegible]	[illegible]	[illegible]		[illegible]

EcosysCorp, Inc.

Bataan-Cavite Interlink Bridge (BCIB) Project

Barangay Consultation/ Information, Education, Communication (IEC) Meeting

Timalan Concepcion Barangay Hall

Municipality of Naic, Cavite

21 January 2020, Tuesday, 2:00 P.M.

ATTENDANCE SHEET

No.	Name	Gender F	Gender M	Designation / Title	Organization / Address	Contact No(s).	E-mail Address	Signature
31	EDGAR VALENZUELA		✓		BRGY. TIMALAN CONCEPCION	P		[signature]
32	Shennalyn O. Bautista	✓			BRGY Timalan Concepcion	09167022346	Shennalyn1212@gmail.com	[signature]
33	ROELAN JIMENEZ		✓		BRGY TIMALAN CONCEPCION			[signature]
34	Frailan O Oñez				" "			[signature]
35	Rolando dela Cruz		✓		Brgy Timalan C.			[signature]
36	Rodel H. MARALAN		✓		Brgy Timalan C.	09351554246		R. Maralan
37	ARLENE D. MARALAN	✓			Brgy TIMALAN	09445842902		[signature]
38	REYNANTE ARATAN		✓		Brgy Timalan			[signature]
39	Charlie Labra		✓		Brgy. Timalan	09480151490		[signature]
40	ARIS Maralan		✓		Timalan Balsahan			A Maralan
41	Roderick Cardinal		✓		Timalan -			RC
42	CRIS UBA	✓		ENGR-II	DPWH			[signature]
43		✓						
44								
45								

EcosysCorp, Inc.

Highlights of the 1st Barangay Consultation Meeting (BCM) Meeting
BATAAN-CAVITE INTERLINK BRIDGE (BCIB) PROJECT
Preliminary Engineering Design (PED)

Sabang Barangay Hall,
Brgy. Sabang, Naic, Cavite
21 January 2020, Tuesday, 10:00 A.M.

Presentation of the Project

Project Description - Presented by ARUP

EIA Process and Activities - Presented by Frederick Esternon (Ecosys Corp)

RAP Activities - Presented by Ecosys Corp

Open Forum:

Presented in the matrices are the summary of issues, concerns, comments, and suggestions raised during the 1st BCM in Brgy. Sabang, Naic. Responses to the queries are also included in the matrices.

Please see the attached attendance sheets for the list of participants during the meeting.

Summary of Issues, Concerns, Comments, and Suggestions Raised during the 1st SCM in Brgy.Sabang, Naic, (1/1)	
Queries/Concerns/Suggestions/Comments	**Responses to Queries**
• Clarified if they will be the Project Affected Persons (PAPs) for the BCIB Project; • Asked regarding the PAPs due compensation (**MR. ZALDY CROOC,** *TODA, Brgy. Sabang,* Naic, Cavite**)**	• There will be a separate meeting that will tackle the Right-of-Way Action Plan (RAP); • This meeting will only tackle the Environmental Impact Assessment (EIA) as well as the Perception Survey of the stakeholders (**MR. FREDERICK ESTERNON**, *EIA Team Leader*, EcosysCorp, Inc.)
• Raised concerns regarding the noise and air pollution as well as the people that will be affected by the project once the construction has started **(MR. Crooc)**	• Based on the presented material, we will be gathering noise and air quality prior, during, and after the project has been constructed; • **E**nvironmental baseline sampling will be conducted to gather the present condition of the area. This is for the project to monitor the possible impact of the project. Once the monitoring team detected any impact or changes to the actual condition of the area, the project will identify and install appropriate mitigating measures to ensure the environmental quality of the Project Affected Areas **(MR. ESTERNON)**
• Asked what will happen to the PAPs of the BCIB Project (**MR. RANDEL ROSS ROBLES,** *Chief Tanod, Brgy. Sabang,* Naic, Cavite)	• Reiterated that there will be a separate activity discussing the RAP; • All questions will be noted and answered on the said activity **(MR. ESTERNON)**
• Asked if the PAPs along the ROW will be compensated by the government;	• Confirmed that the government will be paying all landowners along the ROW;

• Inquired regarding the valuation of the land that will be acquired (**MR. FELIPE CATUBIG**, *TODA, Brgy. Sabang,* Naic, Cavite**)**	• Reiterated that there will be a separate activity discussing the RAP; **(Ecosys RAP Team)**
• Inquired about the manpower that will be hired during the construction of the BCIB Project (**MR. JERRY N. CABUNTON,** *Kagawad, Sabang,* Naic, Cavite)	• Informed that there is a certain percentage of manpower that will be hired locally; • Priority of employment shall be given to the qualified local residents and will be prioritized during the hiring process. Adequate public information for jobs available to local residents in the affected areas will be posted to the Barangay. The project will comply to the conditions and requirements of the labor code of the Philippines **(MR. ESTERNON)**

Photo No. 1 **Mr. Zaldy Crooc**, a *TODA member* from Brgy. Sabang, asking for clarification regarding their status as a PAP of BCIB.

Photo No. 2 **Mr. Jerry N. Cabunton**, a *barangay official* from Brgy. Sabang, inquiring about the manpower that will be hired during the construction of the BCIB Project.

Photo No. 3 **Mr. Frederick Esternon**, *EIA Team Leader* from EcosysCorp, Inc. explaining that environmental baseline sampling will be conducted to gather the present condition of the area. This is for the project to monitor the possible impact of the project. Once the monitoring team detected any impact or changes to the actual condition of the area, the project will identify and install appropriate mitigating measures to ensure the environmental quality of the Project Affected Areas.

Bataan-Cavite Interlink Bridge (BCIB) Project

Barangay Consultation/ Information, Education, Communication (IEC) Meeting

Sabang Barangay Hall

Municipality of Naic, Cavite

21 January 2020, Tuesday, 10:00 A.M.

ATTENDANCE SHEET

IPIF ARUP

No.	Name	Gender F	Gender M	Designation / Title	Organization / Address	Contact No(s).	E-mail Address	Signature
1	FELIPE CATUBIG		✓		SABANG CAA			
2	MARY CRIS SAMSON-URRO	✓		E-III	DPWH			
3	EDNA LYN D. NGO	✓		E-II	DPWH			
4	JUNNEL BAUTISTA		✓	E-II	DPWH			
5	RAPHAEL JOHN PEDRASO		✓	E-II	DPWH			
6	MAFKER VINANCO V		✓	Proj coor.	ARUP			
7	Rowena Delarico	✓			BHW			
8	Elenita O. Lingcuran	✓		Senior	Naic	[illegible]		
9	Anacorita Mendoza	✓		Senior	Masagana SA			
10	RODOLFO GELIFAN		✓	TODA	TODA SABANG	[illegible]		
11	Zaldy Creoc		✓	Pres. TODA	TODA I			
12	Raul H. Catubig		✓	Brgy Admin	PWD	09169501321		
13								
14								
15								

EcosysCorp, Inc.

Representatives from LGUs, BLGUs, DOTR, PNR, JDT, and ADB

LGUs

City/Municipality	Name	Designation/Title
Sabang, Naic		

BLGUs

Barangay	Name	Designation/Title
SABANG	CERALYN ROLLON	BHW
SABANG	MARILYN ANTAZO	BHW
~~SABANG~~	~~ELENITA LINGCURAN~~	~~BHW~~
~~SABANG~~	~~ANACORITA MENDOZA~~	~~BHW~~
SABANG	MYRA REMONOS	BHW
SABANG	CHRISTINE JOY LAGUAN	BHW
SABANG	EVELYN ARROGANTE	BHW
SABANG	ROBLES, RANDEL ROSS S.	AKP / B.A.D.A.C
Sabang	Dezon King R. Mobc	Kagawad
Sabang	JERRY N. CABUNTO	KagawAD
SABANG	Helen E. MANAO	Kagawad
Sabang	AVEGAIL C. CATUBIG	Pres. PWD
SABANG	ANALYNN D. HINTOG	Kagawad
SABANG	Rogelio J. Anggon	Brgy. Kagawad
SABANG	JOSEFINA F. RICOR	HEALTH OFFICER
SABANG	DONATA SISRACON	VWAC

~~DOTR~~	
SABANG / JANELLE M. CAUBA	Sk Chairperson
SABANG Shemlyn H. tu	Secretary
Donata Sisracon	VAWC officer
ROLANDO MAGAMBA/	BPSO
Anna lisa C Layosa	BHW
~~RNB~~	
FEHPI CATUBIG	Fatubig
ALVIN JOSEPH I. CRUZ	PASTORAL COUNCIL/INTERFAITH
ronina M. Malonicom Sabang/BHW	A. Malonicom BHW
~~IDT~~	
~~ADB~~	

Highlights of the 1st Barangay Consultation Meeting (BCM) Meeting
Environmental Impact Assessment (EIA)
Bataan-Cavite Interlink Bridge (BCIB) Project
Preliminary Engineering Design (PED)

Alas-Asin Barangay Hall,
Brgy. Alas-Asin, Mariveles, Bataan
22 January 2020, Wednesday, 1:00 P.M.

Presentation of the Project – ARUP/DPWH/EcosysCorp

EIA and Environmental Sampling Activities - EcosysCorp

Open Forum:

Presented in the matrices are the summary of issues, concerns, comments, and suggestions raised during the 1st BCM in Brgy. Alas-Asin, Mariveles. Responses to the queries are also included in the matrices.

Please see the attached attendance sheets for the list of participants during the meeting.

Summary of Issues, Concerns, Comments, and Suggestions Raised during the 1st SCM in Brgy. Alas-asin, Mariveles, (1/1)	
Queries/Concerns/Suggestions/Comments	**Responses to Queries**
• Asked the specific areas and Sitio to be traverse by the BCIB Project (**MS. MARIA CRISTINA CANLAS,** *BESMO, Brgy. Alas-Asin,* Mariveles, Bataan)	• Consultations with the barangay captains are still ongoing to identify the specific area to be traversed by the BCIB Alignment; (**MR. FREDERICK ESTERNON**, *EIA Team Leader*, EcosysCorp, Inc.)
• Raised concern regarding the pollution that will be produced during the construction of the BCIB Alignment; • Asked who will be responsible in cleaning the pollutants generated during and after the construction (**MS. CANLAS)**	• Based on the presented material, we will be gathering noise and air quality prior, during, and after the project has been constructed; • **E**nvironmental baseline sampling will be conducted to gather the present condition of the area. This is for the project to monitor the possible impact of the project. Once the monitoring team detected any impact or changes to the actual condition of the area, the project will identify and install appropriate mitigating measures to ensure the environmental quality of the Project Affected Areas; • An Environmental Compliance Certificate (ECC) is the product of these meetings which will serve as a planning tool supervised by the DPWH; • The ECC conditions will be followed during the duration of the BCIB Project **(MR. ESTERNON)**
• Asked if there will be toll gates (**MR. POCHA BALMES,** *Pastor, Brgy. Alas-Asin,* Mariveles, Bataan)	• As of this moment, there are no toll gates **(MR. ESTERNON)**

Photo No. 1 **Ms. Maria Canlas,** *BESMO* of Brgy. Alas-Asin, raising concern regarding the pollution that will be produced during construction of the BCIB Project.

Photo No. 2 **Mr. Pocha Balmes**, a *pastor* from Brgy. Alas-Asin, asks if the BCIB Project will have toll gates.

Bataan-Cavite Interlink Bridge (BCIB) Project

Barangay Consultation/ Information, Education, Communication (IEC) Meeting

Alas-Asin Barangay Hall
Municipality of Mariveles, Bataan
22 January 2020, Wednesday, 1:00 P.M.

ATTENDANCE SHEET

IPIF ARUP

No.	Name	Gender F	Gender M	Designation / Title	Organization / Address	Contact No(s).	E-mail Address	Signature
1	CHRISTINE JOY SANCHEZ	O		TEACHER	DEPED	0997205[illegible]		
2	ALECA N. MEDINA	O		TEACHER	DEPED			
3	NESTOR M. CUNANAN		O	CHIEF OF STAFF		09[illegible]8[illegible]		
4	Robel Dave L. Daynay		O	BESMO Clerk		09359679905		
5	MARIA CRISTINA B. [illegible]	O		BESMO	LGU - Alasasin	0949-378-2711		
6	Vanna T. Reyes	O		BADAC	Alasasin	0910 - [illegible]	[illegible]@yahoo.com	
7	Cherry D. Aluyo	O		Brgy. Kagawad	Alasasin	09192378583		
8	Amalia V. Nieto	O		BCPC Clerk	Alasasin	0908[illegible]		
9	Rosalina R. Alvarez	O		Brgy. Utility	Alasasin			
10	ARNOLD PURIO		/	Utility	A			
11	Elmer P. Valdez			BPSO chief	Alasasin			
12	EFREN C. AZORES		/	IHPRA	ALAS ASIN	09494326789		
13	DEANNE IRISH A. TENORIO	F		SK Chairperson	Alasasin	0945324[illegible]		
14	CRISTINA C. REYES			PRESIDENT	DFW ASC.	0910[illegible]4424		
15	ROGER P. Pangaman		/	[illegible]		094[illegible]		

PARDS - disaster
RESCUM - PWD

BCPC - Children
CAFM - Family

Anti
BADAC - drugs
BESMO - Envi.

EcosysCorp, Inc.

Bataan-Cavite Interlink Bridge (BCIB) Project

Barangay Consultation/ Information, Education, Communication (IEC) Meeting

Alas-Asin Barangay Hall
Municipality of Mariveles, Bataan
22 January 2020, Wednesday, 1:00 P.M.

ATTENDANCE SHEET

IPIF ARUP

No.	Name	Gender F	Gender M	Designation / Title	Organization / Address	Contact No(s).	E-mail Address	Signature
16	Fely E. Cogungan	O		Announcer	ERNAI Ligand	0912[illegible]		
17	RALPH SEGARRA		O	EMHC	STO. NIÑO PARK II	0909[illegible]		
18	Horacite R. [illegible]			Kagawad		09482[illegible]		
19	ROMMEL R. ACCEPTAC		O	KAGAWAD	ALASASIN	[illegible]		
20	Galicano Raya			Property Custo				
21	Cornelio V. Pineda		O	BRGY. ELECTRICIAN	Alas-asin	[illegible]		
22	Ericardo C. Magrawa		O	[illegible] - CESM	Alasasin	09[illegible]		
23	Emma M. Villegracia	O		Rel. CESM	Alasasin	[illegible]		
24	MARIA AURORA LLANTO	O		POPCOM	ALASASIN	[illegible]	[illegible]	
25	Roberto M Venturina				KAGAWAD	0928[illegible]		
26	Rocha Balmes OSJ		O	Parish Priest	Parish Rd.			
27	Gemma A. VERANI	O		Brgy. Captain	[illegible]	[illegible]		
28	Wenie Lu A. Panganiban	O		DCW - Main	Alasasin	09216057[illegible]		
29	MARRIZA M. JUSTINIANO	/		DCW - Bakery	Alasasin	[illegible]		
30	ROBERTO M. ARESTOL SR.			P. BARANGAY	LGU	09[illegible]		

EcosysCorp, Inc.

Bataan-Cavite Interlink Bridge (BCIB) Project

Barangay Consultation/ Information, Education, Communication (IEC) Meeting

Alas-Asin Barangay Hall
Municipality of Mariveles, Bataan
22 January 2020, Wednesday, 1:00 P.M.

ATTENDANCE SHEET

IPIF ARUP

No.	Name	Gender F	Gender M	Designation / Title	Organization / Address	Contact No(s).	E-mail Address	Signature
31	[illegible] I. [illegible]	✓		P. [illegible]	+ Pg	09661973844		
32	Michael D. Fernandez			BC-Principal	Morita Bay 21	09460270964		
33	TOMASITO R. CARINO		◯	BRGY. KAGAWAD	Alas-Asin	0946-6145725		
34	Celestina D. Aguilar			OFW	Paseo de Hodi St	09[illegible]8986		
35	ANALIZA E. PERAN				PAROSS F1	09[illegible]7256Y		
36	ELSA V. RUBIC	✓			PAROSS F1	0910 [illegible]		
37	Marfino R. [illegible]			DCW-1	DAY CARE	0910[illegible]470		
38	Soraida R. Payorillo	✓		BHW-[illegible]	[illegible]	[illegible]		
39	ANTONIO R. LUTAPO			BRGY MASANAO				
40	LUWINDA P. NAVARROSA	F		BHW		09308132930		
41	Marlinda A. Uno	✓		BHW		0912443[illegible]		
42	Marilyn G. Asuncion	✓			GPTA/BAPA	09308709388		
43	EDGARDO R. ARRIESGADO		✓	LUPON M.	JMC COMPOUND	09090989767		
44	MERCEDES T. SALUNGA	F		DCW	MANUGAHAN DCC	0946486092		
45	SHIRLEY P. YULO	F		DCW	[illegible] nene			

EcosysCorp, Inc.

Bataan-Cavite Interlink Bridge (BCIB) Project

Barangay Consultation/ Information, Education, Communication (IEC) Meeting

Alas-Asin Barangay Hall
Municipality of Mariveles, Bataan
22 January 2020, Wednesday, 1:00 P.M.

ATTENDANCE SHEET

IPIF ARUP

No.	Name	Gender F	Gender M	Designation / Title	Organization / Address	Contact No(s).	E-mail Address	Signature
46	GINA V. GREGORIO	✓		[illegible]	LGU	[illegible]		
47	Irenelyn A. Tia	✓		BHW		[illegible]		
48	MA. VICTORIA V. [illegible]	✓		PWD PRESIDENT	PWD	09[illegible]		
49	GILBERTO V. PABLO		✓	SAMMAI		09[illegible]		
50	CRIS [illegible]	✓		Engr III	DPWH			
51								
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EcosysCorp, Inc.

Highlights of the 1st Barangay Consultation Meeting (BCM) Meeting
Environmental Impact Assessment (EIA)
Bataan-Cavite Interlink Bridge (BCIB) Project
Preliminary Engineering Design (PED)

Mt. View Barangay Hall,
Brgy. Mt. View, Mariveles, Bataan
22 January 2020, Wednesday, 9:00 A.M.

Presentation of the Project – ARUP

EIA and Environmental Sampling – Ecosys Corp

Open Forum:

Presented in the matrices are the summary of issues, concerns, comments, and suggestions raised during the 1st BCM in Brgy. Mt. View, Mariveles. Responses to the queries are also included in the matrices.

Please see the attached attendance sheets for the list of participants during the meeting.

Summary of Issues, Concerns, Comments, and Suggestions Raised during the 1st SCM in Brgy. Mt. View, Mariveles, (1/2)

Queries/Concerns/Suggestions/Comments	**Responses to Queries**
• Asked if there will be an exit to Corregidor on the BCIB Alignment; • Raised concern that a construction of an exit point will result to repercussions on Corregidor Island (**MR. AURELIO TABORNAL,** *Puyat Flooring*, *Brgy. Mt. View,* Mariveles, Bataan)	• Based on the design, there will be no exit point in Corregidor to avoid further impact in the small island (**MR. FREDERICK ESTERNON**, *EIA Team Leader*, EcosysCorp, Inc.)
• Asked when to expect the development and traffic from the Cavite and Bataan entry points **(MR. TABORNAL)**	• We are still in the Preliminary Engineering Design but based on the timeline, by 2027 there will be apparent changes along the entry and exit points **(DPWH)**
• Raised concern regarding the pollution that the BCIB Project will produce upon construction and operation; • Confirmed if the rumors that fisherfolks would not be allowed to go near the bridge post (**MR. SOTERO DOCULAN,** *Fisherfolk, Brgy. Alas-Asin,* Mariveles, Bataan)	• Based on the presented material, we will be gathering noise and air quality prior, during, and after the project has been constructed; • Environmental baseline sampling will be conducted to gather the present condition of the area. This is for the project to monitor the possible impact of the project. Once the monitoring team detected any impact or changes to the actual condition of the area, the project will identify and install appropriate mitigating measures to ensure the environmental quality of the Project Affected Areas **(MR. ESTERNON)**
• Asked if the fisherfolks could still use the bridge incase their boats break down; • Shared that fisherfolks frequently stays in Corregidor Island when their boats break down (**MR. JOSE CONSON** *Fisherman Brgy. Alas-Asin,* Mariveles, Bataan	• There will be no stairs to climb the post of the bridge; • It will be allowed as long as you have a safe mode of transportation; • Walking and cycling are not allowed on the bridge **(MR. ESTERNON)** • It can be considered in the design and can be written as a suggestion in the Perception Survey (**MS. CRIS UTOD,** *Engineer III*, Department of Public Works and Highways)
• Reiterated **Mr. Tabornal's** point that constructing an entry and exit ramp will result to repurcussions on Corregidor ISLAND	

(MR. ESTERNON)	

Summary of Issues, Concerns, Comments, and Suggestions Raised during the 1st SCM in Brgy. Mt. View, Mariveles, (2/2)	
Queries/Concerns/Suggestions/Comments	**Responses to Queries**
• Raised Mr. Doculan's unanswered question regarding the Right-of-Way (ROW) of fisherfolks along the Bridge Structure (**MR. BONIFACIO VIRTUOSO,** *Fisherfolk, Brgy. Alas-Asin,* Mariveles, Bataan)	• There will be a separate meeting that will tackle the Right-of-Way Action Plan (RAP) where all fisherfolks in Alas-Asin will be invited; • This meeting will only tackle the Environmental Impact Assessment (EIA) as well as the Perception Survey of the stakeholders **(MR. ESTERNON)**

Photo No. 1 **Mr. Sotero Doculan**, BFARMC from Brgy. Mt. View, raising concerns regarding the pollution that the BCIB Project will produce upon construction and operation.

Photo No. 2 **Mr. Jose Conson,** a *fisherfolk* from Brgy. Mt. View, asks if fishermen can use the bridge incase their boats break down.

Photo No. 3 **Mr. BONIFACIO VIRTUOSO**, *a fisherfolk from Brgy. Mt. View,* raising question regarding the Right-of-Way (ROW) of fisherfolks along the Bridge Structure.

Bataan-Cavite Interlink Bridge (BCIB) Project

Barangay Consultation/ Information, Education, Communication (IEC) Meeting

Mt. View Barangay Hall
Municipality of Mariveles, Bataan
22 January 2020, Wednesday, 9:00 A.M.

ATTENDANCE SHEET

No.	Name	Gender F	Gender M	Designation / Title	Organization / Address	Contact No(s).	E-mail Address	Signature
1	MARY RHE ANN HO CABAHUG			Youth Sector	MT. VIEW	09566[illegible]		
2	MARYNELLE HO CABAHUG			Youth Sector	MT. VIEW	0909-150-5353		
3	CRISTOPHER ANDES VERGARA			Youth Sector	[illegible]	0926[illegible]992		
4	FRANCIS NARANJA			YOUTH SECTOR	MT VIEW	09100355056		
5	JANETT D. ABAO	✓		HOME OWNERS ASSOC	SAMAHA	09999777120		
6	MARLE L. MAPLA	✓		HOMEOWNERS ASSOCIATION	SAMAHA	09276151135		
7	SOLIDAD K. CENIZAL	✓		TEACHER-ALS	MT VIEW	09336926[illegible]		
8	Frederick Eckerman		✓	EIA Specialist	EcosysCorp	09175376732		
9	[illegible] CORSON		✓	Mangingisda		09564155293		
10	Bonifacio Virtuoso		✓	[illegible]				
11	Angelyn B. Opiton	✓		ALS	Mt. View	0907[illegible]		
12	REY MENDOZA		✓	[illegible]	[illegible]	0917-3[illegible]7		
13	Josefa D. Dacalan	✓	—	BFARMC		09106176487		
14	AMANCIA P. MIGUEL			home owner	Mt. View	09493149727		
15	CECILIO A. LUNGCAY		✓	PRES	MT VIEW	[illegible]		

EcosysCorp, Inc.

Bataan-Cavite Interlink Bridge (BCIB) Project

Barangay Consultation/ Information, Education, Communication (IEC) Meeting

Mt. View Barangay Hall
Municipality of Mariveles, Bataan
22 January 2020, Wednesday, 9:00 A.M.

ATTENDANCE SHEET

No.	Name	Gender F	Gender M	Designation / Title	Organization / Address	Contact No(s).	E-mail Address	Signature
16	IRENEO G. BARLIS		✓	SENIOR CITIZEN	Villa Carmen	—	—	
17	ELIAS S. DECROSARIO		✓		MT. VIEW [illegible]			
18	Connie Balansag	✓		TWP	Mt. View			
19	[illegible]		✓	PRINCIPAL	MVES			
20	LEONORA B. MORANO	✓		PRESIDENT	KALIPI-MT VIEW	0966[illegible]		
21	Roselle Alibar	✓		Kalipi - Secretary	Mt. View	0929[illegible]		
22	FERDINAND J. GUTIERREZ		✓	BARANGAY	MT. VIEW	09176253795		
23	LEONARD A. LUNGCAY		✓	P.O.	MT. VIEW	09176[illegible]		
24	[illegible]	✓		Brgy Clerk	mt. View	0967[illegible]		
25	ACMARIO C. QUITENG		✓	Pres/Bagaura	MT.V	09[illegible]6755191		
26	Dominador Malaga				MT.V			
27	RHOEL H. LAKUTA			PPC N.P	STA. GEMMA PARISH	09399711913		
28	[illegible]	✓		E-III	DPWH			
29								
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EcosysCorp, Inc.

Bataan-Cavite Interlink Bridge (BCIB) Project

Barangay Consultation/ Information, Education, Communication (IEC) Meeting

Mt. View Barangay Hall
Municipality of Mariveles, Bataan
22 January 2020, Wednesday, 9:00 A.M.

ATTENDANCE SHEET

IPIF ARUP

No.	Name	Gender F	Gender M	Designation / Title	Organization / Address	Contact No(s).	E-mail Address	Signature
31	Maria Julia F. Cuevas	✓		Brgy Kagawad				
32	Aurelio Taborral		✓	Plant Mgr	Royal Flooring	0929817494	[illegible]	
33	Maria E. Reyna	✓		HR Supervisor	Royal Flooring		[illegible]	
34	Aida Catalina E. Avila		✓	MHW		09123615263		
35	FIDEL F. MURILLO		✓	BRGY. KAGAWAD		09083007168		
36	Julita M. Ramos			OPTA MVES		09081601609		
37	EDELBERTO ROCLE		✓	BPC Vice Pres/Cs	Mt. View Garden Ville HS	09952729187	edelberto.rocle @ gsisphilippines.org	
38								
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EcosysCorp, Inc.

Public Scoping
Bataan-Cavite Interlink Bridge
Preliminary Engineering Design (PED)

Venue:	**Naic Municipal Hall, Brgy. Ibayo Silangan, Naic, Cavite**
Date:	**07 February 2020 (Monday)**
Time:	**8:30 AM**

ATTENDEES			
SECTORS REPRESENTED	**TOTAL NUMBER OF MALES**	**TOTAL NUMBER OF FEMALES**	**TOTAL NUMBER OF PARTICIPANTS**
• Municipal Fisheries and Aquatic Resources Management Council (MFARMC) – 3 • Municipal Engineering Office – 1 • Municipal Assessor's Office - 1 • Municipal Agriculture Office - 1 • Municipal Planning and Development Office – 1 • Municipal Environment and Natural Resources Office – 1 • Barangay Chairpersons – 2 • Provincial Government- Environment and Natural Resources Officer – 1 • Provincial Environment and Natural Resources Officer (PENRO) – 1 • Manila Bay Coordinating Council – 1 • Municipal Health Office - 1 • Philippine Coast Guard – 2 • Religious Group – 1 • Maritime Group - 1 • DepEd - 1 • DPWH – 2 • ARUP - 2 • EcosysCorp, Inc. - 8	21	11	31

PROCEEDINGS	
Introduction	The EIA Team Lead introduced the team and provided the agenda of the meeting. He also discussed brief results of IEC meetings both from Municipal and Barangay Level activities. He mentioned that there were series of consultations done with the different stakeholder groups present in the project areas all yielded positive results for the project. There was no objection to the project expressed by any stakeholder. Concerned LGUs, from barangay up to municipal/city

	levels, even expressed their support, adding that the project can bring further developments to their respective localities. There were clarifications raised and concerns expressed by some stakeholders, especially with regard to the project's potential environmental impacts and how these may affect residents/people. The EIA Team was able to decisively address these concerns through careful explanation of the EIA process and how impacts and corresponding mitigating measures will be identified, dispelling whatever concerns stakeholders may have regarding the project's potential impacts. The EIA Team also included these concerns in the EMP. He also provided brief project description and the need for baseline information for the study.
Queries/Concerns/Suggestions/Comments	**Responses to Queries**
• **MS. ANNABELLE CAYABYAB, *HEAD*, CAVITE PROVINCIAL GOVERNMENT – ENVIRONMENT AND NATURAL RESOURCES OFFICE (PG-ENRO)** said that NAMRIA already conducted the research mapping last year on confirming several habitats like seagrass and mangrove areas in Manila Bay to be used as baseline data. More so, she shared that the UP Marine Science Institute also has several studies done on Manila Bay that can be used as reference for the project's baseline data. She suggested to include a vulnerability assessment of coastal erosion in Naic and indicate the Manila Bay source and sink.	• **DR. RUBEN ESTUDILLO**, ***EIA: MARINE SAMPLING TEAM LEADER*, ECOSYSCORP, INC.)** said that they already gathered secondary data from the UP Marine Science Institute but he did not come across the research mapping conducted by NAMRIA.
• **MS. HERRERA** asked if there are permits or clearance that need to be accomplished before conducting the marine surveys	• **MR. JERSON DETAZA, Coast Guard Substation Naic, Cavite**, answered that coordination works with the Office of the Coast Guard, including submission of letter of request to conduct the marine study and regarding schedules and tasks, must be done prior to any activities of the marine sampling team.
• **MS. HERRERA** affirmed that the team will be coordinating with the Naic Coast Guard regarding the activities and surveys to be done by the marine sampling team.	
• A **Representative from PENRO** suggested to update PG-ENRO regarding the BCIB Project activities, which potentially affect the Manila Bay. Moreover, to properly disseminate information to the whole province so that there will be unified movement and support towards the Project.	• **MS. HERRERA** agreed and noted the suggestion.

Photo 1. DR. RUBEN ESTUDILLO*, EIA: Marine Sampling Team Leader*, discussing the marine activities to be conducted for the BCIB Project

Photo 2. MS. ANNABELLE HERRERA, Project Director for the BCIB Project, Inc., asking if there are permits or clearance that need to be accomplished before conducting marine surveys.

Photo 3. A representative from PENRO suggesting to update the PENRO regarding the BCIB Project activities that can potentially have an effect on the Manila Bay.

Public Scoping
Bataan-Cavite Interlink Bridge
Preliminary Engineering Design (PED)

Venue:	**Mariveles Municipal Hall, Roman Super Highway, Mariveles, Bataan**
Date:	**11February 2020 (Tuesday)**
Time:	**10:00 AM**

ATTENDEES			
SECTORS REPRESENTED	**TOTAL NUMBER OF MALES**	**TOTAL NUMBER OF FEMALES**	**TOTAL NUMBER OF PARTICIPANTS**
• Municipal Administrator– 1 • Municipal Fisheries and Aquatic Resources Management Council (MFARMC) – 2 • Municipal Engineering Office – 2 • Municipal Assessor's Office - 2 • Municipal Agriculture Office - 1 • Municipal Planning and Development Office – 1 • Municipal Environment and Natural Resources Office – 1 • Barangay Chairperson – 3 • Philippine Coast Guard – 3 • Administrative Staff - 2 • DPWH – 2 • ARUP – 1 • EcosysCorp, Inc. - 5	21	5	26

PROCEEDINGS	
Introduction	The EIA Team Lead introduced the team and provided the agenda of the meeting. He also discussed brief results of IEC meetings both from Municipal and Barangay Level activities. He mentioned that there were series of consultations done with the different stakeholder groups present in the project areas all yielded positive results for the project. There was no objection to the project expressed by any stakeholder. Concerned LGUs, from barangay up to municipal/city levels, even expressed their support, adding that the project can bring further developments to their respective localities. There were clarifications raised and concerns expressed by some stakeholders, especially with regard to the project's potential environmental impacts and how these may

	affect residents/people. The EIA Team was able to decisively address these concerns through careful explanation of the EIA process and how impacts and corresponding mitigating measures will be identified, dispelling whatever concerns stakeholders may have regarding the project's potential impacts. The EIA Team also included these concerns in the EMP. He also provided brief project description and the need for baseline information for the study.
Queries/Concerns/Suggestions/Comments	**Responses to Queries**
MR. ANGEL PELIGLORIO, JR of *Municipal Administrator,* Mariveles, Bataan, inquired about the schedules of the marine sampling	• **DR. RUBEN ESTUDILLO,** *Marine Sampling: EIA Team Leader, EcosysCorp, Inc***.,** answered that near shore marine sampling will be conducted on 12 February 2020 while the main trunk marine sampling will be done on 13 February 2020. The survey will start at Brgy. Alas-asin towards the Cavite side. If the weather is good, the team will be diving in Corregidor since it will be difficult to conduct samplings during the afternoon because it is already Amihan season. Additionally, he said that boats will be rented and that a bigger one is preferred
• **ADMIN PELIGLORIO JR** explained that the question regarding the schedules is for the sake of transparency. He suggested to utilize the resources from their municipality when conducting the surveys and asked if it is possible for the team to rent the locals' boats.	• **DR. RUBEN ESTUDILLO** said that the offer is highly appreciated and confirmed that the team will be utilizing the resources of the municipality.
• **ADMIN PELIGLORIO JR** agreed to get the marine sampling team's contact details and will proceed with coordination	• **MR. FREDERICK J. ESTERNON** affirmed the Administrator's statement and added that the meeting is conducted to ask for participation from the locals and the LGU.
• **DR. ESTUDILLO** asked if there are marine sanctuaries in the municipality.	• **MR. FELIX DE LEON, ADMINISTRATIVE STAFF, MARIVELES, BATAAN,** said that there are no marine sanctuaries but there are artificial reefs near the pier in Brgy. Alas-Asin placed almost 10 years ago, which are made of concrete modules and nylon string. He also added that there is a possibility that the nylon strings have already been cut because it was installed a long time ago.

Summary of Issues, Concerns, Comments, and Suggestions Raised during the 1st Marine Sampling and Other Environmental Sampling Consultation Meeting in Mariveles, Bataan (2/4)	
Queries/Concerns/Suggestions/Comments	**Responses to Queries**

• **MR. FREDERICK ESTERNON**, *EIA Team Leader*, EcosysCorp, Inc. asked about the possibility of knowing the location of the artificial reefs.	• **MR. FELIX DE LEON, Administrative Staff, Mariveles, Bataan,** said that the consultant team may request information from the Bureau of Fisheries Regional Office, which funded the installation of said artificial reefs.
• **MR. ANGEL PELIGLORIO JR,** *Municipal Administrator,* inquired if there any coral formations along the BCIB Alignment.	• **MR. DE LEON** answered that there are coral formations in Brgy, Alas-asin, which can be seen if the team would dive.
• **DR. RUBEN ESTUDILLO,** *Marine Sampling: EIA Team Leader, EcosysCorp, Inc***,** asked for the clarity of water within the municipality during the Amihan season.	• **MR. DE LEON** answered that it is best to dive during March and April. He also added that seaweeds can be seen in the waters of Brgy. Alas-asin when diving.
• **MS. ANNABELLE HERRERA,** *Project Director*, EcosysCorp, Inc.), asked if there are permits or clearancs that need to be accomplished before conducting marine surveys.	• **MR. DE LEON** answered that a letter of request was submitted to the Corregidor Foundation and an endorsement letter was already given. • **MR. DE LEON** added that it is important to ask for a letter of request from the office of the coast guard. • **MR. AMBANG,** ***MARIVELES COAST GUARD SUBSTATION,*** *s*aid that the boat that shall be used for the surveys must first be registered to the coast guards based on the boat's category and purpose. • **Mr. de Leon** said that the marine sampling team must update the coast guard regarding their schedule as well as the boats that will be used.
• **MS. MARIA CRISTINA**, *Municipal Agriculturist, Mariveles*, Bataan, asked the number of boats that will be used during the marine sampling.	• **DR. ESTUDILLO** said that three boats will be used for near-shore activities while two larger boats will be used for off-shore surveys.
• **DR. ESTUDILLO** asked with whom to coordinate regarding boat rentals.	• **MR. FERDINAND BANCUA**, *Head-Municipal Fisheries and Aquatic Resources Management Council MFARMC*, Mariveles, Bataan, explained the types of boat that can be used near-shore and offshore. He also added that **Mr. Miguel de Loyola** can be asked for coordination regarding boat rentals.
• **MS. HERRERA** shared that the Environmental Impact Statement (EIS) must be finished by March 2020 so that by May 2020, the BCIB Project can proceed to the Detailed Engineering Design (DED).	
• **DR. ESTUDILLO** assured that everything discussed during the meeting shall be considered in the design.	
• **DR. ESTUDILLO** asked if the barangay local government unit (BLGUs) with the jurisdiction over Corregidor was already informed.	• **MR. ESTERNON** answered that Barangay 51B was already informed as well as the Corregidor Foundation. Mire, the Corregidor Foundation has already given its endorsement letter.

<table>
<tr><th colspan="2">Summary of Issues, Concerns, Comments, and Suggestions Raised during the 1st Marine Sampling and Other Environmental Sampling Consultation Meeting in Mariveles, Bataan (3/4)</th></tr>
<tr><th>Queries/Concerns/Suggestions/Comments</th><th>Responses to Queries</th></tr>
<tr><td>• MR. AMBANG informed the marine sampling team that they need to indicate their route as well as the activities that will be conducted, such as scuba diving, in their letter for the Coast Guard.</td><td></td></tr>
<tr><td>• DR. ESTUDILLO shared that the meeting also served as a coordination meeting as well as a courtesy call.</td><td>• MR. DE LEON said that the marine sampling team can coordinate with the Fisheries and Aquatic Resources Management Council (FARMC) should baseline data be needed.</td></tr>
<tr><td>• DR. ESTUDILLO asked if the site to be traversed by the BCIB Project in Mt. View is accessible by car.</td><td>• HON. LEONCIO LUNGCAY, Chairman, Brgy. Mt. View, Mariveles, Bataan said that there is a 100-meter walk before arriving to the site</td></tr>
<tr><td>• MR. BANCUA <u>asked</u> how the BCIB Project can help the fisherfolks because they will surely be affected by it.</td><td>• Ms. Herrera answered that aside from the Environmental Impact Assessment (EIA) study, the Right-of-Way Action Plan (RAP) study will also be a part of the proces,s which focuses on the societal impact of the BCIB Project. While the EIA focuses on the environmental aspect and the people’s perception, RAP studies will tackle the entitlement and the rights of the Project Affected Persons (PAPs). Interviews will be conducted for the RAP study as well as meetings in the community level where the PAPs, such as the fisherfolks, will be invited to inform them of their rights and compensations.</td></tr>
<tr><td>• MR. ALFREDO GABIA., Consultant-Municipal Agriculture, Mariveles, Bataan stated the importance of the conduct of public consultations for the BCIB Project;
• He shared that there were no public consultations during the construction of other previous projects in the municipality;
• He expressed his hope that all concerns will be raised and that the PAPs shall be justly compensated</td><td>• MS. HERRERA assured that the Asian Development Bank (ADB), the foreign counterpart of the government that will fund the project, would not allow the project to proceed without RAP and an Environmental Compliance Certificate (ECC). She also said that it is significant part of the social safeguards and meetings will first be with the LGUs followed by the meetings at the barangay level.</td></tr>
<tr><td>• ADMIN PELIGLORIO asked about the topic for the next meeting.</td><td>• MS. HERRERA answered that the next meeting will be at the barangay level meeting where potential PAPs shall be invited and the RAP will further be explained</td></tr>
<tr><td>• ADMIN PELIGLORIO raised his concerns that there is a possibility that the Roman Super Highway will be congested upon the operation of the BCIB.
• He shared that road-widening is currently happening along the highway, from four lanes to six lanes, but the road widening was planned for the current traffic flow in the</td><td>• MS. HERRERA said that the traffic component is a part of the BCIB’s engineering feasibility study and a traffic feasibility study is already ongoing. Traffic is also being studied in the EIA but only its environmental impact.

• A REPRESENTATIVE OF ARUP said that traffic</td></tr>
</table>

municipality without the BCIB. • He also added that that Roman Super Highway could possibly have an EDSA-like traffic after 10 years.	projection is part of the study.

Summary of Issues, Concerns, Comments, and Suggestions Raised during the 1st Marine Sampling and Other Environmental Sampling Consultation Meeting in Mariveles, Bataan (4/4)	
Queries/Concerns/Suggestions/Comments	**Responses to Queries**
• **ADMIN PELIGLORIO** raised his concerns regarding the possibility that Mariveles is not yet ready for the impact of the BCIB Project. • He suggested that if transportation is already being developed, all related components should have supplemental developments as well.	• **MS. HERRERA** suggested that since the concern was raised on the municipal council, then to the Provincial Development Council (PDC), then finally to the Provincial Development Council (RDC); reshaping of land use and planning of other surrounding municipalities can simultaneously be done in accordance with new developments. • She also said that it is good that the concern was raised and heard by the Department of Public Works and Highways (DPWH).
• **ADMIN PELIGLORIO** hoped that supplemental projects will be given to the municipality as well as other surrounding municipalities.	• **DR. ESTUDILLO** said that the EIA is a study involving the anticipation of what will happen in the next few years and all concerns will be included in the EIS and RAP recommendations but it will only be actualized through DPWH and ARUP. • A **representative from DPWH** confirmed that there will be road openings and expansions in the future because BCIB is a big project with a big budget.

Photo 1. MR. ANGEL PELIGLORIO, Municipal Administrator of Mariveles, Bataan, inquiring about the schedules of the marine sampling.

Photo 2. MR. FELIX DE LEON, Administrative Staff from Mariveles LGU, sharing that there are no marine sanctuaries but there are artificial reefs near the pier in Brgy. Alas-Asin.

Photo 3. MS. MARIA CRISTINA, Municipal Agriculturist of Mariveles, Bataan, asking the number of boats that will be used during the marine sampling.

Photo 4. MR. FERDINAND BANCUA, Head-Municipal Fisheries and Aquatic Resources Management Council from Mariveles LGU asking how can the BCIB Project help the fisherfolks.

Bataan-Cavite Interlink Bridge (BCIB) Project

Public Scoping and Coordination Meeting for Environmental Sampling

Naic Function Room, Municipal Hall Building, Barangay Ibayo Silangan

Municipality of Naic, Cavite

07 February 2020, Friday, 8:30 A.M.

ATTENDANCE SHEET

No.	Name	Gender F	Gender M	Designation / Title	Organization / Address	Contact No(s).	E-mail Address	Signature
13	Narcisa A. Mariano	✓		Chair-14FARMC	M-FARMC	09420103641		N. Mariano
14	CPO JERSON A. DE TAZA PCG		✓		PCG			[signature]
15	SN2 BONIFACIO G. DE LUNA		✓		PCG	09953175492		[signature]
16	ROMEO B. MIRANDA		✓	V. Chair MFARMC	Timalan/Balsahan	09555401284		[signature]
17	ROGELIO E. MENDOZA		✓		"			[signature]
18	Anabelle L. Cuyabyab	✓		PG-ENRO	PG-ENRO	09778236695		[signature]
19	Esternon, Frederick		✓	Head-Environment	Arup/EcosysCorp	09175326722		[signature]
20	Marina F. Palacton			Brgy Capt	Tim. Con	09950787010		[signature]
21	Angel Salcedo	✓		Arup				[signature]
22	EDNA LYN NGO	✓		DPWH-EII				[signature]
23	JUNNEL BAUTISTA		✓	DPWH-EN				[signature]
24	WINFRED UNANAC II		✓	~~South~~ Arup				[signature]
25	Juddline A. Fabro	✓		PENRO				[signature]

Bataan-Cavite Interlink Bridge (BCIB) Project

Public Scoping and Coordination Meeting for Environmental Sampling
Naic Function Room, Municipal Hall Building, Barangay Ibayo Silangan
Municipality of Naic, Cavite
07 February 2020, Friday, 8:30 A.M.

ATTENDANCE SHEET

No.	Name	Gender F	Gender M	Designation / Title	Organization / Address	Contact No(s).	E-mail Address	Signature
1	BRYAN P. ESTUDILLO		✓	TECH. SUPPORT	ECOSYS Q.C.	09334563835		[signature]
2	Virgilio S. Palpal-latoc		✓	Consultant	Ecosys Corp.	09195180375		[signature]
3	NOEL C. BARUT		✓	Consultant	Ecosys Corp.	09393908999		[signature]
4	EDWIN BREGANZA		✓	Consultant	Ecosys Corp	09212146352		[signature]
5	JAYSON OBLEN		✓	DIVE SUPPORT	ECOSYS CORP.	09778371919		[signature]
6	Glenn Dumalaog		✓	DIVE SUPPORT	ECOSYS CORP	09127592552		[signature]
7	Ruben Estudillo		✓	Consultant	ECOSYS CORP	09163551214		
8	Kristine Ann Gallardo			Consultant	"	09169261033		[signature]
9	Antonete A. Diano	✓		Staff	SB Member Staff	09178694162		[signature]
10	Pamela A. Cordin	✓		Agri II	DA-LGU	507 0553		[signature]
11	Ariel Jr. Fernandez		✓	AT	DA-LGU	507 0553		[signature]
12	EVA P. PANGILINAN	✓		MENRO	LGU	09178324244		[signature]

Bataan-Cavite Interlink Bridge (BCIB) Project

Public Scoping and Coordination Meeting for Environmental Sampling
Naic Function Room, Municipal Hall Building, Barangay Ibayo Silangan
Municipality of Naic, Cavite
07 February 2020, Friday, 8:30 A.M.

IPIF ARUP

ATTENDANCE SHEET

No.	Name	Gender		Designation / Title	Organization / Address	Contact No(s).	E-mail Address	Signature
		F	M					
1	NOEL H. CATUBIG	F	M	BRGY. CHAIRMAN	SABANG	09178081764		
2		F	M					
3		F	M					
4		F	M					
5		F	M					
6		F	M					
7		F	M					
8		F	M					
9		F	M					
10		F	M					
11		F	M					
12		F	M					

Bataan-Cavite Interlink Bridge (BCIB) Project

Public Scoping and Coordination Meeting for Environmental Sampling Mariveles Municipal Conference Room, Municipal Hall Building, Roman Super Highway, Municipality of Mariveles, Bataan

11 February 2020, Tuesday, 9:00 A.M.

ATTENDANCE SHEET

No.	Name	Gender F	Gender M	Designation / Title	Organization / Address	Contact No(s).	E-mail Address	Signature
1	Ferdinand Bancud		✓	MFARMC	Mariveles	09491331858	Lucanin	[signature]
2	PO2 JAINAL AMBANG PCG		✓	~~MEPO-PCG~~ MARPOL INSPECTOR	MEPO - PCG	0997 641 6190	ajpilgrim_pcg08@yahoo.com	[signature]
3	SN2 Al-Yazar Muyong PCG		✓	member/oper	CGSS MARIVELES	09480214425		[signature]
4	Maria Cristina V. Bagsic	✓		MAO	D.A. Staff	09389281838		[signature]
5	PLT FERNANDO A. DEL MUNDO JR		✓	DEPUTY, STN CHIEF 303[rd]	MMFSTN	09175406586		[signature]
6	ALFREDO V. GABIOLA JR.			CONSULTANT	MARIVELES	09507254887	gabiolo_jhun@yahoo.com	[signature]
7	ROMMEL R. ARCENAL		✓	BRGY KAGAWAD	ALAUAGIN	09190371603		[signature]
8	Felix S. de Leon		✓	Admin Staff	Admin.	09468839245	felixdeleons@gmail.com	[signature]
9	MIGUEL DE LOYOLA			ADMIN STAFF	Admin	09095065525		[signature]
10	DANILO C. ABREICA	✓		Sr. Agri. of. Agri. promotor	OPA/Prov. Agri	09207788760		[signature]
11	ED R. ESCABILLO		✓	CONSULTANT	ADMIN.	09494008765		[signature]
12	Ermito Z. de Asis Jr.		✓	SB STAFF		09150657812		[signature]
13	LEONCIO A. LUNGCAY		✓	P.B	MT. VIEW	09176244417		[signature]

EcosysCorp, Inc.

Bataan-Cavite Interlink Bridge (BCIB) Project

Public Scoping and Coordination Meeting for Environmental Sampling Mariveles Municipal Conference Room, Municipal Hall Building, Roman Super Highway, Municipality of Mariveles, Bataan

11 February 2020, Tuesday, 9:00 A.M.

ATTENDANCE SHEET

No.	Name	Gender F	Gender M	Designation / Title	Organization / Address	Contact No(s).	E-mail Address	Signature
1	George Imperial Jr.		✓	Admin Aide III	Mayor's Office	09178691891	imperialgeorge@gmail.com	[signature]
2	ELDIE ESCABILLO		✓	MENRO STAFF	MENRO	0930-178-10-70		[signature]
3	RESHELL CONCEPCION	✓		MENRO STAFF	MENRO	09123112890	reshellconcepcion.e.c	[signature]
4	Angel V. Pyliglomo Jr.			Administrator	Admin	[illegible]	[illegible]@gmail	[signature]
5	BHAL S ULIJAN		✓	VICE P. BSNA	SISIMAN			[signature]
6	Cecilia A. Sandulan	✓		Secretary	Lucanin	09568492146		[signature]
7	June Del Rosario	✓		Comm officer	LGU Mariveles		june.delrosario@yahoo.com	[signature]
8								
9								
10								
11								
12								
13								

Bataan-Cavite Interlink Bridge (BCIB) Project

Public Scoping and Coordination Meeting for Environmental
Sampling Mariveles Municipal Conference Room,
Municipal Hall Building, Roman Super Highway,
Municipality of Mariveles, Bataan
11 February 2020, Tuesday, 9:00 A.M.

IPIF ARUP

ATTENDANCE SHEET

No.	Name	Gender		Designation / Title	Organization / Address	Contact No(s).	E-mail Address	Signature
		F	M					
1	JAMES ANTHONY IGNACIO		/	ENGINEER III	DPWH - MANILA	(02) 5 304 3621	ignacio_james_anthony@dpwh.gov.ph	
2	RAPHAEL JOHN PEDROSO		/	ENGINEER II	DPWH - MANILA		rapho812@gmail.com	
3	Angel Salcedo	/		ES	ARUP - ORTIGAS	09176099805	angel-frances.salcedo@arup.com	
4	~~ANGEL V. FELIGLORIO JR.~~			~~ADMINISTRATOR~~				
5								
6								
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EcosysCorp, Inc.

Bataan-Cavite Interlink Bridge (BCIB) Project

Public Scoping and Coordination Meeting for Environmental Sampling Mariveles Municipal Conference Room, Municipal Hall Building, Roman Super Highway, Municipality of Mariveles, Bataan

11 February 2020, Tuesday, 9:00 A.M.

ATTENDANCE SHEET

No.	Name	Gender F	Gender M	Designation / Title	Organization / Address	Contact No(s).	E-mail Address	Signature
1	EDWIN BREGANZA		✓	Consultant	Ecosys	09061214632	edwinbreganza@yahoo.com	[signature]
2	JAYSON OBIEN		✓	DIVER	ECOSYS	09778371919	obienjayson@gmail.com	[signature]
3	GLENN DUMALAOG		✓	DIVER	ECOSYS	09177592332	28glenndumalaog@gmail.com	[signature]
4	Virgilio S. Palpal-latoc		✓	Consultant	Ecosys	09155183375	virpalpal-latoc@yahoo.com	[signature]
5	Ruben Estudillo		✓	Consultant	Ecosys	09162151744	ruben-estudillo@yahoo.com	[signature]
6	Annabelle N. Herrera	○		Consultant	Ecosys	09189016437	aherrera@ecosyscorp.com	[signature]
7								
8								
9								
10								
11								
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EcosysCorp, Inc.

IEC and Consultation Reports/ Documentation

DRAFT

DPWH - ISO – QUALITY MANAGEMENT SYSTEM

Title/Description:

Presentation of the BCIB to the Municipal Government of Mariveles under Infrastructure Preparation and Innovation Facility (IPIF) Output 1 – Roads & Bridges, ADB Loan No. 3589-PHI

Date:	Started:	Adjourned:	Venue:
October 7, 2019	9:00AM	12:00NN	Conference Room, Mayor's Office, Mariveles Municipal Hall, Roman Superhighway, Mariveles, Bataan
Meeting Presider:			
Arup			
Meeting Attended by:			
See **Appendix A – Attendance Sheet**			

TOPIC	DISCUSSION	ACTION
1. **Introduction**	Atty. Jocelyn Castañeda (Mayor of Mariveles) introduced DPWH and Arup representatives to the group and noted key participants.	
2. **Arup Presentation**	Ms. Maria Catherine Rontos (Arup) introduced the project in the context of the IPIF programme, EIA definition and EIA process. Engr. Miguel Ramos (DPWH) gave a brief overview of the project. Engr. Winfred Liwanag (Arup) presented project information, project objectives, alignment options, artistic rendering, and projected timeframe. Ms. Angel Salcedo (Arup) presented preliminary identified environmental impacts. See **Appendix B – Presentation**	
3. **Discussion**	See **Appendix C – Detailed Transcription**	
3.1.	Mr. Oscar Delos Reyes (Knights of Colombus) commended the project and highlighted the need to consider the impacts to small-scale fisheries in Cabcaben, San Lorenzo Ruiz, and Lamao. Mr. Delos Reyes further asked if restrictions will be imposed in areas during construction; if construction will be undertaken by the Chinese; and if just compensation for informal settlers will be considered. Mr. Delos Reyes cautioned that the lack of public consultations in previous projects hindered their completion. Ms. Angel Salcedo (Environmental Engineer, Arup) responded that IEC is the start of the consultation process and all concerns will be integrated in the EIA. Baseline sampling will be conducted in the next days. A RAP will be included in the study. Ms. Maria Catherine Rontos (Assistant Environmental Engineer, Arup) added that all issues and concerns will be addressed in the public hearing.	Noted
3.2.	Atty. Jocelyn Castañeda (Mayor of Mariveles) asked about the source of funding of the project. Engr. Miguel Ramos (Engineer V, DPWH) said that the current study is funded by the ADB. There is no certainty for the next stages.	
3.3.	Ms. Arlene Nava (Mayor's Office) asked if settlement areas have been identified for people who would be resettled and if data on people who will likely be resettled is available.	

	Engr. Miguel Ramos (Engineer V, DPWH), areas for resettled people have not been identified since the number of affected people remains unknown. Their rights however, will be protected. Ms. Angel Salcedo (Environmental Engineer, Arup) added that they have a designated team to identify affected settlers along the alignment and consultations will be conducted with them.	
3.4.	Mr. Rey Sebastian (Mariveles Mayor's Consultant) remarked that the project presents disadvantages for Mariveles in terms of increasing traffic and waste in the locale, affecting fishermen, and displacing constituents. Mr. Sebastian also remarked that all advantages for Mariveles are mostly generalized. Arup will note all concerns.	Noted
3.5.	Ms. Alitt Fallore (President, Kababaihan Isang Tinig Association) expressed hope that settlers along the coastline relying on the sea for income will be resettled in locations that will still allow this form of dependence on the sea. Ms. Fallore further hopes for proposals on livelihoods that will be affected. Ms. Sheilette Untalan (Urban Development Specialist, Arup) explained that the bridge was designed to be high particularly to allow large vessels and fisheries to pass through. Livelihood impacts will be included in the socioeconomic survey and the RAP.	Noted
3.6.	Mr. Oscar Delos Reyes (Knights of Colombus) proposed for the alignment to be connected to the existing pier instead. Participants generally agreed that the proposed alignment will affect more people.	
3.7.	Mariveles Mayor's Consultant commended the project for convening consultations and hopes that public hearings with affected residents will be conducted and that negative and positive impacts will be presented. Ms. Angel Salcedo (Environmental Engineer, Arup) answered that perception surveys will be conducted in all affected barangays and a similar IEC activity will also be conducted with barangay representatives.	Noted
3.8.	Mr. Rolando Cruz (Administrator, Municipal Government of Mariveles) highlighted that the alignment will traverse transmission lines and suggested that the project coordinates with the NGCP to identify towers and secure permits. Arup noted the suggestion	Noted
3.9.	Dr. Gerald Sebastian (Municipal Health Officer, Government of Mariveles) asked if water lanes and impacts on traffic, peace and order, criminality and health have been considered; and for specific benefits of the project to Mariveles and Cavite. Dr. Sebastian also raised that traffic would be a problem, considering Cavite is a densely populated province. Engr. Miguel Ramos (Engineer V, DPWH-UPMO) noted that economic benefits will be studied. If economic benefits are not adequate, NEDA will not approve the project. Ms. Cristina Villaraza (Transport Planner, Arup) added that a traffic study will be included to identify congested areas and plan out diversion schemes.	Noted

3.10.	Mr. Domingo Pasaraba (Fisheries Sector Representative) expressed support for the project, though questioned how the project will ensure just resettlement for those affected. Ms. Maria Catherine Rontos (Assistant Environmental Engineer, Arup) said that a condition of an ECC is to form a Multi-Partite Monitoring team that would involve all sectors. The team will join DENR to monitor the project for impacts.	
3.11.	Mr. Oscar Delos Reyes (Knights of Colombus) shared that an ECC has been granted by the DENR prior to public consultations in several instances. Mr. Delos Reyes hopes that the study would be thorough enough to avoid corruption issues Ms. Maria Catherine Rontos (Assistant Environmental Engineer, Arup) mentioned that the study will go through the proper process of the DENR and will conduct consultations.	Noted
3.12.	Mr. Manny Molina (Area Inspector, Engineering Department) shared that the municipality has experienced problems with adjusting construction specifications to a substandard level in DPWH projects. Mr. Molina hopes that stricter monitoring of inspectors and certification of materials will be imposed. Engr. Miguel Ramos (Engineer V, DPWH-UPMO) reiterated that DPWH-UPMO will not allow such experience considering strict foreign consultants onboard and that a cable-stayed bridge requires all specifications to be followed. Funds will also be monitored.	Noted
3.13.	Mr. Amante Versoza (Resident of Mariveles, Homeowners Representative) raised concern with the DPWH road project that will be demolished after only being used for a few years; and hopes that the current project will not have a similar experience. Mr. Versoza questioned the reliability of the timelines of DPWH projects and raised that several accidents have occurred due to lack of signages. Atty. Jocelyn Castañeda (Mayor of Mariveles) interjected that one death resulted from the said DPWH road construction project. Mr. Versoza requested DPWH to send inspectors for construction projects since roads frequently require reconstruction. Mr. Versoza expressed fear that the bridge project may collapse as in the case of Taiwan if not properly inspected. Engr. Miguel Ramos (Engineer V, DPWH-UPMO) said that BCIB is a national project and will not reach the kind of experience described. Quality assurance visits are undertaken every 3 or 6 months. A Department Order also requires termination of contract if work exceeds defined number of days and requires the contractor to explain delays, which most likely caused the delays of current projects.	Noted
3.14.	Mr. Oscar Delos Reyes (Knights of Colombus) shared that in another project, the district engineers assigned are unaware of the project and hoped that the Municipal Government's concerns will not happen again in this project. Mr. Delos Reyes agreed with Mr. Versoza that another bridge project has taken six years and yet only half has been completed. Engr. Ken John Barcelona (Engineer III, DPWH-UPMO) responded that for the BCIB project, DPWH will be thoroughly watchful. Everyone is invited to call the	Noted

hotline of Duterte and the internet is readily available. Do not raise concerns elsewhere. If the district is unaware, leave it to ABS-CBN, GMA, Patroller.

Mr. Delos Reyes added that complaints are spread out in social media.

Engr. Barcelona said that DPWH has a Stakeholders Relations Service Office to receive public complaints. Official complaints will also be relayed to Malacañang and other offices and we will be embarrassed.

Ms. Angel Salcedo (Environmental Engineer, Arup) said that the project will be forming a team to serve as a Grievance Redress Mechanism for locals to raise concerns. Concerns will be addressed by the DPWH.

Mr. Delos Reyes expressed frustration over the 8888 hotline and shared that the Government redirects concerns elsewhere instead of having face-to-face consultations such as the current IEC activity with the Mayor. Mr. Delos Reyes hopes that this project will clearly address the locale’s concerns.

Engr. Miguel Ramos (Engineer V, DPWH-UPMO) said that any tax-paying citizen has the right to complain and complaints will be strongly addressed.

Atty. Jocelyn Castañeda (Mayor of Mariveles) questioned the integrity of DPWH projects and questioned how measures to address impacts, such as the Grievance Redress Mechanism, will be sustained if the project will extend more than 12 or 15 years. The Mayor highlighted that DPWH projects take long to complete and that concerns of the locality are not immediately relayed to contractors. The Mayor also reminded the group that even if the project is a DPWH or a national project, the project still lies under the local government jurisdiction and is concerned over her liability. The Mayor further questioned why, despite having project inspectors, DPWH inspectors do not report the status of projects to DPWH, which leads the LGU to regularly report project status. The Mayor further shared that the Municipal Government and LGUs do not have the personality to invite contractors over a meeting to discuss project concerns. The Mayor inquired about the status of the current bridge project.

The Mariveles Municipal Engineer shared that the Region 3 engineer has coordinated with the Municipal Government; however, the project remains suspended until a definite completion date is set and a traffic management scheme is enforced to avoid accidents.

Mr. Delos Reyes expressed fear that the same concerns will likely happen in the BCIB project and hopes that the BCIB project will be thoroughly studied to avoid public rallies.

Engr. Mark Anthony Alejo (Engineer IV, DPWH-UPMO) explained that contracts with every project specifies a completion date. In cases where the contractor is unable to finish on time, the contractor would need to explain why and pay for delayed damages.

3.15.	Mr. Amante Versoza (Resident of Mariveles, Homeowners Representative) suggested a standardized system is in place for all projects and that impacts will be clearly explained to those people relocated. Arup noted his suggestion.	
3.16.	Ms. Glady Dacion (Municipal Planning and Development Coordinator, Municipal Planning and Development Office) shared that the Comprehensive Development Plan of the municipality does not cover projects that collaborates with the BCIB. Ms. Dacion further shared that some proponents do not coordinate with the LGU once a certificate is secured and hopes that in everything done, including the results of the impact assessment, the project advises the Municipal Government in advance before draft investigations are submitted to national agencies. Ms. Dacion asked how long-term monitoring will be undertaken since this component is sometimes neglected. Ms. Maria Catherine Rontos (Assistant Environmental Engineer, Arup) explained that the DENR issues ECC after a successful review of the EIS and series of consultations. If we will be granted an ECC, it will be coursed through the LGU because that is the EIA process. Atty. Jocelyn Castañeda (Mayor of Mariveles) echoed Ms. Dacion's request that a copy would be provided to the Municipal Government prior to submission among the agencies in order for the Municipality to have a voice. Arup noted the mayor's concern.	Noted
3.17.	Mr. Oscar Delos Reyes (Knights of Colombus) shared how the idea of the project originated, which was from Chairman Payumo in the First District of Bataan.	

Review and Confirmation:		
Prepared by:	Reviewed by:	Approved by:
Cristina Villaraza		
Transport Planner		

DRAFT

DPWH - ISO – QUALITY MANAGEMENT SYSTEM

Title/Description:

Presentation of the BCIB to the Barangay Representatives of Mariveles under Infrastructure Preparation and Innovation Facility (IPIF) Output 1 – Roads & Bridges, ADB Loan No. 3589-PHI

Date:	Started:	Adjourned:	Venue:
October 7, 2019	2:00PM	4:00PM	Conference Room, Mayor's Office, Mariveles Municipal Hall, Roman Superhighway, Mariveles, Bataan
Meeting Presider:			
Arup			
Meeting Attended by:			
See **Appendix A – Attendance Sheet**			

TOPIC	DISCUSSION	ACTION
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3. **Discussion**	See **Appendix C – Detailed Transcription**	
3.1.	Mr. Joey Carandang (Councilor, Municipality of Mariveles) asked if the bridge will be hanging. Engr. Winfred Liwanag (Project Coordinator, Arup) responded that the bridge will be entirely elevated.	
3.2.	Mr. Ricardo Chua (Councilor, Municipality of Mariveles) asked if the project team has checked and coordinated with the DENR on the piers along the shoreline and their applications. Ms. Angel Salcedo (Environmental Engineer, Arup) noted the query and responded that Arup will check with the DENR.	Noted
3.3.	Mr. Roberto Arcenal (Barangay Captain, Alas-Asin) remarked that no existing pier and no one will be affected in the area, which he identified as pasture land. Engr. Winfred Liwanag (Project Coordinator, Arup) said that Brgy Captain Arsenal is correct. Engr. Liwanag added that based on gathered vessel activity data, no large vessels idle around the area. The project is purposely laid out the planned bridge along the area without any port or ferry terminal.	
3.4.	Mr. Roberto Arcenal (Barangay Captain, Alas-Asin) asked if the road from the shoreline to the existing National Road will be elevated. Engr. Winfred Liwanag (Project Coordinator, Arup) answered that a section of the alignment will be a road and a section will be a land viaduct.	

	Mr. Roberto Arcenal estimated that the distance between the existing highway and the shoreline would be about 5-6km. Engr. Liwanag mentioned it is about 5.1km.	
3.5.	Ms. Ludy Funilas (Barangay Captain, Lucanin) remarked that there are several settlements in Cabcaben along the Old Road and Roman Superhighway. Mr. Roberto Arcenal (Barangay Captain, Alas-Asin) clarified that the bridge seems to be far away from Cabcaben and is in Alas-Asin. Ms. Funilas remarked that the bridge will start in Mountain View. Mr. Roberto Arcenal disagreed and clarified that the bridge is far from Mountain View and that the illustration is correct except for the boundaries of Mountain View and Alas-Asin. Mr. Arcenal also clarified that the Alas-Asin river serves as the boundary between Cabcaben and Mountain View. Ms. Angel Salcedo (Environmental Engineer, Arup) explained that the data used was taken from the Provincial Government.	Coordinate with LGU for an updated administrative boundary map for revisions necessary
3.6.	Mr. Ricardo Rocha (Councilor, Municipality of Mariveles) expressed hope that affected parties will be invited in the public consultations and public hearings. Mr. Chua also asked how many public hearings will be conducted. Mr. Roberto Arcenal (Barangay Captain, Alas-Asin) emphasized that the present activity is a consultation and on-the-ground visits with concerned barangays will be conducted before the public hearing.	
3.7.	Ms. Arlene Wabat (Municipality of Mariveles) asked if DPWH and ADB funded the present feasibility study. Mr. Joey Carandang (Councilor, Municipality of Mariveles) requested that the project team emphasizes to everyone that the Chinese are not funding the project and for the team to always cite the source of funding. Engr. Junnel Ray Bautista (Engineer, DPWH-UPMO) said that the current study is funded by the ADB.	
3.8.	Mr. Leoncio Lungcay (Barangay Captain, Mountain View) asked about the impacts to fishermen and if fishing will be restricted. Ms. Sheilette Untalan (Urban Development Specialist, Arup) answered that the bridge was designed to be 41m high in the North Channel and 71m high in the South Channel. The bridge was designed to allow vessels to pass through and to avoid impacts on the livelihoods of fisherfolks. Disruptions will occur in the affected area to ensure the safety of our fisherfolks. Mr. Leoncio Lungcay (Barangay Captain, Mountain View) asked if fishing restrictions will only be temporary during construction. Engr. Winfred Liwanag (Project Coordinator, Arup) said that they have not yet discussed activities during construction and the distance of fisheries and most	

	efficient way for fishermen. The plan is to simultaneously construct both ends to be time-efficient.	
3.9.	Mr. Leoncio Lungcay (Barangay Captain, Mountain View) asked if the bridge provides a way going to Corregidor. Engr. Winfred Liwanag (Project Coordinator, Arup) replied that there will be a roundabout in front of Corregidor to allow travelers to visit Corregidor and to serve as a U-turn to return to Bataan or Cavite.	
3.10.	Mr. Leoncio Lungcay (Barangay Captain, Mountain View) asked if the bridge will pass in front of Mall of Asia and lead to Manila. Engr. Winfred Liwanag (Project Coordinator, Arup) answered no.	
3.11.	Mr. Manny Virgilio (Municipality of Mariveles) expressed his concern that the traffic from Cavite and pollution will be led to Bataan. Ms. Cristina Villaraza (Transport Planner, Arup) mentioned that part of the study will include a traffic component where congested areas will be identified and an efficient routing scheme will be planned.	Noted
3.12.	Councilor Chua (Municipality of Mariveles) expressed concern for the livelihood impacts to boatmen travelling to Corregidor and hopes alternatives could be provided. Ms. Sheilette Untalan (Urban Development Specialist, Arup) asked the participants to elaborate the tourism activities or economic activities that may be affected by the project for initial data gathering. Mr. Roberto Arcenal (Barangay Captain, Alas-Asin) agreed that the livelihoods of boatmen will be affected, though remarked that the project as a whole is favourable. Councilor Chua recognised that the project has both positive and negative impacts and clarified that he requests for alternative jobs to be provided for livelihoods affected. Ms. Sheilette Untalan (Urban Development Specialist, Arup) emphasized that surveys will be conducted to inform the stakeholders and for the development of Resettlement Action Plan. She added that boating associations and tour guides will be included in consultations.	Noted
3.13.	Mr. Ricardo Rocha (Councilor, Municipality of Mariveles) expressed hope that air quality monitoring results will be disclosed. The consultant respondent that before construction phase, surveys will be conducted to provide the team a reference of air quality. Part of the conditions of the ECC is for us to disclose the results.	Noted
3.14.	Mr. Ricardo Rocha (Councilor, Municipality of Mariveles) asked if the project is toll-free. Engr. Winfred Liwanag said that initially the project is toll-free, as proposed by the DPWH. The bridge will only be for vehicles and there will be no pedestrians and cycle lanes.	

3.15.	Ms. Arlene Wabat (Municipality of Mariveles) asked how many lanes will be constructed; if Corregidor will be properly protected from the surge of tourists; and if the bridge will allow trucks. Engr. Winfred Liwanag (Project Coordinator, Arup) clarified that based on the DPWH latest plan, it will be a two-lane dual carriageway, with a lane width of 3.65m and a hard shoulder of 2.5m. In total, there will be four lanes, consisting of 2 lanes per direction. A series of discussions with CFI and their identified stakeholders were conducted. A holding station with a bus transit service provided by Corregidor is being considered to control tourists. Another possible control measure is requiring tourists to make advance reservations before visiting the Island. Engr. Junnel Ray Bautista (Engineer, DPWH-UPMO) supported the statement of Engr, Liwanag and mentioned that DPWH have received an endorsement from the CFI Board of Trustees allowing the connection to Corregidor.	
3.16.	Mr. Joey Carandang (Councilor, Municipality of Mariveles) asked if Bataan can have a share in the income of Corregidor derived from the project. Ms. Angel Salcedo (Environmental Engineer, Arup) said that his concern is noted.	Noted
3.17.	Ms. Lynie Galvan (Barangay Alas-Asin) asked if boat travel will still be allowed. Engr. Winfred Liwanag (Project Coordinator, Arup) answered that boat travel will be optional. Ms. Lynie Galvan (Barangay Alas-Asin) raised concern over the livelihoods of boatmen traveling from Cabcaben to Corregidor and hopes that affected livelihoods will be prioritized. Ms. Maria Catherine Rontos (Assistant Environmental Engineer, Arup) responded that Arup's succeeding surveys and socioeconomic surveys will include considerations for affected parties, whether temporarily or permanently affected.	Noted
3.18.	Mr. Jester Ivan Ricafrente (Barangay Captain, San Carlos) asked for clarification if the present activity is the first step to be issued an ECC and if effects of the project during construction and operation will be considered. Mr. Ricafrente further remarked that the LGU efforts to clean-up the Manila Bay will go to waste if the bridge will cause pollution. Mr. Ricafrente then asked if the project considered the Writ of Continuing Mandamus of the Supreme Court regarding the clean-up of the Manila Bay. Ms. Maria Catherine Rontos (Assistant Environmental Engineer, Arup) said that BCIB project is currently at the IEC stage now -first step of the process. She added that the suggestion of Mr. Ricafrente is good and will be include it in our study. Mr. Ricafrente added that the Municipality is making efforts on solid waste management and allowing more people and vehicles to enter will require double efforts. Mr. Ricafrente expressed hope that the Municipal Government of Mariveles will be prepared for the project.	Noted
3.19.	Mariveles Fisherman Representative (Barangay Mountain View) asked what help could be extended to affected fishermen in Mountain View and Alas-Asin.	

	Ms. Maria Catherine Rontos (Assistant Environmental Engineer, Arup) answered that the project will have a baseline assessment, which includes marine ecology and livelihoods. Once existing conditions are established, potential impacts can be identified therefore appropriate mitigating measures to prevent or lessen/compensate the impacts could be provided.	
3.20.	Ms. Maria Catherine Rontos (Assistant Environmental Engineer, Arup) solicited suggestions on organizations or people to invite for pubic scoping. Arup also outlined the next stages of the process which would involve perception surveys and FGD with affected stakeholders before submitting a Project Description Report. Arup further explained that a public scoping, which is a bigger gathering than the IEC will be conducted in 2-3 months. Arup ensured that all participants will be invited to the public scoping. General response from the participants are fisheries, tourism groups	Noted
3.21.	Ms. Maria Catherine Rontos (Assistant Environmental Engineer, Arup) asked if the alignment will affect any ancestral domain and historical site. The participants responded none.	Noted
3.22.	Mr. Joey Carandang (Councilor, Municipality of Mariveles) emphasized that there should be no objections from the LGU in the process of securing the ECC and that the project needs to be clearer before a resolution is requested. Mr. Roberto Arcenal (Barangay Captain, Alas-Asin) remarked that the BCIB project is a government project and the said request is not required. Ms. Angel Salcedo (Environmental Engineer, Arup) said the project will going to request for a Sangguniang Resolution for relevant parties to convene and request for an endorsement from the LGU.	

Review and Confirmation:		
Prepared by:	Reviewed by:	Approved by:
Cristina Villaraza		
Transport Planner, Arup		

DRAFT

DPWH - ISO – QUALITY MANAGEMENT SYSTEM

Title/Description:

Presentation of the BCIB to the Municipal Government of Naic, Cavite under Infrastructure Preparation and Innovation Facility (IPIF) Output 1 – Roads & Bridges, ADB Loan No. 3589-PHI

Date:	Started:	Adjourned:	Venue:
October 9, 2019			Naic Municipal Hall, Antero Soriano Highway, Naic, Cavite
Meeting Presider:			
Arup			
Meeting Attended by:			
See **Appendix A – Attendance Sheet**			

TOPIC	DISCUSSION	ACTION
1. **Introduction**	introduced DPWH and Arup representatives to the group and noted key participants.	
2. **Arup Presentation**	Ms. Maria Catherine Rontos (Arup) introduced the project in the context of the IPIF programme, EIA definition and EIA process. Mr. Winfred Liwanag (Arup) presented project information, project objectives, alignment options, artistic rendering, and projected timeframe. Ms. Angel Salcedo (Arup) presented preliminary identified environmental impacts. See **Appendix B – Presentation**	
3. **Discussion**	See **Appendix C – Detailed Transcription**	
3.1.	Engr. Joel Antonio (Naic Municipal Planning and Development Coordinator) asked if the possibility of hitting submarine cables was considered. Engr. Antonio shared that he has already informed and cautioned DCCD. Engr. Winfred Liwanag (Project Coordinator, Arup) confirmed that submarine cables were laid out with the alignment and were avoided. Engr. Liwanag further explained that the project team had a geodetic survey to determine the alignment.	
3.2.	Mr. Noel Catubig (Barangay Captain, Sabang) inquired about the possible route to Bataan from Dasmariñas. Engr. Winfred Liwanag (Project Coordinator, Arup) showed that from Dasmariñas, once could pass through Antero Soriano Highway. Engr. Liwanag also explained that the project team chose the landing point due to its short distance connection with CALAEx, thereby affecting less settlements.	
3.3.	Ms. Eva Pangilinan (Municipal Environment and Natural Resources Office) shared that the government is active with efforts for the Manila Bay clean-up, citing the Manila Bay Environmental Management Project (MBEMP) and the Manila Bay Coastal Strategy and Operational Plan. Ms. Pangilinan asked which component of the MBEMP does the project belong to. Ms. Angel Salcedo (Environmental Engineer, Arup) recognized that the project will affect Manila Bay and assured that existing plans will be included in the Environmental Impact Statement Report.	Secure a copy of the Operational Plan for Manila Bay

	Ms. Pangilinan requested that the project considers the Manila Bay Coastal Clean-Up and Conservation Program of the DILG and that the Provincial Government will provide the team a copy of the Operational Plan for Manila Bay. Ms. Pangilinan further shared that Naic Government has plans with Bataan on marine turtle conservation, which needs to be considered in the study. Ms. Maria Catherine Rontos (Assistant Environmental Engineer, Arup) assured that such concerns will be addressed later on in the Public Hearing/Consultation.	
3.4.	Mr. Cesar Ryan Nazareno (SB Member, LGU) asked what Naic can offer for the project and if employees and workers will be sourced from Naic. Engr. Miguel Ramos (Engineer V, DPWH-UPMO) confirmed that local workers will be prioritized for the project.	
3.5.	Engr. Joel Antonio (Naic Municipal Planning and Development Coordinator) asked if Naic will have financial gains from the project, such as revenues if a toll gate is implemented. Engr. Antonio also expressed his opinion that Naic should benefit as a "host" municipality. Engr. Miguel Ramos (Engineer V, DPWH-UPMO) explained that funds from a possible toll gate will likely go to bridge maintenance. Engr. Ramos further explained that the consultants (Arup) will look into where excess funds could be diverted to.	Noted
3.6.	Mr. Renato Cabuhat (Kagawad, Timalan Balsahan) asked when the bridge will be operational. Mr. Cabuhat expressed support for the project; however expressed concern and asked if Timalan Balsahan will be completely cleared. Engr. Miguel Ramos (Engineer V, DPWH-UPMO) cited the project timeframe, which sets 2020 as the construction year and 2027 as the possible operational year. Engr. Ramos explained that Arup is conducting activities to determine and assess impacts in order to mitigate them.	
3.7.	Ms. Eva Pangilinan (Municipal Environment and Natural Resources Office) asked what alternatives could be provided for fishermen that will be displaced from the municipal water, which wil be affected by the alignment. Ms. Pangilinan hopes that livelihood alternatives would be a priority. Ms. Maria Catherine Rontos (Assistant Environmental Engineer, Arup) outlined the process of the EIA and emphasised that the present activity is to hear issues, concerns about the project. A series of data gathering activities will be conducted to determine the existing condition of affected areas and to provide appropriate mitigating measures, which would be presented in the Public Hearing/Consultation stage.	Noted
3.8.	A Barangay Representative expressed full support for the project; however, is concerned about the people residing in affected barangays. He asked who should the concerned individuals approach for any incidents relating to the project. Ms. Angel Salcedo (Environmental Engineer, Arup) explained that the project involves forming a Grievance Redress Mechanism, which is a platform where concerns/issues regarding the project could be voiced out and would be addressed. Ms. Salcedo further asked if there are any other workers/communities that may be affected, aside from fisherfolks.	Noted

	The barangay representative identified farmers and others involved in aquaculture. Engr. Joel Antonio (Naic Municipal Planning and Development Coordinator) further suggested that farmers and fisherfolks should be included in the Public Scoping and for the team to coordinate with Barangay chairmen. Ms. Maria Catherine Rontos (Assistant Environmental Engineer, Arup) confirmed that the stakeholders mentioned will be included in the activity.	
3.9.	Engr. Joel Antonio (Naic Municipal Planning and Development Coordinator) highlighted the need to undertake the correct process and shared that the Mayor of Naic fully supports the project.	Noted

Review and Confirmation:		
Prepared by:	Reviewed by:	Approved by:
Cristina Villaraza		
Transport Planner, Arup		

ARUP

Subject IPIF1-BCIB: Corregidor Key Informant Interviews

Date 31 October 2019 **Job No/Ref** 265508

Interviewee	Designation	Length of Service in Corregidor
Jennelyn Abelarde	Frontdesk Assistant (Corregidor Inn), Sun Cruises	2 years
Edward Buko Soriano, Jr.	Security Guard, LC Ibarra Agency	6 months
Alberto Juanico	Sun Cruises Driver	32 years
Cleofe B. Diestro	Clinic / Lodge / Island Disbursement, CFI	27 years
Jovelyn Isla	Saleslady, self-employed	14 years
Ronnie Amado	Corregidor Inn Employee	3 years
Fidel del Losa	Procurement Officer, Island Supervisor	14 years
Restituto Solis	Property Officer	30 years
Armando Hildawa	Freelance Tour Guide	29 years
Kevin Ballon	Safety Officer	1 year
Brian Bongalin	Activity Coordinator	13 years
Jeremy Rolin	CFI Consultant	
Mitos Magrare	CFI Cashier	27 years
William Payumo	Motorpool and Transport Supervisor, Sun Cruises	17 years
Gelio Pascua	Sun Cruises Driver	10.7 years

	Interviewee	Response
Project Awareness		
	Jennelyn Abelarde	Yes

	Interviewee	Response
1. Have you had prior knowledge about the project?	**Edward Buko Soriano, Jr.**	Yes
	Alberto Juanico	Yes
	Cleofe B. Diestro	Yes
	Jovelyn Isla	Yes
	Ronnie Amado	Yes
	Fidel del Losa	Yes
	Restituto Solis	Yes
	Armando Hildawa	No
	Kevin Ballon	Yes
	Brian Bongalin	Yes
	Jeremy Rolin	Yes
	Mitos Magrare	Yes
	William Payumo	Yes
	Gelio Pascua	Yes
1.1 How did you learn about the project?	**Jennelyn Abelarde**	Hearsay in the community here in the island since most of the people are from Cavite.
	Edward Buko Soriano, Jr.	Hearsay in the community
	Alberto Juanico	From Facebook
	Cleofe B. Diestro	Newspaper
	Jovelyn Isla	From the community
	Ronnie Amado	Hearsay. This year
	Fidel del Losa	During a meeting with the consultant (Arup) last year

	Interviewee	Response
	Restituto Solis	Consultants (Arup foreigners) already visited the area last year to inform [Head Office] about the project but, was not officially invited to that meeting
	Armando Hildawa	CFI mentioned about the bridge; though no full details about it
	Kevin Ballon	Hearsay two months ago
	Brian Bongalin	People here in Corregidor have been talking about the bridge since 2015. I also see Facebook posts about it.
	Jeremy Rolin	I represented CFI in the meetings we had with Arup and had the whole project described to me by them. We had another meeting with them about 10 days ago. So, that's how I got to know about the project since CFI is involved and I am their consultant, therefore, I was involved.
	Mitos Magrare	Some people visited here to discuss the project; however, I am unaware of the details of the discussion and who were the visitors. They seemed to be Korean investors. The news about the bridge was also circulated several times on Facebook.
	William Payumo	We were supposed to do an ocular [investigation of the site] for the Bataan-Corregidor-Cavite project with the Bataan Governor and other people who I am unaware of. However, plans were cancelled for some reason.
	Gelio Pascua	I only heard about it one time since there was a newspaper clipping on the bridge project that was circulated here.
1.2 What do you know about the project?	**Jennelyn Abelarde**	The project might take up to 10 years before it is completely built, and the bridge will be from Cavite to Corregidor only.
	Edward Buko Soriano, Jr.	None
	Alberto Juanico	I only know that they have plans of constructing a bridge
	Cleofe B. Diestro	Bridge from Bataan to Cavite
	Jovelyn Isla	Bridge from Bataan to Cavite
	Ronnie Amado	Just hearsays

	Interviewee	Response
	Fidel del Losa	[That there is a] planned bridge
	Restituto Solis	Just hearsays
	Armando Hildawa	None
	Kevin Ballon	Bridge from Bataan to Cavite
	Brian Bongalin	The bridge will connect Bataan, Cavite, and Corregidor. There are Chinese investors involved in the construction of the bridge.
	Jeremy Rolin	(see answer to Q1.1)
	Mitos Magrare	I thought that the bridge will connect to the center of Corregidor from Maap Pier in Bataan.
	William Payumo	Just hearsays about the project. Various VIP guests have mentioned the possibility of the project, though we have no solid evidence to back it up. Last time, news circulated that a DPWH representative mentioned that the bridge project will start soon. At first, we were informed by those who conducted an ocular investigation that the alignment will be positioned at the head part, the point that is closest to Bataan.
	Gelio Pascua	It informed us that the bridge would connect Bataan, Corregidor, and Cavite. Other than that, we are not aware of anything more.
1.3 Have you participated or are you aware of any meetings about it?	**Jennelyn Abelarde**	None. I haven't participated in any meeting about the project
	Edward Buko Soriano, Jr.	I only heard about the bridge from people meeting about it
	Alberto Juanico	No/None.
	Cleofe B. Diestro	No/None
	Jovelyn Isla	No/None
	Ronnie Amado	No, there are none.
	Fidel del Losa	No
	Restituto Solis	No, we were not asked nor informed about any meetings or consultations yet

	Interviewee	Response
	Armando Hildawa	No
	Kevin Ballon	No
	Brian Bongalin	We are not included in any meetings conducted by CFI, particularly about the bridge since we are tenants here. Basically, Sun Cruises is a company that only rents some parts of Corregidor.
	Jeremy Rolin	(see answer to Q1.1)
	Mitos Magrare	There was really no formal meeting about the bridge and only a discussion with the people who visited. We were not included in the discussion. They just arrived and then I just saw the news about the bridge on social media and Bataan Weather.
	William Payumo	I was not supposed to be in the planned meeting, which was cancelled. I was just asked to accompany the group who will be conducting the ocular investigation.
	Gelio Pascua	N/A
2. To what extent is the community aware about the project?	**Jennelyn Abelarde**	The people don't know much about the project. They are not sure if it is a real project or if these will push through.
	Edward Buko Soriano, Jr.	I have no idea
	Alberto Juanico	A lot of people already know about it since we saw it in Facebook and newspapers
	Cleofe B. Diestro	Everyone except newbies know about it.
	Jovelyn Isla	Everyone except other newbies in the island know about the project.
	Ronnie Amado	The community may not be aware but I heard [about] the project from my co-employees
	Fidel del Losa	No idea
	Restituto Solis	I am not sure if employees are aware, though there are hearsays
	Armando Hildawa	N/A
	Kevin Ballon	No idea
	Brian Bongalin	I think so. Some of us have been hearing about the bridge before.

	Interviewee	Response
	Jeremy Rolin	Probably not very much. Probably there are people who don't have any idea. We haven't indulged in sharing the information yet. The information is at the level of the senior management of CFI. The Island Managers know as well as the *bangkeros*, but nobody below that. Because at this stage, we have got more problems to sort out without having to worry about it. Over the last 3 or 4 years, the tourists have gone down. The facilities have become less good because we haven't had tourists, we haven't had the upkeeping, so we need to get the tourists back up. So, we are not waiting for the bridge. We have our own plans. We have very active plans for 2020 to really start. This year we have introduced them slightly but next year we are going to make a big leap and that is one of the reasons why I was talking with the *bangkeros* to bring people over here because one of our main aims is to get people on this island.
	Mitos Magrare	I think they know as much as I do.
	William Payumo	We are just few in the island. Others are in a way, excited about the project, particularly since employees are stranded in the island during a storm. The project will significantly help employees especially in emergency cases requiring easy travel outside of the island. Tabloid material about the project also circulated. However, there has been no formal discussion about the project.
	Gelio Pascua	All the people here know as much as I do.
Perceived Impacts		
1. Do you think the project will pose negative impacts to the barangay?	**Jennelyn Abelarde**	N/A
	Edward Buko Soriano, Jr.	Yes
	Alberto Juanico	No
	Cleofe B. Diestro	No
	Jovelyn Isla	Yes
	Ronnie Amado	Yes
	Fidel del Losa	Yes
	Restituto Solis	No

	Interviewee	Response
	Armando Hildawa	Yes
	Kevin Ballon	Yes
	Brian Bongalin	Yes
	Jeremy Rolin	Depends
	Mitos Magrare	Yes
	William Payumo	N/A
	Gelio Pascua	N/A
1.1 If yes, in what way?	**Jennelyn Abelarde**	The island is currently exclusive to tourists who booked their tours. So, with the presence of the bridge, the island would be more accessible to anyone who would want to visit the island. Increase in the number of tourists might cause more waste in the island.
	Edward Buko Soriano, Jr.	N/A
	Alberto Juanico	N/A
	Cleofe B. Diestro	Waste in the island but it will depend on the management. Lack of parking is also a problem.
	Jovelyn Isla	Waste during construction may end up in the water surrounding Corregidor
	Ronnie Amado	We are concerned with how the boat will pass through when the bridge is already constructed, though maybe the design will allow the boats to pass underneath the bridge. Also concrned that the ferry will no longer be an option to travel from Manila to Corregidor. Tourists will also have no limitations to go to Corregidor, which may impact the preservation of the area. Impacts on water, air pollution, and disturbance to the monkeys, snakes, and marine animals are also expected.
	Fidel del Losa	Since it is now open to the public, there is a possibility that its historical value will not be preserved. Also concerned about the effects of the columns to marine biodiversity during construction.
	Restituto Solis	None, because the bridge will pass through the tail side of Corregidor only. There may be impacts on the airfield, choppers, and airplanes and effects to trees and monkeys, though impacts may be minor
	Armando Hildawa	Sun Cruises will be affected since tourists will now have another option to access Corregidor

	Interviewee	Response
	Kevin Ballon	Since the area is excluded, waste (incl. cement, excavated soils, liquids – fuel and grease) will be generated. Aesthetics and views will also be affected. The Japanese cemetery may be affected. And Sun Cruises will be affected.
	Brian Bongalin	Sun Cruises may be affected since there would be another option going to the island. The negative effect would probably be on the company [Sun Cruises]. Tourists booking their tours through Sun Cruises may decrease in number. Another possible problem is the destruction of some parts of the island where the bridge will be constructed. The bridge may also ruin the bird's eye view of the island since it is known as a tadpole-shaped island. The tail-end of the island was declared as a tourist memorial zone, so it would be okay if ever there are buildings that would have to be destroyed for the development of the island. However, the head part of the island was declared as a war memorial zone which means you cannot destroy any part of it. The tail-end of the island has a runway, which might be affected since there are still small planes landing on that runway. There are limestones in that part of the island. There may be snakes, but there are no monkeys in that part. There is also a civilian cemetery on the tail-end of the island. There are not IPs in the area since this is a national shrine. There are more or less 150 civilians here in the island. [50-60 from Sun Cruises and 50-60 from CFI]. The bridge might ruin the look of the island, but we need to get more people here.
	Jeremy Rolin	You've been in the island and you have seen that basically it is a *wonderland* of trees, plants, and birds. We've been asked to close down the airport and we said "no". As far as we are concerned, we need the airstrip. At the moment, it is being renovated and we're not having people come in, but it's an ideal spot for light aircraft and small aircraft. There are more modern, small aircrafts with up to 30 seats. In the future, we could have them there. We have to ensure that we can keep that open even when the bridge is there. The bridge will have the same height as the runway so that won't get in the way. However, we have to allow 5 meters for the trucks and the like who will pass through the bridge, so that's my concern. We need to have that runway. It is not a civilian runway. It's a military runway. The military wants to maintain it. They want to have the ability to use that. I don't know why. It's a military facility, they don't want to lose it. So we haven't been able to say, 'we'll close it down'. We're not prepared to do that. The military owns this island. We only run it. The Department of Defense owns it. The Department of Tourism appointed CFI to run the island.

	Interviewee	Response
		We have a beautiful, tree-covered island and we have to maintain the element of the "wild" and "quiet". I have problems with the extent of the masterplan. The only way to get people here is through the bridge. But for me, the cutting down of trees and bringing thousands of people here will just ruin Corregidor. The bridge will have that sort of impact to allow more people to come here. But we have to control them. We certainly want them, but there has to be a limit to the number and the amount of development there is here because not only will it ruin the quietness but there are certain remembrance areas which must not be touched. (…) As far as the bridge is concerned, as long as we control the people coming in, it's a very good thing. (…) We can't let the bridge allow too many people here in some way. For example, you might have to talk to your construction people about toll booths or getting permission to have a toll booth. So yes, it could have a negative impact, but we cannot let it have a negative impact. It will be a positive impact if we can get 500 people a day coming off there. We can cope with that. One can also argue that it rather ruins the look of the island.
	Mitos Magrare	In general, allowing access to Corregidor will be good, especially for tourists. However, we are concerned that the bridge will affect the sacredness of the island and historical sites. Also, Corregidor currently has a zero crime rate. Once the bridge is done and more people enter, the likelihood of crime to happen here in Corregidor will increase. Controls would need to be implemented.
	William Payumo	We cannot determine the positive or negative effects. The bridge would have a positive effect if it will be able to increase potential guests. Other than the boatmen traveling from Bataan to Corregidor, most impacts are positive.
	Gelio Pascua	Whatever I will say, even if I do not support the bridge and if the government wants to pursue the project, I cannot do anything about it. The bridge could affect Corregidor since tourists will be coming in and out of the Island. It will not be a tourist destination anymore and will only be a mere thoroughfare for vehicles. But whatever that the government thinks is right and if it will make the Island better, then I support the bridge since I want tourists to come in.

	Interviewee	Response
1.2 Who would be most affected?	**Jennelyn Abelarde**	Sun Cruises. With the presence of the bridge, ferry passengers might decrease in number since there would be another option which is by land. *No IPs
	Edward Buko Soriano, Jr.	N/A
	Alberto Juanico	Bangkeros
	Cleofe B. Diestro	All the people in Corregidor including tourists.
	Jovelyn Isla	None
	Ronnie Amado	Tourists and employees
	Fidel del Losa	CFI and tourists
	Restituto Solis	There are no residents in the island, so just employees
	Armando Hildawa	Sun Cruises business
	Kevin Ballon	Sun Cruises business and tourists
	Brian Bongalin	Sun Cruises and boat operators (boat organization).
	Jeremy Rolin	N/A
	Mitos Magrare	If the project is not implemented properly, the sacredness of the entire island as a whole [will be affected].
	William Payumo	Sun Cruises since it is a private company and our main business is ferry operations. For sure if a link bridge is established, our guests from Manila will be affected.
	Gelio Pascua	The whole island will be affected. Other boatmen will also be affected since the bridge will mostly allow vehicles to enter the island
2. Have you heard of any concerns from the community about the project?	**Jennelyn Abelarde**	Yes
	Edward Buko Soriano, Jr.	No
	Alberto Juanico	No

	Interviewee	Response
	Cleofe B. Diestro	No
	Jovelyn Isla	No
	Ronnie Amado	No official plans, just hearsay
	Fidel del Losa	None
	Restituto Solis	None, just hearsay
	Armando Hildawa	None
	Kevin Ballon	None
	Brian Bongalin	No
	Jeremy Rolin	N/A
	Mitos Magrare	No
	William Payumo	No. Most of my colleagues have mostly positive views and are supportive about the bridge.
	Gelio Pascua	Among us here, we are supportive of the bridge since it will encourage more tourists to come in. If the bridge will destroy parts of the island, we are in no position to oppose the project.
2.1 What are these?	**Jennelyn Abelarde**	The island would not be exclusive to the tourists visiting the island.
	Edward Buko Soriano, Jr.	N/A
	Alberto Juanico	N/A
	Cleofe B. Diestro	N/A
	Jovelyn Isla	N/A
	Ronnie Amado	N/A
	Fidel del Losa	N/A
	Restituto Solis	N/A

	Interviewee	Response
	Armando Hildawa	N/A
	Kevin Ballon	N/A
	Brian Bongalin	N/A
	Jeremy Rolin	N/A
	Mitos Magrare	N/A
	William Payumo	N/A
	Gelio Pascua	N/A
2.2 Who are most concerned?	**Jennelyn Abelarde**	Workers in the island.
	Edward Buko Soriano, Jr.	N/A
	Alberto Juanico	N/A
	Cleofe B. Diestro	N/A
	Jovelyn Isla	N/A
	Ronnie Amado	N/A
	Fidel del Losa	N/A
	Restituto Solis	N/A
	Armando Hildawa	N/A
	Kevin Ballon	N/A
	Brian Bongalin	N/A
	Jeremy Rolin	N/A
	Mitos Magrare	N/A
	William Payumo	N/A

	Interviewee	Response
	Gelio Pascua	N/A
Barriers to Implementation		
1. What are the main barriers to implementation?	**Jennelyn Abelarde**	None because constructing the bridge would be beneficial during typhoons (or LPA)
	Edward Buko Soriano, Jr.	Sorry I cannot answer
	Alberto Juanico	None if there is a budget for the project.
	Cleofe B. Diestro	None
	Jovelyn Isla	None
	Ronnie Amado	None
	Fidel del Losa	Check possible laws, ask CFI
	Restituto Solis	Check with CFI Management
	Armando Hildawa	Check with CFI Management
	Kevin Ballon	No barriers can be identified because the proejct will benefit Corregidor
	Brian Bongalin	It will depend on DENR. There are some employees here who fish on the tail-end of the island, but for leisure only.
	Jeremy Rolin	The barrier is the airstrip at the moment. That's the only barrier. You've gotten the CAAP approval that the height of the bridge does not interfere with Sangley Airport. We haven't yet gotten clearance from CAAP for the Sangley International Airport if that ever opened. We'd have to go back to CAAP to get approval for that.
	Mitos Magrare	Nothing in mind. There just needs to be a mutual consensus between governments [Bataan and Cavite] and CFI needs to agree.
	William Payumo	A big factor to consider are the veterans. The veterans are regarded with highest priority here in Corregidor. From the tour, we can see how important we revere the veterans. There is a veterans association now called FAME. Your group should speak with the association regarding this project. In our case, we previously offered ATV services for our guests; however, the veterans were

	Interviewee	Response
		concerned since the ATVs will pass through hollowed grounds. We were therefore allowed restricted access. They are the biggest factor to consider.
	Gelio Pascua	We are just few in the island and all of us here are not permanently living in the island
Support to Project		
1. Are you willing to support project implementation?	**Jennelyn Abelarde**	Yes
	Edward Buko Soriano, Jr.	I think I will
	Alberto Juanico	Of course
	Cleofe B. Diestro	Yes, as long as Corregidor will stay the same.
	Jovelyn Isla	Yes
	Ronnie Amado	Yes, the project is a good project
	Fidel del Losa	Yes
	Restituto Solis	Yes
	Armando Hildawa	Yes
	Kevin Ballon	Yes
	Brian Bongalin	Depends
	Jeremy Rolin	Yes
	Mitos Magrare	If the three governments – Bataan, Cavite, and CFI – approve of the project, we will support it.
	William Payumo	Yes
	Gelio Pascua	If tourism will be more favorable for Corregidor and as long as the environment, trees, and ruins will not be affected or if there will be ways to ensure that historical remains and artifacts will not be destroyed, I am supportive of the project.

	Interviewee	Response
1.1 In what way?	**Jennelyn Abelarde**	By telling other people about it. I will tell them that Corregidor will be more accessible and travel time will lessen.
	Edward Buko Soriano, Jr.	I can't think of a way right now
	Alberto Juanico	Through surveys, whether people like it or not
	Cleofe B. Diestro	By knowing the opinion of other people and researching about the project
	Jovelyn Isla	By informing others about it.
	Ronnie Amado	I will cooperate if there is something I need to do
	Fidel del Losa	I will participate in meetings when invited
	Restituto Solis	I will participate in activities when invited
	Armando Hildawa	Participate in consultations when invited
	Kevin Ballon	Depends on CFI
	Brian Bongalin	N/A
	Jeremy Rolin	I have put forward the official CFI view of the project and we, in CFI, encourage it.
	Mitos Magrare	N/A
	William Payumo	N/A
	Gelio Pascua	N/A
1.2 Why?	**Jennelyn Abelarde**	I think it is a good project. Many will benefit, not only from Corregidor, but also from Bataan and Cavite. The bridge will lessen travel time.
	Edward Buko Soriano, Jr.	More tourists would come to visit
	Alberto Juanico	The project is very good. A lot of employees and tourists would be happy. Traffic in EDSA would lessen since people coming from the north going to the south can pass by the bridge.
	Cleofe B. Diestro	The project will give everyone easy access for everyone and will boost tourism

	Interviewee	Response
	Jovelyn Isla	It will provide easier access to the island.
	Ronnie Amado	I think this is a good project that can help most employees and help Corregidor to be more easily known
	Fidel del Losa	It is a good project with a lot of benefits
	Restituto Solis	N/A
	Armando Hildawa	The bridge will make access easier
	Kevin Ballon	I believe this is a good project
	Brian Bongalin	DEPENDS on the purpose of the bridge. The question is if it would be open to the public or not.
	Jeremy Rolin	From our point of view, by providing a link for tourists, oru main customers, would be a very good idea. During the period of June to October, our sales are down because of the difficulty in travelling across the bay. If we have road link, we can have them here all year round. However, we have done a masterplan by Jun Palafox and his company on the development of Corregidor as a tourist site because we are struggling. We don't have enough tourists. Our only income is from tourists. We don't get it from anywhere else, so we need people to come here and that is why we support the concept of the bridge.
	Mitos Magrare	The project will encourage tourism and will showcase how beautiful and peaceful Corregidor is.
	William Payumo	Currently, I handle Motorpool Inn. Our main concern is the cost of electricity. The generators contribute to high operational costs. I was hoping that once the bridge provides connections to the mainland, we will easily have an electricity source. I have raised this with the management group and this will be a big advantage for us in terms of electricity costs since our current source [generators] is from Bataan.
	Gelio Pascua	N/A
2. Who are the right / appropriate people to inform?	**Jennelyn Abelarde**	CFI and Sun Cruises
	Edward Buko Soriano, Jr.	I don't know
	Alberto Juanico	Those running the government in Bataan and Cavite

	Interviewee	Response
	Cleofe B. Diestro	(…) Chairman of the Island (Cynthia), everyone
	Jovelyn Isla	CFI
	Ronnie Amado	CFI
	Fidel del Losa	CFI, hotel management, Coast Guard, PPA
	Restituto Solis	CFI, concessionaires
	Armando Hildawa	Sun Cruises and CFI
	Kevin Ballon	Department of Tourism, Sun Cruises, and CFI
	Brian Bongalin	CFI and their consultant. The head of CFI is Ma'am Cynthia Carreon. They also have consultants for the island. Ask CFI if they are okay with the project. Maybe their concern would be if there would be an exit / tollgate here in Corregidor.
	Jeremy Rolin	Me, CFI, Palafox. They [Palafox group] already know about it. We told them. At the last meeting we had about the bridge, the group of Palafox was there, and the bridge had already been included in the draft masterplan. Yet, they need to be talked to. The CFI office in Manila should also be informed. The association of veterans should be informed. The Department of Defense [also needs to be informed] because they own this place. Generally they delegated it to the Chief of the Philippine Veterans Association – General Carolina. We can't do anything major here. We have to refer to them [first]. You should first speak with their technical assistant.
	Mitos Magrare	CFI Head Office Chairman Cynthia Carreon. You should first contact Ms. Rowena Bautista, OIC Department Manager for Corporate Affairs. Office address is in the CCP Complex. Contact number: 2823328
	William Payumo	CFI handles the Island. All matters need to be approved by them.
	Gelio Pascua	CFI since they head the entire Island. Even if we are not supportive of the bridge and if CFI wanted to pursue the project, we cannot do anything about it.

	Interviewee	Response
3. If you could have 3 things to develop in your community as a result of the project, what are these?	**Jennelyn Abelarde**	With the presence of the bridge, I think more people would come so I hope that the destinations here would be maintained, especially the beach area and battery. This would attract more people since they would see that the destinations are well-maintained.
	Edward Buko Soriano, Jr.	Improve and develop other destinations in the island
	Alberto Juanico	Maintenance of the island, as well as waste management.
	Cleofe B. Diestro	Cleanliness, security, and assistance for vehicles who want to enter Corregidor. Management should also regulate tourists and have scheduled visits.
	Jovelyn Isla	Cleanliness and attractiveness
	Ronnie Amado	Higher tourists rates since they will learn about Corregidor; the overall area will improve; easier way of accessing hom and Cavite during emergency situations
	Fidel del Losa	Better access; more people will be knowledgeable about Corregidor; and access in emergency cases
	Restituto Solis	Improves sightseeing options to attract tourists and easier access
	Armando Hildawa	All goods in Corregidor will be cheaper; better access in case of emergencies
	Kevin Ballon	Easier access going to Corregidor; promotes tourism; access in case of emergencies; improved utilities (e.g. electricity)
	Brian Bongalin	Depends if the bridge would be open to the public. If it is private, then why would we go there?
	Jeremy Rolin	What we need to do is to control the traffic in some way, and there are many ways in which we can do it. There is no way we can allow a man from Manila to drive up here and drive around the island. It’s not big enough. We have to input a stop or a car park up there and our tour bus will transport them around the island. That’s very important. How are we going to do that? Well, there are various ways. We are looking, realistically, 10 years. A construction period of 5 [years], and I know it would take up to 2 years to start the construction or it might take longer, about 5 years, to start the construction because that’s the way it is. I know that if we’re being realistic, it would be 10 years from now. Our masterplan is for the next 30 years.

	Interviewee	Response
	Mitos Magrare	Improved transport and options to travel to Bataan. The bridge may attract investors to develop golf courses. Water sports activities could be set-up.
	William Payumo	Other than the electricity, I want to see the island develop as a whole.
	Gelio Pascua	We are not in favor of further developments. For example, if a mall or Jollibee will be established here, we are not in favor of that. Before, Henry Sy wanted to buy a part of the island to establish PAGCOR. The government did not allow it because the historical appreciation of Corregidor will be lost.
4. Do you have any other suggestions and recommendations in the design and/or implementation of the project?	**Jennelyn Abelarde**	None at the moment because I haven't seen the actual bridge and the construction haven't been started. Maybe when the bridge is fully operating, I think I can recommend something. So far, from what I can see now in the photos, I think the projects is okay. I think it's safe.
	Edward Buko Soriano, Jr.	None
	Alberto Juanico	Can we pass by the bridge? Can motorcycles pass by the bridge?
	Cleofe B. Diestro	None
	Jovelyn Isla	None at the moment
	Ronnie Amado	None
	Fidel del Losa	None
	Restituto Solis	None
	Armando Hildawa	Will there be lights along the bridge so that Corregidor will also have their own power? Sun Cruises may also consider having a mainland tour
	Kevin Ballon	None
	Brian Bongalin	Hopefully the bridge would be open to the public. Whenever there are typhoons, it would be easier for us to evacuate the island. Also, if it is our day off from work, which is usually once a week, we may opt to travel by land especially if the waves are strong. I think having the bridge and opening it to the public would increase our safety when travelling. I hope it will be open to the public and have an exit here in Corregidor. Hopefully we can have a parking space as well so that other people can

	Interviewee	Response
		have the chance to tour around the island. More signages should also be added on the road to prevent accidents.
	Jeremy Rolin	None
	Mitos Magrare	A toll gate could be set-up and could also collect visitor entrance fees to Corregidor
	William Payumo	We might not be able to reach the time when the bridge materializes. We hope that we are still around once the bridge is operational.
	Gelio Pascua	Help us to ensure that the bridge will be established or stop the establishment of the bridge if it is not favourable because we are not in the position of power to oppose the project.
Other concerns, suggestions	**Jennelyn Abelarde**	Tourists don't usually go to the part of the island where the airport is located. Since on the side of Bataan, the water is usually high/deep, is the bridge high enough if ever there would be typhoons?
	Edward Buko Soriano, Jr.	N/A
	Alberto Juanico	N/A
	Cleofe B. Diestro	N/A
	Jovelyn Isla	N/A
	Ronnie Amado	Concerned about the timeline and if benefits will be soon.
	Fidel del Losa	What are the chances that connection to Corregidor will push through?
	Restituto Solis	Concerned how people will travel from the tailend to the main tourist area of Corregidor; concerned about the toll gate
	Armando Hildawa	Concerned that timeline of construction to operation will not be followed. Who will be using the bridge? Will this be accessible to the public?
	Kevin Ballon	Concerned about waste disposal.
	Brian Bongalin	What is the purpose of the bridge? Is it only for private vehicles? Is the bridge a private, provincial, or national road? The bridge may be beneficial for us. As for me, I live in Batangas so imagine how I

	Interviewee	Response
		travel to and from Corregidor. Most workers are from Bataan, Cavite, Maragondon, Manila, Batangas, and Pangasinan.
	Jeremy Rolin	They say that the saturation rate is 166,000 per day. But I don't agree with them. That's 550 ferries with 300 people on them. I'm not happy with the extent of the masterplan. At the moment, we are expecting a maximum of 1,000 people in February next year. We can't at the moment cope with that much people on the island. We haven't got the toilet. We haven't got the garbage collection system. We are going to have to put a bloc of facilities in here to cope with the people. So at the moment, I would say the saturation rate is about 400 (maybe 500) people in the island at maximum. My own masterplan calls for 2 small hotels – 1 for 250 beds, 1 for 150 beds. So we're talking about 1,000 people and day trippers about 500.
	Mitos Magrare	Only tall grass and rocks are present in the area of the alignment
	William Payumo	Several people died at the tailend part of the island, which is also where the Japanese landed and attacked. The tail end part also mostly has Ipil-Ipil trees and Kawayan, which are fast-growing.
	Gelio Pascua	N/A

Information, Education, and Communication (IEC) Meeting
Bataan-Cavite Interlink Bridge Project
Environmental Impact Assessment
Detailed Engineering Design Stage

Online IEC
Date: 21 October 2021, Wednesday, 10:00 A.M.
Corregidor Islands Marine Park Executive Committee
Meeting ID: 895 1049 4695

Open Forum:

Presented in the matrices are the summary of issues, concerns, comments, and suggestions raised during the IEC Meeting (DED Stage) with Corregidor Islands Marine Park Executive Committee (CIMP). Responses to the queries are also included in the matrices.

Please see the attached attendance sheet/s for the list of participants during the meeting.

Summary of Issues, Concerns, Comments, and Suggestions Raised during the DD IEC Meeting with the Corregidor Islands Marine Park Executive Committee (1/6),	
Queries/Concerns/Suggestions/Comments	**Responses to Queries**
• Asked how the team got the 3.7 kilometers distance between the sampling point and Corregidor's declared protected area. • Informed that CF5 is in the middle of their protected area, as well as CF3, CF4, and CF6. • Shared that based from their conversation with DENR and other concerned agencies, the Marine Protected Area is all around Cavite. • Stated that the CIMP Executive Committee is not objecting the conduct of study however it only wants the team to be accurate with the declared measurements, especially the distance from the MPA. **MR. JERRY ROLLIN,** *Member,* Corregidor Islands Marine Park Executive Committee	• Responded that the marine experts plotted the alignment in reference to the Management Plan of Corregidor Islands Marine Park, from PENRO-Cavite. • Answered that the team is willing to relocate their sampling station to the boundary of the protected area. • Their concern will be raised to the marine experts to overlay the alignment again and consider having new sampling stations. **MR. FREDERICK ESTERNON,** *Environmental Management Specialist,* DCCD
• Inquired if there is an assurance that the project will push through or prioritized by the new administration. **MR. MARIO DAGA**, Department of Transportation Region 4A	• Answered that the EIA team is trying to double time with their activities and that there are already initial works in the alignment. • Shared that the team is trying to have the ECC amended by December and by early next year, the construction is expected to start. • By doing the said steps, the team is hoping that the activities for the project will not be affected by the forthcoming election. • Reassured that the project will push through. **MR. ESTERNON**

Summary of Issues, Concerns, Comments, and Suggestions Raised during the DD IEC Meeting with the PENRO-Cavite and Corregidor Foundation Inc. (2/6),	
Queries/Concerns/Suggestions/Comments	**Responses to Queries**

• Asked if this is the only IEC that the Cavite City was a participant of. • Inquired if this is the only IEC wherein matters about the MPA was raised. • Requested a confirmation if the construction posts were not supposed to be traversing the MPA based on the FS design. • Informed Mr. Esternon that the MPA is not only the core zone but the surrounding waters as well. • Raised his concern about the alignment passing through the middle of the MPA. • Added that the heritage of the area and the military zones must also be considered during the EIA. • Emphasized that there are bombs in Caballo Island wherein the bridge is passing through and there are also underwater mines within the MPA. • Stated that the CIMP is not anti-progress, they would just like to assure that the progress will not compromise that environmental and historical heritage. • Raised his concern on how will the government will recoup its expenses for the project when areas such as Mariveles (in Bataan), Naic, Ternate, and Maragondon (in Cavite) are all rural areas. • Requested to consider all their concerns to the study of the project. **ATTY. IAN ENCARNACION,** *City Legal,* City of Cavite	• Answered that there already have been around 3 to 4 IECs conducted with participants from Cavite City. • Clarified that during the first few IECs, specifically during the Feasibility Study (FS) stage, the alignment was far from the Corregidor Islands. • Confirmed that it is the plan and still is during the Detailed Engineering Design (DED) stage of the project. • Explained that the team of marine experts are aware with the presence of bombs and mines and assured that the team is knowledgeable and capable of doing the study since they are the same team who made studies for the Manila Bay. • Added that in the ECC Amendment, CIMP Executive Committee is considered as the resource group for consultations with regards to the Corregidor Islands. • Affirmed that the purpose of the meeting is to get inputs from the CIMP, to be incorporated in the study. **MR. ESTERNON**
• Asked for a copy of the results of the underwater studies. Representative from the **Planning and Development Office of Cavite City (CPDO)**	• Answered that they will be providing them copies after it has been made official. **MR. ESTERNON**
• Requested to take note of Atty. Encarnacion's concerns since it is PVAO's concern as well. **COL. AGERICO AMAGNA III,** *Veterans Memorial and Historical Division,* Philippine Veterans Affairs Office (PVAO)	

Summary of Issues, Concerns, Comments, and Suggestions Raised during the DD IEC Meeting with the PENRO-Cavite and Corregidor Foundation Inc. (3/6),	
Queries/Concerns/Suggestions/Comments	**Responses to Queries**
• Stated that the alignment presented to them before is different comparing to the design in the current stage of the project.	• Responded that the alignment during the FS stage is just the proposed design. • Discussed that the EIA team is concerned about the possible effects of designing an exit point to

• Shared that PVAO requested the proponent an exit point leading to the CIMP. **COL. AMAGNA III**	Corregidor but it is still not final and under further study. **MR. ESTERNON**
• Requested for a copy of the different type of management plans of the CIMP to serve as a reference for the study and align it to the purpose of the Environmental Performance Report and Management Plan (EPRMP) of the project. • Inquired if they are referring to ARUP. **MR. ESTERNON** • Informed that TYLIn has not been communicating with them as of the moment. • Raised his concern about the effects of the project on the operational areas of the island, especially on the tail side of Corregidor wherein there is a military air road drone. • Informed Mr. Esternon that tail side of the Corregidor is planned to be developed. **COL. AMAGNA III**	• Responded that the study was already finished by the Engineering Team or consultants of the project. • Confirmed that it was ARUP. **COL. AMAGNA III** • Clarified that ARUP was the consultant during the FS stage but with the DED stage, TYLin International Group is the new consultant. • Stated that he is part of the TYLin International Group. • Reiterated his request for the management plans or reports for the CIMP. **MR. ESTERNON** • Responded that the Tourism Infrastructure and Enterprise Zone Authority (TIEZA) have the said plans for the CIMP. • Added that it is best to ask TIEZA to provide PENRO Cavite the requested documents so PENRO can share it with the EIA team. **COL. AMAGNA III**
• Informed Mr. Esternon that their team from Mt. Samat FTEZ can request for information disclosure from their main office in TIEZA so they can share the Tourism Master Plan for Corregidor Islands. **MR. FRANCIS INITORIO,** *Representative,* Mt. Samat Flagship Tourism Enterprise Zone (FTEZ) • Asked if Mr. Esternon's team would need to submit a letter for their request. **MS. FAITH FALCUTILA**, *Representative,* PENRO-Coastal and Marine Conservation Unit	• Confirmed that the EIA team must submit a request letter. • Affirmed that TIEZA can closely coordinate with the EIA team to properly incorporate the development of the tail side with the design of the project. **MR. INOTORIO**

Summary of Issues, Concerns, Comments, and Suggestions Raised during the DD IEC Meeting with the PENRO-Cavite and Corregidor Foundation Inc. (4/6),	
Queries/Concerns/Suggestions/Comments	**Responses to Queries**
• Shared his concern about the master plan, which calls for a large increase in the number of tourists visiting Corregidor. • Informed that the daily number of cars visiting the island will go from 75-100 cars to a thousand, which the island cannot	• Explained that it is the EIA team's concern as well that is why they are not into the idea of constructing an access to the island. • Discussed that the team have considered the "Island Capacity" and also worried that project would not be able to regulate the entry of vehicles into the island.

accommodate since there is no road structure and it is not possible to construct one. • Suggested to establish a bus terminal at the both ends of the bridge so the CIMP can regulate the number of vehicle and tourists in the island. • Stated that the project will be a great help to the CIMP in terms of electricity and water supply as well as garbage disposal but it has to consider how to regulate the number of people going to the island. **MR. ROLLIN**	• Stated that the team needs a copy of the master plan to incorporate such concerns and proposals to the design of the project. **MR. ESTERNON**
• Suggested that since natural heritage, historical and archaeological sites will be affected, not only environmental, assistance and permission from the National Commission for Culture and Arts (NCCA), National Museum, and National Historical Commission of the Philippines (NHCP) must be obtained. **MR. JC ASUNCION** • Informed Mr. Esternon that TIEZA can help them in coordinating with the NCCA and NHCP since they are in partnership for Mt. Samat and Corregidor Islands. **MR. INOTORIO**	• Affirmed that their suggestion is duly noted. **MR. ESTERNON**
• Requested for the recording of the video and minutes of the meeting from PENRO, once available. **MR. ESTERNON**	• Confirmed that PENRO Cavite will provide requested files. **MS. FALCUTILA**
• Asked if the EIA team is aware about the presence of a caldera between the Corregidor Islands and Caballo Island. **MS. ANDREA PANGANIBAN,** *Development Management Officer II,* PENRO Cavite	• Responded that the team is aware about the presence of caldera in the said area. **MR. ESTERNON**

Summary of Issues, Concerns, Comments, and Suggestions Raised during the DD IEC Meeting with the PENRO-Cavite and Corregidor Foundation Inc. (5/6),	
Queries/Concerns/Suggestions/Comments	**Responses to Queries**
• Requested for a clarification regarding the aforementioned 3.7 kilometers distance, if it is from the tail end of the island or core zone. • Shared that the viaducts will be traversing the MPA, considering that it has buffer zone. • Inquired if the posts to be constructed do not have an impact to the caldera. **MS. PANGANIBAN** • Asked if the exact location of the caldera is available in the CIMP Management Plan so the	• Clarified that the team is referring to the distance from the core zone. • The team will be informed about this concern and assured that they will keep PENRO posted. • Informed that there is already a dredging activity within the area by another company or project and the team reported it to the Environmental Management Bureau Central Office. This is to avoid possible misconception

team can overlay the alignment with reference to the location of the caldera. **MR. ESTERNON** • Requested for a copy of the ECC Amendment once available. **MS. PANGANIBAN** • Informed that the northern side of the caldera is the Corregidor Islands while its eastern side is the Caballo Island. • Recommended to refer to marine charts to locate the caldera. **MR. ROLLIN**	that the said activity is made by the BCIB project. • Assured that their concern would be considered for the ECC Amendment. **MR. ESTERNON** • Explained that it is not actually part of the MPA that is why they do not have its exact location however its details can be requested to DOST or Philvolcs. **MS. PANGANIBAN** • Assured that they will provide PENRO a copy of the ECC Amendment. • Expressed appreciation to Mr. Rollin's input. **MR. ESTERNON**
• Asked who will be providing the Marine and Aquatic Ecology Team a certification, either via email or formal letter, stating that they can proceed with their sampling activity. • Explained the importance of the activity, not only for the project, but as well as for the CIMP. **MR. ESTERNON** • Referred the question to Atty. Encarnacion. • Inquired if the LCE will not act as the CIMP Chairman for this matter. **MS. PANGANIBAN** • Asked for Atty. Encarnacion's contact information. **MR. ESTERNON** • Requested to be copy furnished in all communications with regards to CIMP. **MS. PANGANIBAN**	• Answered that it should be provided by the CIMP. • Added that the DENR/PENRO is just the secretariat of the CIMP and its chairman is the Local Chief Executive (LCE) of Cavite City. **MS. PANGANIBAN** • Responded that they would still convene with the Sangguniang Panglungsod and ask for their concurrence. • Explained that even if the LCE is the Chairman of the CIMP, the Mayor still decide for matters with the concurrence with the Sangguniang Panglungsod. • Shared his contact information with the participants. **ATTY. ENCARNACION** • Assured that the Secretariat will be copy furnished, as requested. **MR. ESTERNON**
Summary of Issues, Concerns, Comments, and Suggestions Raised during the DD IEC Meeting with the PENRO-Cavite and Corregidor Foundation Inc. (6/6)	
Queries/Concerns/Suggestions/Comments	**Responses to Queries**
• Informed Mr. Esternon that the sampling station CF6 is located in the Caballo Island and they will need permission from the military to enter or proceed with their activity. **MR. ROLLIN**	• Responded that the team will relocate the sampling station. **MR. ESTERNON**
• Inquired if there will be viewing area in the design of the project. **MR. DAGA**	• The view deck area was proposed however it is still under discussion if it would be included in the final design. • Assured that they will be updated regarding this matter. **MR. ESTERNON**

Photos:

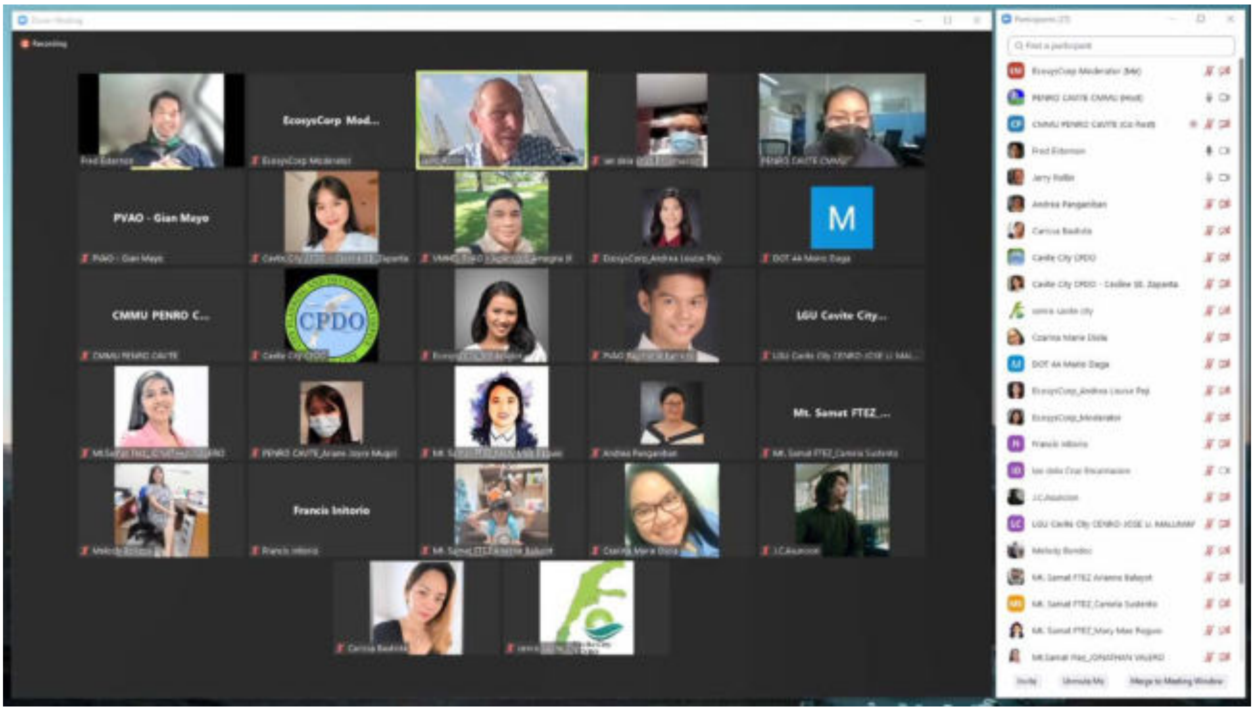


Photo No. 1 **Mr. Jerry Rollin** sharing his concern about the distance of the sampling stations to the MPA.

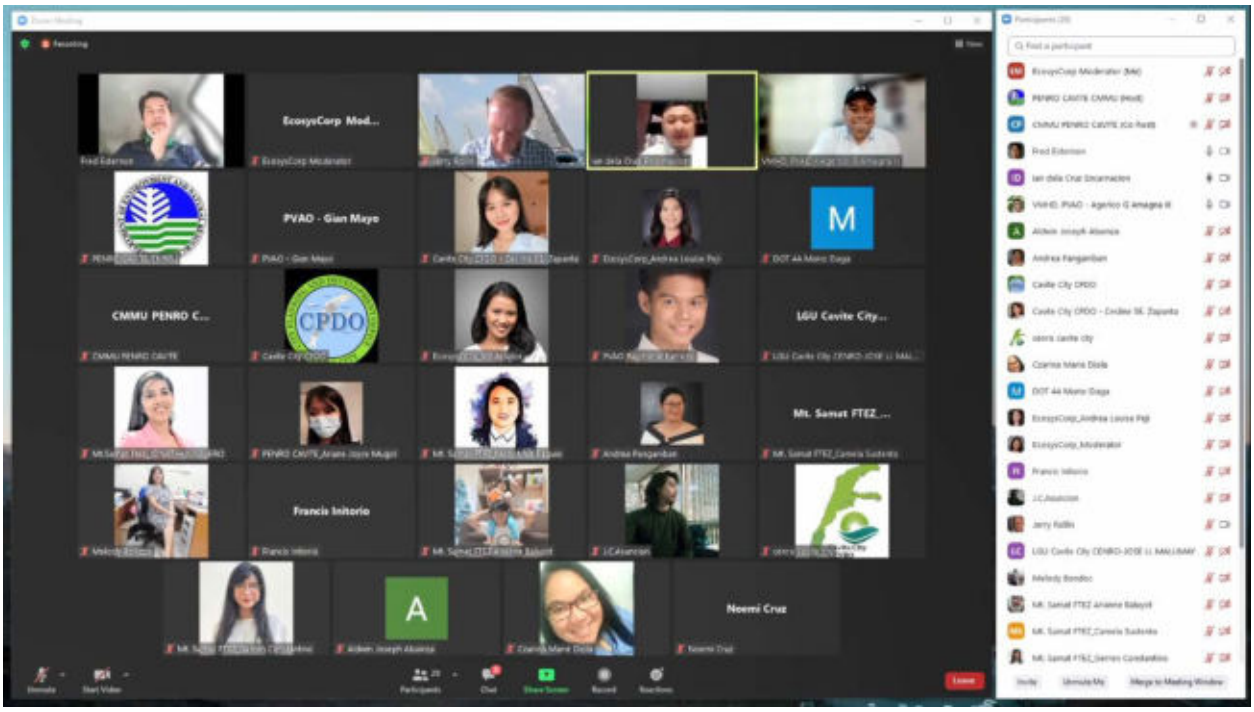


Photo No. 2 **Atty. Ian Encarnacion** clarifying that the surrounding waters is part of the MPA.

Attendance:

NAME	OFFICE
Faith Falcutila	PENRO CMCU

Jose Malumay	CENRO Cavite City
Frederick Esternon	DCCD
Andrea Panganiban	PENRO Cavite
Ariane Joyce Mugol	PENRO CMCU
Carissa Bautista	
Cesline Zapanta	CPDO Cavite City
Melody Bondoc	CFI
Mario Daga	DOT Region 4A
Jerry Rollin	CIMP
Jonathan V.	Mt. Samat FTEZ
Gian Mayo	PVAO
Raymond Barreno	PVAO
Col. Agerico Amagna III	PVAO, VMHD
Andrea Louise Peji	EcosysCorp, Inc.
Francis Inotorio	Mt. Samat FTEZ
Czarina Marie Diola	
J.C. Asuncion	Mt. Samat FTEZ
Arianne Baluyot	Mt. Samat FTEZ
Carmela Sustento	Mt. Samat FTEZ
Gerren Constantino	Mt. Samat FTEZ
Mary Mae Paguio	Mt. Samat FTEZ
Jonathan Valero	Mt. Samat FTEZ
Atty. Ian Encarnacion	Cavite City Legal

DPWH - ISO – QUALITY MANAGEMENT SYSTEM

Title/Description:

Consultation Meetings on Environmental Impact Assessment with Mr. Simeon Stairs at Cavite for the Detailed Engineering Design Consultancy Services for the Bataan-Cavite Interlink Bridge Project

Date:	Started:	Adjourned:	Venue:
March 30, 2022	9:00 AM	5:00 PM	Cavite

Meeting Presider:

Mr. Simeon Stairs

Meeting Attended by:

Please see the attached Attendance Sheet

TOPIC/DISCUSSION/ACTION ITEM

TOPIC/AGENDA	DISCUSSION
CIMP Technical Meeting and Consultation attended by the representatives from DPWH UPMO RMC II, PEO, PPDO, PVAO – DND, PGENRO, CPDO, CENRO, and PENRO with the DCDD Engineering Corp. and Associates	• Mr. Simeon Stairs started the consultation meeting by presenting the outline of the discussion as listed below: o BCIB Project ▪ Project Overview ▪ Updates on alignment and turnaround position ▪ Updates on construction activity and impacts o ADB Requirement for Mitigation Planning in Natural, Critical, and Protected Habitat o Next Steps ▪ Development of mitigation options and plans ▪ Further consultation with marine science community to shape Biodiversity Action Plan o Questions and Discussions • During the discussion of the BCIB Project particularly on the updates on construction activity and impacts, Mr. Roldan Bayaga asked on the specific ideas for the habitat offset to compensate for habitat loss. Mr. Stairs stated that currently, they are on the stage of identifying impacts and about to move on finding mitigation. In general, there will be an enhancement on existing habitats on nearby areas. Ideally that will be in coordination and support with CIMP artificial reef program. He added that artificial reef is the most obvious idea to make up habitat loss which will be located in installation area (pointed out on the map). Another idea is that, the parts of the bridge that will be constructed particularly on the foundation part can serve as one of the mitigation measures as a habitat offset. • Ms. Anabelle Cayabyab asked on the extent of the coral cover and seagrass bed that will be affected by the project and the depth of the project to be able to consider the area for the computation of the marks (silk curtain) and its location within the project alignment. Mr. Stairs stated that they still don't have the exact number yet from the marine team. He added that the extent of coral cover in the area along the Corregidor area is quite long, estimated to be 10% coral cover. In terms of the overall coral area that will be affected, he stated that there is still no exact number yet. As long as the sea grasses are concerned, the number is close to zero. Along the Corregidor Island, much of the bottom part were boulders which is not conducive to seagrass quarrying. Near the Cavite shore, the water is naturally very turbid, and they are more turbid by the existing activities which is a very significant

	limitation to development. In terms of depth, the alignment has quite some range of depths. The deepest area is in the North Channel between the Corregidor Island and Bataan, the deepest depth in that area is about 90 meters, but where the bridge will across, its 40 to 50 meters. He added that the exact number is not yet determined since the geophysical survey is still ongoing. For areas close to the shore, there were some shallow areas. Along the coast of Corregidor particularly in tail end, much of the alignment is more or less 10m. • Ms. Cayabyab asked whether the bathymetry and wave direction were being considered in order to address or identify the possible risk like inclination, sea level rise and tsunamis. Mr. Stairs stated that the sea level rise and tsunami risk were being part of the design. He added that it is one of the reasons why there were consultation meetings being conducted in order to input important aspects in the updating of the EMP. • Ms. Cayabyab asked if the ongoing dredging project or seabed quarrying along Cavite is being considered since it is near the BCIB Project site plus the ongoing proposal of the DENR PENRO for the Corregidor-Ternate Marine Protected Area Network. Mr. Stairs stated that they were aware of the seafloor dredging operations and the extent of possessions that have been defined all throughout the Manila Bay. He added that obviously, this should be taken seriously and its conducive effects. As far as the bridge is concerned, the bridge is going to have a protective effect wherein the areas near the BCIB Project site will have a strict monitoring for other dredging activities. Mr. Stairs added that buffer zone is not yet identified. Mr. Esternon stated that there will be a 1000m boundary, as mentioned by EMB, away from the alignment just to make sure the integrity of the structure (the figure is still needed to be confirmed). • Ms. Cayabyab stated that there will be a time where the BCIB project and the ongoing dredging project will be simultaneously conducting activity in the area which might affect the seabed floor especially the depth on the proposed project site. Mr. Esternon stated that since the BCIB project is an ADB project, every step is scrutinized and as mentioned by Mr. Stairs, there will be navigating measures needed to install prior and during the construction. He added that it's saddening that the dredging activity is currently on process according to meeting with MENRO. Ms. Cayabyab added that there were two (2) for-approved dredging companies which started last December. • Along the discussion of the ADB Requirement for the Mitigation Planning in Natural, Critical, and Protected Habitat, Ms. Cayabyab stated that in the biodiversity team, they already studied the seek and source of the egg of the fishes for the computation of the net losses of the biodiversity. Mr. Stairs stated that seek and source will be needed to be followed-up. Ms. Caybyab stated that each habitat is interconnected to one another; the seagrass bed, coral comfort, seek-source area for the species of fish and eggs which is needed to be considered for biodiversity to be able to consider the carrying capacity and to be to target the natural habitat and no net loss of biodiversity values. Mr. Stairs stated that on a conceptual level, they were not aware of it but will be one part to considerate. He added that if ever they collected sufficient data, they will be conducting a detailed calculation of net gain and loss. When it comes to next steps, Mr. Stairs stated that they will

	call the local marine science community and experts especially in the area in refining the EMP as a requirement to have local expert's involvement to help figure out what is the appropriate offset to achieve the 'no net losses. Mr. Esternon recalled the project way back 2019 presented in Naic Conference by a marine biologist with the consultation to stakeholders. He stated that one of the targets is to identify possible biodiversity or the area where the species can grow. It just happened that there were no resources like mangrove area along the alignment where most of it have boulders. That's why there was no seagrass base from the 1000m boundary from the alignment. Mr. Esternon requested for the assumptions and pictures from the project way back 2019. As mentioned by Mr. Stairs, all the data that will be acquired will be part on the updating of EMP. • Ms. Cayabyab suggested to consider marine turtle conservation since Corregidor Island and several coastal areas in Cavite is the location of the nesting site of the Olive Ridley which is the only species in Cavite nesting in the coastal area. She added that they have a protection conservation program and even in Morong, Bataan, they also have conservation project for the 3 species of turtle. Mr. Esternon asked for data regarding the existing monitoring report on the marine turtle conservation. Ms. Cayabyab stated that she can provide the study at the Marine Science Institute of the University of the Philippines regarding the olive ridley and its nesting site. She added that she used the Landsat image to project the coastal erosion and abrasion to the nesting area. Recently, her office has conducted the coastal assessment to be able to identify the extent the coastal erosion in Cavite and the sea level rise based on the five species in Manila Bay. • Ms. Cayabyab asked on the status of the compliance with the ECC. Mr Esternon stated the ECC was already secured early 2021. Since the project started, he added that they need to find out whether there will be a minor or major amendments with the ECC. Ms. Cayabyab asked whether the amendment will be based on the new alignment. Mr. Esternon stated that there will be no new alignment, just a minor addition along the alignment particularly on the changing of the interchange. Mr. Esternon added that during the FS stage, it was presented that the design will have possible connection to the Corregidor Island, but now, it was completely removed. Mr. stairs added that there was also changed in the land site wherein the area for land part is getting final, about 90%. Ms. Cayabyab asked on the status of other permits, particularly on the requirement of an area clearance and area status prior to commencement since it will affect the start and the time for the execution of the BCIB Project. Mr. Esternon stated that with regards to other permits, the DPWH have already secured necessary permits as per terms with the ECC. Ms. Cayabyab asked the target date of the start of the project. Mr. Esternon stated that the project will start probably early next year, 1st quarter as mentioned by Mr. Stairs. Ms. Cayabyab requested for the project briefer for them to prepare and see the Direct Impact Area (DIA) which could be similar with the DIA of the ongoing dredging activity for them to prepare the SDP which is also one of the compliances to the ECC and to be able to address some issue which could emerge in the area during the construction phase. Mr. Esternon stated that as per mentioned by PENRO, we have options whether to provide the current EMP or the revised one. Ms. Cayabyab requested to have both copy for comparison.

	• Mr. Bayaga stated that on the side of CIMP, they have adopted the zoning of the Corregidor Island Marine Science Project. Mr. Esternon asked on the target date of the revised masterplan. Mr. Bayaga stated that it would probably be available on the start of the second quarter. • Engr. Aldrin Malabad asked on how far the turnaround area from the Corregidor is. Mr. Stairs stated that the turnaround is approximately 250 m. Engr. Malabad asked on the reason why the link was not included in the design. Mr. Esternon stated that during the consultation with the CIMP, a representative from MAO stated that there is a possibility of unexploded material in the area. He added that since the BCIB Project was a Build Build Build Project, they don't want to delay more of the project for the conducting of research studies just to pinpoint the unexploded materials. Engr. Malabad anticipated a direct link to the island since it was a great link potential for economic growth wherein, he is asking for reconsideration from the DPWH. Mr. Esternon stated that if there will be reconsideration, it will take an extension for the project to be constructed. He added that the link to the island can be the next project after the construction of the bridge. Mr. Stairs stated that the link in the island is not part of the Terms of Reference (TOR) of the environmental study of the BCIB project. Engr. Malabad suggested to indicate connection for electricity from the bridge to the island. • Ms. Cayabyab asked on the area clearance of the BCIB Project. Mr. Esternon stated that if required, DPWH will process other necessary clearances. Ms. Cayabyab asked on the status of the permits from the LGU and the provincial government. Mr. Esternon stated that the permits were already processed by the NEDA. Ms. Cayabyab asked on the preparation of the proponent or the ECC holder regarding the preparation stage of the SDP since the presented one is for EMP. Mr. Esternon stated that the EMP is being updated which includes the SDP since what stated on the previous EIS is just the framework of the SDP. Ms. Cayabyab stated that the EMP, the study, and the SDP is connected to one another. She added that for the Economic Resource Evaluation, for whatever habitat that will be impacted by the project, there should be value for whatever losses especially for the biodiversity loss. She also stated that for the output of the EMP particularly on the conducted ERV, for every hectare of coral reef cover, there will be an equivalent species of fish per day or month production which could affect the SDP based on the fish catch or fish net value which is needed to be considered for the amendment or improvement of the plan. This could also affect the LGU if the DIA area will ask on what will be the support if there will be a loss of fish catch. Ms. Cayabyab then asked on a copy of SDP, the whole EIS, and the project description for them to have a background on the impact area for both environment and social. • Ms. Lorna R. Leyran asked whether consultants already have the copy of the CIMP Management Plan. Mr. Stairs asked for the updates on the CIMP Plan. Mr. Bayaga stated that they have already incorporated the plan to another comprehensive plan. He added that they have two (2) management team in wherein the Corregidor Island Foundation should be onboard in order for the plan to be updated. He added that it has to be the secretary's task to continue for the consultation and negotiation regarding the implementation of the plan.

DPWH - ISO – QUALITY MANAGEMENT SYSTEM

Title/Description:

Consultation Meetings on Environmental Impact Assessment with Mr. Simeon Stairs at Cavite for the Detailed Engineering Design Consultancy Services for the Bataan-Cavite Interlink Bridge Project

DPWH Cavite 2nd District Engineering Office	• The meeting started with the introduction of the participants from DPWH NCR RMC II, DPWH Cavite 2nd District Engineering Office, DCDD Engineering Corp. and T.Y. Lin International- Pyunghwa Engineering Consultant JV and Associates • Mr. Stairs asked the cases of accidents within the area. Engr. Ariel P. Umipon stated that the data on accidents was not updated and the last record was in 2018 (pre-pandemic). He added that they acquired the data on Naic Police Station. They have the data but they were not sure whether the data was transferred to the newly constructed building in Alfonso, Cavite. • Mr. Stairs asked whether the municipality is experiencing road congestion. Mr. Umipon stated that they seldomly have accidents in the area and the last one they know was during the collecting of reports in 2018. Mr. Frederick Esternon the asked whether the DEO experienced complains from the community regarding the hazards, and safety signages since during the past meetings, it was stated that the community were complaining on the signages. Mr. Umipon stated that they don't experience any complains. He added that there is a possibility that the regional office may have experience complains. • Mr. Stairs asked whether the DEO have plans for the Antero Soriano Highway particularly on the Governor's Drive since the BCIB Project could create traffic in the said road. Mr. Stairs added that the question was asked due to two (1) main reasons: (1) In the short term when the construction will be starting, there will be a lot of construction that will happen. It is interesting to know whether there will be plans for upgrading or maintenance of roads that will be simultaneous with the BCIB Project for the consultant and proponent side to have advance thinking for the necessary coordination purposes and (2) traffic will increase and needed time to think for traffic safety. Engr. Umipon stated that they already widened the roads from a 2-lane road to 4 lanes. Mr. Stairs asked if the upgrading of roads was full length. Mr. Umipon stated that there were still areas with obstruction such as Meralco posts and trees in which they already requested for relocation of the posts and tree cutting permit. Mr. Esternon asked whether the area can be cleared within the year in preparation for the BCIB Project. Engr. Vicente Gutierrez cannot answer the question since they were still not sure on the exact date for the removal of the post and trees. Mr. Stairs asked on any plans for the Governor's Drive. Engr. Umipon stated whether there will be widening or not in the area. He added that Palanas Bridge and Bisaya Bridge were already widened from two (2) lanes to four (4) lanes. For the bridge located within the boundary of Naic and Tanza, there was a new bridge constructed beside an old bridge. There was a proposed demolition of the old bridge and creating a new parallel one which is included in the budget proposal for 2023. Mr. Esternon then asked whether the construction of the proposed bridge will be on 2023. Engr. Umipon stated that it depends whether there will be a budget. He added that the new bridge which has two (2) lanes was the one being used not the old one. Engr. Gutierrez asked whether there will be alternative route for the construction materials for the BCIB project. Mr. Esternon stated that there was no alternative route and the only option is to upgrade the existing road within the area. Engr. Gutierrez asked on the barging point. Mr. Stairs stated that the barging point would be near the alignment but the river is not too deep to bring the barges

DPWH - ISO – QUALITY MANAGEMENT SYSTEM

Title/Description:

Consultation Meetings on Environmental Impact Assessment with Mr. Simeon Stairs at Cavite for the Detailed Engineering Design Consultancy Services for the Bataan-Cavite Interlink Bridge Project

	from the river to the site. He added the possible barging point is within the coastline located on the north side. Mr. Stairs showed on the map on the location of the proposed staging area. Mr. Stairs asked on the capacity of the newly constructed bridge. Engr. Umipon stated that the bridge can carry more than 20 tons. Mr. stairs opened the topic on the plan for coastal road (Tanza to Nasugbu). Engr. Umipon stated that they were not aware of the proposed coastal road project. • Mr. stairs asked whether the DEO have environmental unit or environmental specialists for the monitoring of the project. Engr. Umipon stated that they don't have environmental specialists wherein for concerns, the Right-of-Way Acquisition Unit was the one handling it. Mr. Stairs asked on the office handling projects. Engr. Umipon stated that the bigger project was handled by the Regional Office and the small ones were handled by the DEO. Mr. Esternon stated that they were expecting that the DEO will be the one leading the monitoring since they will the first one to know the cultural background of the local communities. • Engr. Rafael Espino asked regarding the ROW of the project especially the payment of the land. Mr. Esteron stated that there is a team handling the LARP or the Land Acquisition. Engr. Erica Juria stated that the Ecosys were the one doing the IEC and the Stakeholders Consultation Meeting.

Review and Confirmation:

Prepared by:	Reviewed by:	Approved by:
EZEKIEL A. CALINAGAN	**DANTE B. BAUTISTA**	**TERESITA V. BAUZON**
Environmental Management Specialist II	Deputy Project Manager	Project Manager III
RMCII (Multilateral), UPMO	TYLI-PEC JV	RMCII (Multilateral), UPMO

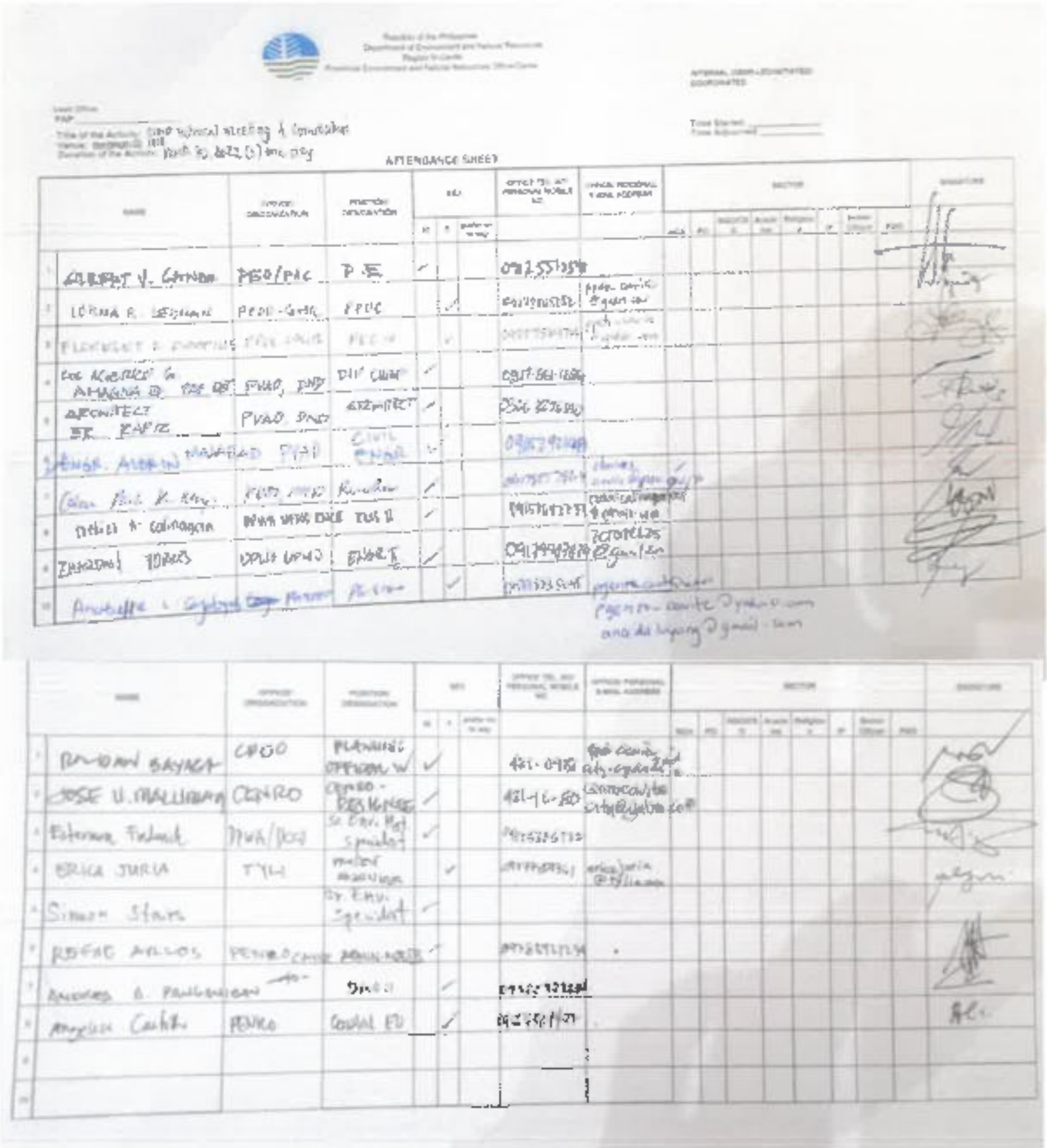
DPWH - ISO – QUALITY MANAGEMENT SYSTEM

Title/Description:

Consultation Meetings on Environmental Impact Assessment with Mr. Simeon Stairs at Cavite for the Detailed Engineering Design Consultancy Services for the Bataan-Cavite Interlink Bridge Project

ATTENDANCE SHEET

A. CIMP Technical Meeting and Consultation attended by the representatives from DPWH UPMO RMC II, PEO, PPDO, PVAO – DND, PGENRO, CPDO, CENRO, and PENRO with the DCDD Engineering Corp. and Associates



ATTENDANCE SHEET

No.	Name	Office/Organization	Position/Designation	Office Tel. No./Personal Mobile No.	Email Address
1	[illegible] V. [illegible]	PEO/PAC	P.E.	[illegible]	
2	Lorna R. [illegible]	PPDO-Cavite	PPDC	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	[illegible]	PVAO, DND	[illegible]	[illegible]	
5	Architect [illegible]	PVAO DND	Architect	[illegible]	
6	[illegible]	PVAO	Civil Engr.	[illegible]	
7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9	[illegible] Torres	DPWH UPMO	Engr. I	[illegible]	[illegible]
10	[illegible]	[illegible]	[illegible]	[illegible]	pgenro-cavite@yahoo.com
1	[illegible] Bayaga	CPDO	Planning Officer	431-[illegible]	[illegible]
2	Jose U. [illegible]	CENRO	CENRO-Designee	431-[illegible]	[illegible]
3	[illegible]	[illegible]	Sr. Envi. Mgt. Specialist	[illegible]	
4	Erica Juria	TYLI	[illegible]	[illegible]	ericajuria@tylin.com
5	Simeon Stairs		Sr. Envi. Specialist		
6	[illegible]	PENRO	[illegible]	[illegible]	
7	[illegible]		[illegible]	[illegible]	
8	[illegible]	PENRO	[illegible]	[illegible]	
9					
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Consultation Meetings on Environmental Impact Assessment with Mr. Simeon Stairs at Cavite for the Detailed Engineering Design Consultancy Services for the Bataan-Cavite Interlink Bridge Project

PHOTOS

A. CIMP Technical Meeting and Consultation attended by the representatives from DPWH UPMO RMC II, PEO, PPDO, PVAO – DND, PGENRO, CPDO, CENRO, and PENRO with the DCDD Engineering Corp. and Associates

DPWH - ISO – QUALITY MANAGEMENT SYSTEM

Title/Description:

Consultation Meetings on Environmental Impact Assessment with Mr. Simeon Stairs at Cavite for the Detailed Engineering Design Consultancy Services for the Bataan-Cavite Interlink Bridge Project

Date:	Started:	Adjourned:	Venue:
March 29, 2022	8:30 AM	4:30 PM	Cavite

Meeting Presider:

Mr. Frederick Esternon

Meeting Attended by:

Please see the attached Attendance Sheet

TOPIC/DISCUSSION/ACTION ITEM

TOPIC/AGENDA	DISCUSSION

Provincial Environment and Natural Resources Office – Cavite (PENRO-Cavite)	• The meeting started with the introduction of the participants from PENRO - Cavite, DPWH UPMO RMC II, DCDD Engineering Corp. and Associates.
	• Mr. Simeon Stairs discussed the outline of the meeting
	    ○ BCIB Project
	        ▪ Project Overview
	        ▪ Updates on alignment and turnaround position
	        ▪ Updates on construction activities and impacts
	    ○ ADB Requirements for Mitigation in Natural, Critical and protected habitat
	    ○ Next steps
	        ▪ Development of Mitigation options and plans
	        ▪ Further consultation with marine science community to shape Biodiversity Action Plan
	    ○ Questions and Discussion
	• During the discussion of the project alignment and turnaround position, Mr. Januel Peras asked if the alignment of the project will touch the Corregidor Island. Mr. Simeon Stairs stated that the boundary of the alignment to the island is 50m. away from the coastline.
	▪ During the discussion on the construction activities, its impact, and the mitigations to be used, Mr. Peras asked on the definition of habitat offset. Mr. Stairs stated that habitat offset is an area that will be enhanced and rehabilitated due to some losses from the impacts of the project. Mr. Stairs stated that habitat offset could be in a form of artificial reefs or a support/improved enforcement of fisheries spot. Mr. Peras asked on the deployment of silk curtains since its their first time to hear that approach. Mr. Stairs stated that during the construction process, there will be probability that soil below will be suspended due to presence of fine sediments. Deployment of silk curtains will keep the sediments within the area. Mr. Peras clarified on the possible impact of the project particularly on the navigation of fishes. Mr. Stairs stated that the best way to avoid impacts it create a containment area; as small as possible. He added that the impact depends on the situation but with the process of localizing silk curtains, it can lessen the localized destruction. Mr. Peras suggested to put sample photos to better picture what will happen during the deployment of silk curtains and bubble curtains for siltation and sedimentation and underwater noise and vibration effects, respectively since they were not familiar with the

	concept. Mr. Peras asked the deepest part on the alignment. Mr. stairs stated that the deepest area was 40m around the north area. • During the discussion of concrete work and shallow water construction, Mr. Reynaldo asked for some elaboration on addition of new hard substrate on the sea floor. Mr. Stairs stated that new hard substrate pertains to additional properties under water which could add as artificial reef for the habitat of fishes. Ms. Judaline Fabro asked if it is possible to put artificial coral reefs prior the construction period to attract the fishes to its new habitat to lessen the impact to fishes' underneath. Mr. Stairs stated that it makes a lot of sense conceptually but it will be hard since it will require a lot of time for the artificial reef to be an offset. Mr. Esternon agreed that it will require a lot of time plus, sampling or survey is needed on where to put the artificial reefs. Ms. Andrea Panganiban stated that the Bureau of Fisheries and Aquatic Resources (BFAR) already conducted study on artificial reef in Rosario and Tanza. Mr. Stairs pointed out that there is a conflict with the timing of the artificial reef to be introduced in the project. Ms. Panganiban added that it is doubtful that the CIMP would agree with the concept of artificial reef on the tail of Corregidor since the area is shallow. She added that the shallow part of the tail was mostly rocky due to boulders. She then suggested to go farther (few hundred meters) for the concept to be possible. Mr. Stairs stated that the one way for the concept to be possible is to move the boulders. Mr. Esternon stated that the alignment will be maintained but the best option is to move the boulders prior to the study. Mr. Stairs asked on the date of the study. Ms. Andrea stated that BFAR Region IV-A conducted the study in 2017. • Ms. Merly M. Piad asked whether the project was discussed with the representatives of Corregidor Island Foundation. Mr Stairs stated that there was already a conversation between the two parties and discussed the ideas and management plan for the island. So far, the representative from CIF stated that for year, the island is served as a historical island. • Mr. Reynaldo asked on the sustainability of the mitigation measures and restoration. Mr. Esternon stated that the project is compiled from the Philippine Standard. The proposed mitigation measures were part of the compliance, ECC, and the MMT. He also added that during the FS, itvwas already scrutinized by the Review Committee (REVCOM) which is composed of different experts from the central office. • Mr. Reynaldo asked on the Return of Investment (ROI) of the project. Engr. Maria Eugenia Karisma Oarde stated that the Economic Internal Rate of Return is 34% wherein the requirement for NEDA is 10% therefore, the project is economically viable. • Ms. Oli asked why there is still an updating of EIA when the ECC was granted and also if the EMP was still on preparation. Mr. Esternon stated that the updating of EIA is due to the possible amendments. Moreover, Mr. Stairs added that the updating of EIS was also due to the continuous updating with the stakeholders. Mr. Esternon stated they were still updating the EMP. Ms. Oli also asked on the impact of the project to the fisherfolks, the biodiversity that will be affected, and the coverage of the area of concern. Mr. Stairs stated there were still concerns and is still gathering concerns from the sector that's why the EIA and the EMP will be updated. Mr. Stairs then shown on the map of the biodiversity that is present in the area and the area

	of biodiversity that will be affected. He also added that the coverage of the area of concern is 1.3km landward. • Mr. Reynaldo asked on the territorial boundary of the project whether the project is mostly in Cavite or Bataan side. Mr. Esternon stated that most of the alignment is part of Cavite due to the presence of Corregidor Island. He added that the part can be 60% of the total alignment in terms of water body. • Ms. Piad asked if the affected persons can be hired from the project. Engr. Oarde stated that as part of the compliance with the ECC, affected people will be hired. • Ms. Oli asked if there can be accessed to the Corregidor Island as part of the bridge project. Mr. Esternon stated the project will not land on the island. But the project can help in providing electricity in the island. • Ms. Fabro asked on the specific project that could be implemented for habitat implementation. Mr. Stairs stated that there should be a proof of concept which can be adopted from other projects that could be used for habitat implementation. Ms. Fabro added that it is better for the CIF and other science-based team to join the MMT for the suggested restoration. • Mr. Stairs as the status of the implementation on the ground of the CIMP. Ms. Oli stated that the CIMP was declared locally last year. They currently have two (2) in Cavite: Ternate Marine Park and Corregidor Marine Park. Ms. Andrea stated that the implementation of the management plan of the CIMP was ongoing and have several targets based on the CIMP management plan which is a 3-year plan. Recently, they have conducted coastal clean-up within the area. The CIMP management plan was legislated locally. Mr. Stairs asked for the budget allocation of the CIMP implementation. Ms. Andrea stated that Cavite allocated an estimate of 1 million Pesos.
Municipal Environment and Natural Resources Office – Cavite (MENRO-Naic, Cavite)	• The meeting started with the introduction of the participants from DPWH NCR RMC II, MENRO – Naic, Cavite, and Associates. • Mr. Simeon Stairs asked whether the LGU is concerned on the extraction of groundwater in the area which will be used for construction purposes such as casting yard and staging area. Ms. Elma Valenzuela agreed that they were concerned on the extraction since ground water could not replenished easily and could create problem to the municipality for water supply. Ms. Pangilinan stated that the province of Cavite is experiencing water depletion, in which water applicants for extraction was not approved by the National Water Resources Board (NWRB) due to the current situation with ground water. There is a presence of water concessionaire which is Naic Water wherein pumping station is present for water supply. The communities are operation their own deep wells due to water scarcity wherein even during pumping of deep wells, no water is coming out. Ms. Antonete Digno added that the community in the upland area near the pumping station were complaining due to water scarcity. • Mr. Stairs asked whether the problem of water is worse within the coastline. Ms. Pangilinan stated that the community is experiencing salt water intrusion on shallow wells near the coastal area (shallow wells near the coastal area, deep wells in the upland). • Mr. Stairs asked on the intensity of the problem and if the water can be used for irrigation. Ms. Pangilinan stated that there is a presence of dam but is not sufficient for farming section due to *Baldo System* in which there is a

	shifting/rotation of water supply. The source of water is fresh water from Tagaytay. • Mr. Esternon asked if there is a connection of NAWASA in the area. Ms. Pangilinan stated that NAWASA only supply water to some parts of Cavite but not in Naic since they have Naic Water. Mr. Esternon suggested that if source of water for the project could be acquired from NAWASA, it would lessen the burden of the municipality of Naic for water supply. • Mr. Esternon asked on the concerns of the municipality to flooding. Ms. Pangilinan stated that there is a presence of floodings in the coastal barangays particularly near Balsahan River. Timalan Concepcion River do not affect the population since the river is wide enough. Mr. Esternon asked on the data of flood history in the area. Timalan Balsahan, which is the first barangay near Balsahan River, is experiencing flooding unlike in Timalan Concepcion wherein the river is wide enough. Mr. Stairs asked whether the people evacuates once there were flooding events in Timalan Balsahan. Ms. Pangilinan stated that people were not relocating since the flood subsides easily. If ever they were relocated, they will be going to covered court. • Mr. Stairs asked on the situation of solid waste management in the municipality. Ms. Pangilinan stated that currently, there is an ongoing establishment of a Category 2 Sanitary Landfill in one of the upland barangay particularly in Malainin Luma. The said landfill has a size of 5 hectares and is expected to be used by five (5) LGUs for 15 years. Moreover, the landfill is now in excavation stage and is expected to be operational on the third quarter of the year. Currently, the LGU is implementing RA 9003 or the Ecological Solid Waste Management Act particularly on the segregation of wastes. They also have private roller which is EMB accredited until semi-quarter. She added that wastes were being disposed in Sta. Cruz, Laguna. For Hazardous wastes, wastes were being collected by registered transporter and treated on a treatment facility in Silang, Cavite. The municipality have Material Recovery Facility wherein recyclable and biodegradable wastes were being retained in the facility and other types of waste were being transported in landfill. • Mr. Stairs asked on the possible location for the construction wastes from the BCIB project and how the municipality will accept the BCIB project's construction wastes. Ms. Pangilinan stated that the municipality will accept the wastes. She added that the landfill that will be using from the third quarter is a private one and they will be preparing a Memorandum of Agreement on the amount of tipping fee from wastes that will be deposited in the landfill. Mr. Esternon added that recyclable wastes during the construction such as woods can be utilized by the municipality. • For road-related concerns, the municipality is concern on the presence of too narrow roads. With the presence of ongoing project by the municipality of Tanza, Cavite, traffic is being experienced in the municipality of Naic. Moreover, there is a presence of accidents due to absence of signages. • For other information, there is a presence of Pawikan nesting located within the municipality particularly in Barangay Labac and sites for hatching which is located along the beach areas. The said activity was being monitored for 11 years. Data for this activity has been acquired during the meeting. The other economic activities in the municipality are fishing, farming, and presence of Overseas Filipino Workers. According to Ms. Pangilinan, there

	will be a soon to be project, Cavite Metro Park, wherein there is 4 locations and is expected to have 50 or more locators which could increase employment in the municipality. The municipality called their maincrops as Pakbet Vegetables, wherein its ingredients were the one being planted in the municipality and other food such as rice and shrimp paste/'alamang'. The said crops were being delivered to nearby areas. • Ms. Pangilinan stated that there is a presence of fish sanctuary in the area wherein the is a requirement from BFAR of a yearly assessment. It was managed before by the Cavite State University and was transferred to the LGU of Naic 10 years ago through an ordinance for adaptation. There were no data for yearly assessment. The area of the said sanctuary was decreased from a very large area. For the checking on the condition of the sanctuary, the LGU together with BFAR deployed 20 continuously trained bantay dagat. • For the establishment of the role of MENRO to MMT, Ms. Pangilinan stated that they have no experience on leading MMT According to her, mostly, the Municipal Administrator usually represents in the MMT of the province of Cavite. On the topic of the capacity of MENRO for seabed quarrying, on a personal opinion, Ms. Pangilinan stated that she doesn't want to be involved with the destructive activities. • In relations to capacity building, currently, there were two (2) technical staffs for MENRO. Mr. Esternon stated that to develop capacity building for MMT, there will be seminars and workshops to be technically capable to do the tasks.
Municipal Agriculture Office (MAO) - Cavite and Fisherfolks from Barangays Timalan Balsahan, Timalan Concepcion, Munting Mapino, and Bukana Sasahan	• The meeting started with the introduction of the participants from MAO – Cavite and Representatives from Fisherfolks from different barangays, DPWH NCR RMC II, and Associates. • Mr. Stairs asked the fisherfolks on the location of boundaries where fisherfolks do fishing activities and the docking area for fishing boats by locating it through the maps provided. • The representatives stated that there is no boundary on the location of fishing activities by fisherfolks since they do it along the whole Manila Bay, including the area on the North of Corregidor Island near the Province of Bataan. The area they pointed out for the docking area is within the project alignment which was then clarified by Mr. Esternon since on both side of the project alignment, there were boulders which means, the docking area for boats is after the boulders so there's no boat positioned within the alignment. • Ms. Virginia Poblete re-clarified the boundary of fishing activities near the project alignment to give space for the construction. Mr. Esternon elaborated that there will only be a certain time of no fishing activities within the alignment during the construction period. He then added that there is a strategic plan for fishermen to cross the alignment. This is through construction of by-portions of the bridge in which he also explained that the time allotted for the construction of the said portion could help then in providing artificial reefs which will be home for fishes. • Mr. Stairs asked on the number of fishermen per barangay along the coastline. Engr. Arianne stated that for all coastal barangays, there were approximately 700 fishermen. According to representatives from different barangays who have provided the data, there were 86 fishermen from Timalan Balsahan, 87 in Timalan Concepcion, 300 in Munting Mapino, and

	500 in Bukana Sasahan. All representatives agreed to the benefits of the project but was worried on possible impacts which was then raised. • Ms. Nancy Mariano pointed out that there is a presence of talaba culture which can be affected by the project especially those near the alignment. Mr Estenior informed the representatives that there will be a silk curtain that will be used to prevent siltation and sedimentation. • Mr. Danilo Cavasa asked on the possible impacts of the changes in weather to the project. Mr. Stairs stated that there will be a possibility of delayed in the project due to unexpected weather condition especially during rainy period. • Mr. Romeo Miranda raised concern on the possibilities of coastal erosion due to construction activities such as dredging. • Mr. Orlando Persa asked on the possible alternative livelihood for those affected fisherfolks. Mr. Esternon stated on hiring affected fisherfolks as laborers during the construction period which was agreed by Mr. Edgar Valenzuela. Mr. Esternon also clarified that the affected fisherfolks will be prioritized first for hiring of laborers. Mr. Cavasa, who was a senior citizen, was worried on the side of fisherfolks who are senior citizens on the possible alternative livelihood for them since some seniors cannot do labour for construction. He then suggested for provision of financial assistance. Mr. Esternon stated that those young fisherfolks can do the labour tasks and those older ones can still continue fishing since the number of people who will do fishing activities will be lessen since some will be applying as labourers during for the construction period. Mr. Cavasa also worried on the possibilities of hiring few laborers since he thought that additional laborers will not be needed due to presence of machineries that will be used for construction. Mr. Esternon clarified that additional laborers will still be needed not only for construction but also to other areas (e.g., manual mixing of concrete, sieving of sand, etc.) of the construction phase of the project. • Mr. Valenzuela asked whether they can be provided trainings from TESDA for capacity building. Engr. Oarde stated that the suggestion will be raised from DPWH authorities. • Engr. Arianne Armijo asked on the estimated number of labourers that can be hired for construction. Mr. Esternon stated that for the initial year, there will be an estimated number of 500 people that will be hired and will increased throughout the 2nd and 4th year of the construction phase and then decrease on the succeeding year. Engr. Armijo ask whether the hired labourers will be provided temporary shelter near the site. Mr. Esternon stated that labourers will still be going home since the labourer that will be hired for the construction in Cavite side is coming from the area where the people reside. Engr. Armijo also clarified on the disposal of construction waste which was then answered by Mr. Esternon that there was already a conversation with MENRO regarding the disposal of construction wastes.

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Title/Description:
Consultation Meetings on Environmental Impact Assessment with Mr. Simeon Stairs at Cavite for the Detailed Engineering Design Consultancy Services for the Bataan-Cavite Interlink Bridge Project

Review and Confirmation:

Prepared by:	Reviewed by:	Approved by:
EZEKIEL A. CALINAGAN	**DANTE B. BAUTISTA**	**TERESITA V. BAUZON**
Environmental Management Specialist II	Deputy Project Manager	Project Manager III
RMCII (Multilateral), UPMO	TYLI-PEC JV	RMCII (Multilateral), UPMO

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Consultation Meetings on Environmental Impact Assessment with Mr. Simeon Stairs at Cavite for the Detailed Engineering Design Consultancy Services for the Bataan-Cavite Interlink Bridge Project

ATTENDANCE SHEET

A. Meeting with the Provincial Environment and Natural Resources Office – Cavite (PENRO-Cavite)

29 March 2022
9:00 AM
DENR-PENRO Building

BCIB DED - ENVIRONMENTAL CONSULTATION MEETING WITH CORREGIDOR ISLANDS MARINE PARK MANAGEMENT TEAM

PRE - TECHNICAL MEETING WITH DENR - PENRO CAVITE

1.	Andrea A. Panganiban	DMO II	09385927234	cmemcavite@gmail.com
2	Judaline A. Fabro	Supervising EMS	09447640616	[illegible]cavite@yahoo.com
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5.	[illegible] G. [illegible]	FORESTER	0915 591 8319	
6.	Angelica L. Castillo	Coastal ED	09554384497	cmemcavite@gmail.com
7.	Merle M. Piad	SEMS	09165935384	merlepiad@gmail.com / [illegible]
8.	[illegible]	Engineer I - [illegible]	0992 264 9355	[illegible]@gmail.com
9.	MARK ANTHONY GARCIA	Forester I - SMU	0915-415-[illegible]	markgarcia.[illegible]@gmail.com
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12.	GERALDO G TACBAD	SEMS	0909964[illegible]	geraldtacbad@gmail.com
13.	MAYBELLE KRISTINE N. RODRIGUEZ	FORESTER I	09563797541	emucavite@gmail.com
14.	LARA ANGELI C. LIPIT	PEC	09191828413	gelhpit@gmail.com
15.	ZHARDAN C. TORRES	DPWH-RMCII-ENGR I	09679947970	zctorres25@gmail.com
16.	AILEEN JOY A. ESTANO	UMI	09381260662	estanoaiken@gmail.com
17	Estacion, Frederick J.	Sr. Envi Mgt. Specialist	09175326722	festacion@gmail.com
18.	Simeon Stairs	Sr. Envi Specialist	09699368301	
19.	SAMUEL A. FABRO	Sr. EMS	[illegible]	[illegible]@gmail

B. Meeting with the Municipal Environment and Natural Resources Office – Cavite (MENRO-Cavite)

BATAAN-CAVITE INTERLINK BRIDGE (BCIB) PROJECT CONSULTATION MEETING WITH MENRO, MAO & FISHERFOLKS AT NAIC FUNCTION HALL

March 29, 2022

ATTENDANCE SHEET

NO.	NAME	SEX: MALE	SEX: FEMALE	OFFICE/ADDRESS	CONTACT NO.	SIGNATURE
1	EVA P. PANGILINAN		✓	LGU - MENRO - NAIC	[illegible]	[signature]
2	Antonette A. Digno		✓	LGU Naic - MENRO	[illegible]	[signature]
3	ELVIRA T. VALENZUELA		✓	LGU-NAIC-AGRI	0917-81396-29	[signature]
4	Frederick Esteban	✓		RCO / DPWH Envi	[illegible]	[signature]
5	LAVINA ANGELI LIPIT		✓	PSC / Asst. Manager	[illegible]	[signature]
6	[illegible]	✓		DPWH - UPMO RMC II	[illegible]	[signature]
7	CARDE, MARIA VALERIA KATRINA		✓	DPWH - UPMO RMC II	09352558132	[signature]
8	[illegible]	✓		DPWH UPMO RMC II	[illegible]	[signature]

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Title/Description:

Consultation Meetings on Environmental Impact Assessment with Mr. Simeon Stairs at Cavite for the Detailed Engineering Design Consultancy Services for the Bataan-Cavite Interlink Bridge Project

C. Meeting with Fisherfolks from Naic, Cavite

BATAAN-CAVITE INTERLINK BRIDGE (BCIB) PROJECT CONSULTATION MEETING WITH MENRO, MAO & FISHERFOLKS AT NAIC FUNCTION HALL
March 29, 2022

ATTENDANCE SHEET

NO.	NAME	SEX		OFFICE/ADDRESS	CONTACT NO.	SIGNATURE
		MALE	FEMALE			
1	Eva P. Pangilinan		✓	LGU - Naic	09783242[illegible]	
2	[illegible] A. [illegible]		✓	LGU Naic - MENRO	0919-909-4[illegible]	
3	Elma T. Valenzuela		✓	LGU - Naic - [illegible]	0917-8[illegible]	
4	Frederick Esleman	✓		[illegible]	[illegible]	
5	Sarra Angeli Light		✓	[illegible]	[illegible]	
6	[illegible]	✓		DPWH - UPMO RMC II	0917995747[illegible]	
7.	Carde, Maria Eugenia Kabigting		✓	DPWH - UPMO RMC I	09862558132	
8.	[illegible]	✓		DPWH UPMO RMC II	[illegible]	
9.	Narcisa A. Mariano			T. Balsahan	09957631918	
10	Danilo M. Cayabsa	✓		[illegible]	0916 [illegible]	
11	Romeo A. Miranda	✓	✓	[illegible]	0945[illegible]	
12	Virginia P. Poblete			[illegible]	09179189457	
13	Edgar R. Valenzuela	✓		[illegible]	[illegible]	

NO.	NAME	SEX		OFFICE/ADDRESS	CONTACT NO.	SIGNATURE
		MALE	FEMALE			
	Orlando J. Perea	✓		M. Marino N.C	0955[illegible]	
	Allan L. Igliz	✓		Unito C	0966560[illegible]	
	Carlito P. Araque	✓		J. Balsahan	0975[illegible]	
	Nina Modell Magbitay		✓	LGU Naic	0977309[illegible]303	
	[illegible]			[illegible]	[illegible]	
	Helen A. Poblete		✓	[illegible]	[illegible]	

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Title/Description:

Consultation Meetings on Environmental Impact Assessment with Mr. Simeon Stairs at Cavite for the Detailed Engineering Design Consultancy Services for the Bataan-Cavite Interlink Bridge Project

PHOTOS

A. Meeting with the Provincial Environment and Natural Resources Office – Cavite (PENRO-Cavite)

B. Meeting with the Municipal Environment and Natural Resources Office – Cavite (MENRO-Cavite)

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Title/Description:

Consultation Meetings on Environmental Impact Assessment with Mr. Simeon Stairs at Cavite for the Detailed Engineering Design Consultancy Services for the Bataan-Cavite Interlink Bridge Project

C. Meeting with Fisherfolks from Naic, Cavite

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Consultation Meetings on Environmental Impact Assessment with Mr. Simeon Stairs at Bataan: for the Detailed Engineering Design Consultancy Services for the Bataan-Cavite Interlink Bridge Project

Date:	Started:	Adjourned:	Venue:
March 22, 2022	9:00 AM	4:00 PM	Mariveles, Bataan

Meeting Presider:

PM Marlon V. Galerio

Meeting Attended by:

Please see the attached Attendance Sheet

TOPIC/DISCUSSION/ACTION ITEM

TOPIC/AGENDA	DISCUSSION

Municipal Environment and Natural Resources Office – Mariveles (MENRO-Mariveles)	• The meeting started with the introduction of the participants from MENRO-Mariveles, DPWH NCR RMC II, DCDD Engineering Corp. and T.Y. Lin International- Pyunghwa Engineering Consultant JV and Associates
	• Mr Simeon Stairs presented the outline of the discussion:
	    ○ Ground Water
	    ○ Safety and Environmental Concerns on Receiving Roads
	    ○ Institutional Capacity for Roles in Project Oversight
	    ○ Monitoring
	    ○ Disposal Site
	• Mr. Stairs asked on the availability of groundwater resources in Alas-Asin and also if there can be a presence of water scarcity in the area once the project started.
	• Ms. Reshell Concepcion stated that the only water concessionaires which provides water in Alas-Asin is the Mariveles Water District (MARIWAD). Also, there is a presence of Dam which is operated by the Authority of the Freeport Area of Bataan (AFAB) which supplies water for four (4) barangays: Baseco, Sisiman, Malaya, and Maligaya. She added that water for some portion of the LGU were also provided by FAB. For other water supply, there were also presence of deep wells (Data for deep wells will be provided from the census coming from PG-ENRO/MENRO). Moreover, CENRO and PENRO conducted survey on deep wells (data will be asked from sanitation section). Mr. Banjo Laurel asked if there were studies pertaining to water quality. Ms. Concepcion mentioned that GN Power conducted studies on water quality within and on nearby communities.
	• For road concerns, she stated that the presence of road accidents in the area is due to the problems with steep roads in which the mitigation they come-up with are certain hours for large vehicles such as trucks to passed through and speed limit especially for those unloaded trucks. There is a proposed widening but they are experiencing problem with Right-of-Way Acquisition.
	• For Institutional capacity of MENRO, it has four (4) sections (coastal, forest, solid waste, and administrative) headed by Ms. Gladies Reyes under the umbrella of the Mayor's Office in which their staffs are composed of Job Orders/Volunteers and One (1) Environmental Management Specialist II. She stated that the office can help with manpower but not much on the technical side/aspect due to lack of skilled/knowledgeable staff on the environment side.

Consultation Meetings on Environmental Impact Assessment with Mr. Simeon Stairs at Bataan: for the Detailed Engineering Design Consultancy Services for the Bataan-Cavite Interlink Bridge Project

	• The conversation lead on the discussion of the possible participants for Multi-Partite Monitoring Team (MMT) in which Mr. Ian Borja stated that mostly, participants are composed of mayor, barangay officials, stakeholders, people's organization/NGOs, MENRO, and Engineering Office. Ms. Concepcion stated that there is a presence of IIMT (Inspection, Inventory, and Monitoring Team) in the area in which they conduct quarterly meeting about the environmental concerns in the area. For the capacity to monitor the bridge project, there will be further discussion with regards to the monitoring of the bridge project (e.g., MENRO, DEO, or MPDO). • Last topic discussed were disposal sites particularly on the presence of disposal site for the present waste generation and waste coming from the project and budget for construction of disposal sites. Ms. Concepcion stated that annually, 40M funds are needed for waste transfer station but they can't afford to produce one due to lack of funds brought by small amount of money they can collect from fees from factories/companies (P10,000.00/year). But there is a proposed area of disposal site (sanitary landfill) which is located within Mariveles, Bataan. With the absence of owned disposal site, wastes in the area are being transferred to Metro Clark which requires additional payment for disposal. Ms. Concepcion also stated that based from PG-ENRO, there is also a proposed sanitary landfill located in Abucay, Bulacan. The municipality has its own treatment machines but not yet operating. • For additional information about the area particularly on coastal and forest section, Mariveles, Bataan has a nesting and hatchling site for marine turtles. There were activities for coral reefs with the help of the Department of Agriculture and the presence of National Greening Program which is near but not within the project site. Concerns on the forest side particularly on the key biodiversity area in Mariveles, Bataan for the long-term project have no discussions yet from the authorities.
DPWH Bataan 2nd District Engineering Office	• The meeting started with the introduction of the participants from DPWH NCR RMC II, DPWH Region III 2nd District, DCDD Engineering Corp. and T.Y. Lin International- Pyunghwa Engineering Consultant JV and Associates. • For the road widening along the Roman Expressway, there will be a presence of drainage canals which will also serve as sidewalk for both sides. Not all sections are widened due to problem with Right-of-Way Acquisition, fundings, and some properties that are privately owned. According to DE Ulysses Llado, if ever fund is available, road widening will stop in Mariveles seaside but is still to be confirmed from the ocular visit that will be conducted. There is a presence of steep roads (by-pass road) that is planned to be widened but there is currently encroachment and presence of informal settlers in the area. The local community suggested to have a diversion road in the area for the informal settlers to not be affected by the planned widening. • For institutional capacity of DEO to monitor the bridge project, DE Llado stated that they have the capacity to monitor but the problem is the funding since 50% of the budget of DEO was cut. • Additional information: No presence of environmental unit
Brgy. Alas-Asin Fisherfolks	• The meeting started with the introduction of the participants from Barangay Alas-Asin Officials, Representative from Fisherfolks, DPWH NCR RMC II, DCDD Engineering Corp. and T.Y. Lin International- Pyunghwa Engineering Consultant JV and Associates.

Consultation Meetings on Environmental Impact Assessment with Mr. Simeon Stairs at Bataan: for the Detailed Engineering Design Consultancy Services for the Bataan-Cavite Interlink Bridge Project

- Mr. Stairs asked the representative from Bantay Dagat regarding on their fishing boundary and possible alternative livelihood that is aligned to their skills once the project started.
- Mr. Norly Francisco, representative from Bantay Dagat stated that the area where they are fishing is not covered by the alignment of the project; it is located more on the Cabcabin side. But he stated that when the project begins, there'll be possibilities that fishermen will be affected and could cause other areas to be crowded. He added that there were certain boundaries where there were abundant of fish which can be affected once the project started. Moreover, they are also worried on the environmental impact that the project could cause.
- For alternative livelihood, Mr. Ian Borja asked for alternative livelihoods which are aligned to their skills. Since no suggestions have yet to provide, he then provided suggestions such as labourers during construction of the project and assistance for possible business such as convenience store. Mr. Francisco suggested to offer affected fishermen as labourers during construction period. According to the barangay officials (Mr. Elpidio Estiebar, Sr. and Mr. Rommel Arcenal), there were various skilled workers (carpentry and welding) and people who are willing to be a labourer (legal-age children). But they are worried on the possibilities of hiring workers outside of the affected project area than those within Alas-Asin. Mr. Florante Malimban suggested to have MOA on prioritizing workers from Alas-Asin. Mr. Francisco also suggested to provide financial assistance and alternative business to compensate certain loss during the project period. PM Marlon Galerio asked if the representative for fishermen can provide lists of the number of registered boats and with their names.
- PM Galerio verified the estimated number of registered fishermen that will be affected. Mr. Malimban asked Mr. Francisco to provide only the estimated number for those affected people along the alignment of the project. Mr. Galerio stated that not all fishermen will be affected since the project will only affect a certain area. Mr. Francisco stated that there were 208 fishing boats in the area wherein 96 of these were registered. Moreover, there were 100 estimated boats sailing along Alas-Asin. In addition, PM Galerio clarified that fishermen can cross along the alignment but not allowed to catch fish until the construction is done.
- For mitigation measures, Mr. Malimban suggested for resettlement areas for affected people. He also suggested to have artificial coral reefs in the area which can help for fish culture even after the construction period. Mr. Estiebar suggested to have a talaba and tahong culture that could serve as alternative for fishing which can be located in Dinginin river. Mr Francisco was worried about the daily income from talaba and tahong culture since they will wait several days for the harvesting period.
- Additional Information: Representative stated that income depends on the fishermen on whether they will catch fish for a longer time to have more income. Per day, a three (3) people per boat can earn P5,000 per day in which they sail every day. He also stated that income may vary depending on the sizes of fish: P10,000 for bigger fish such as swordfishes and tanigue and P2000-P3000 for small fishes. There were also crab spot in the area which is a good generation today.

DPWH - ISO – QUALITY MANAGEMENT SYSTEM

Title/Description:
Consultation Meetings on Environmental Impact Assessment with Mr. Simeon Stairs at Bataan: for the Detailed Engineering Design Consultancy Services for the Bataan-Cavite Interlink Bridge Project

Review and Confirmation:		
Prepared by:	Reviewed by:	Approved by:
EZEKIEL A. CALINAGAN	**DANTE B. BAUTISTA**	**TERESITA V. BAUZON**
Environmental Management Specialist II	Deputy Project Manager	Project Manager III
RMCII (Multilateral), UPMO	TYLI-PEC JV	RMCII (Multilateral), UPMO

ATTENDANCE SHEET

A. Meeting with the Municipal Environment and Natural Resources Office – Mariveles (MENRO-Mariveles)

REPUBLIC OF THE PHILIPPINES
PROVINCE OF BATAAN

MUNICIPALITY [illegible]

OFFICE OF THE
MUNICIPAL MAYOR

AGENDA:
VENUE:
DATE/TIME:

NAME	GENDER	COMPANY/DEPT.	ADDRESS	CONTACT NO.	SIGNATURE
1. JAO MAY ZAMORA	F	TY Lin	MANILA	[illegible]	
2. [illegible]	M	DCCD	Manila	[illegible]	
3. Simeon Stair	M	[illegible]	Chicago [illegible]	[illegible]	
4. Marlon V. Galerio	M	DPWH-RMC2	Manila	[illegible]	
5. [illegible]	M	DPWH - RMC2	MANILA	[illegible]	
6. [illegible]	M	DPWH - RMC2	Manila	[illegible]	
7. [illegible]	F	DPWH - RMC2	Manila	[illegible]	
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Serving Marivelenos with a HEART:

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C. Meeting with the Brgy. Alas-Asin Fisherfolks

Republic of the Philippines
Province of Bataan
Municipality of Mariveles
BARANGAY ALASASIN

OFFICE OF THE PUNONG BARANGAY

BCIB CONSULTATION MEETING WITH FISHERMEN AND LGU
MARCH 22, 2022 @ 3:00 pm

NO	NAME	DESIGNATION	GENDER	SIGNATURE
1	Elpidio S. Estiobar Sr.	Brgy. Kagawad	M	
2	Donato R. Ondiwo	Brgy. Kagawad	M	
3	Marlon V. Galerio	PM II	M	
4	NICOLE ANNE T. BUMAGAT	ENGR. II	F	
5	Ezekiel A. Camagan	ENG II	M	
6	BANJO LAUREL	DPWH UPMO	M	
7	Simeon Stairs	Sr Env. Specialist	M	
8	JAD MEY ZAMORA	[illegible]	F	
9	Ian Borja	DCCO	M	
10	Nony K. Francisco	Bantay Dagat	M	
11	Lourdes [illegible]	MFFARMC Alas-asin	F	
12	Marceta Plateros	Sto Pinumpan	F	
13	Romnel R. [illegible]	Brgy. Kagawad	M	
14	Maria Consorcion N. Cuna	Brgy. Secretary	F	
15	Florante E. Maminban	Punong Barangay	M	
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DPWH - ISO – QUALITY MANAGEMENT SYSTEM

Title/Description:

Consultation Meetings on Environmental Impact Assessment with Mr. Simeon Stairs at Bataan: for the Detailed Engineering Design Consultancy Services for the Bataan-Cavite Interlink Bridge Project

PHOTOS

A. Meeting with the Municipal Environment and Natural Resources Office – Mariveles (MENRO-Mariveles)

C. Meeting with the Brgy. Alas-Asin Fisherfolks

Notes from conversations with Mr. Jerry Rollin of Corregidor Foundation, Inc (28 Mar 2022)
Prepared by Simeon Stairs, Sr. Environment Specialist, Renardet SA

1. Objective of conversations. The purpose of the conversations with Mr. Rollin was to gather background information relevant to the updating of the EIA for the BCIB project. Although the BCIB project does not include a link to Corregidor Island, existing conditions on the island and in the surrounding waters, as well as proposals for the island's future development, shape the potential for impacts from the BCIB both on and off the island. In addition, consideration of the appropriateness of the proposed positioning of the turnaround structure along the BCIB alignment relies in part on information that could be supplied by Mr. Rollin. Several subject areas were covered during the conversation, including

(i) Environmental history of the island;
(ii) Use of Corregidor Island nearshore waters by local fisherfolk;
(iii) Corregidor Islands Marine Park;
(iv) Visual and aesthetic impacts of the BCIB on Corregidor Island;
(v) Vehicular access expectation under the 'with BCIB' scenario; and
(vi) Development plans under the 'with BCIB' scenario.

2. Environmental history of the island. During the period of heaviest military use and bombardment (WWII), Corregidor Island was almost completely denuded of vegetation. It is therefore considered unlikely that any old-growth vegetation remains. Tree seeds (ipil-ipil) were spread from airplanes sometime after the war to jump-start regeneration, and this explains the prevalance of ipil-ipil in the forest seen on the island today. Relatively low avian species diversity on the island is attributed to the relative absence of fruit-bearing trees used by birds (seeds of fruit-bearing trees were not included in the aerial seeding). Goats roam wild on the island, and this likely shapes the range of plant species present in the understory. Forest and rangeland fires of natural origin have not been reported in living memory, which suggests that the grassland areas found on the island are likely related to precipitation and soil capability, rather than a recurrent fire regime.

The island's ecology is not well documented; ecological studies were not conducted as part of the preparation of the Tourism Master Plan for the island, and the only study Mr. Rollin is aware of is a bird survey conducted by a group of local birders. There are significant numbers of monkeys (Long-tailed macaques) resident on the island, and these had become quite a problem before the pandemic, as some individuals had grown habituated to people and dependent on handouts of food from tourists, and were getting aggressive. Recently, a policy of routinely scaring monkeys away when they appear near the developed areas (as well as a lack of tourists due to the pandemic-induced shutdown) has helped encourage the monkeys to stay in the woods and eat a natural diet. CFI has also been collaborating with DENR on population control, primarily through castration. Other notable wildlife on the island includes Philippine brown deer, but these are shy and tend to stay in the forest, and are rarely observed. CFI has considered setting up a captive breeding program to boost the deer population. Mr. Rollin reported that marine turtles are known to nest occasionally on the South Beach; nesting success has been threatened in the past by egg collectors and also by roaming dogs, but egg collection, at least, has been reduced by educational efforts.

The possible presence of contaminated or dangerous sites was discussed, with a view to understanding the potential for a landing site on the Tail End to generate safety or environmental risks. Mr. Rollin reported that there are no known abandoned munitions dumps anywhere on the island (Caballo Island, by contrast, has large stores of live ammunition left over from WWII, in underground vaults). Regular solid waste has always been disposed of in haphazard dump sites (and is presently thrown into a ravine), but waste dumping has always been closer to the developed portions of the island, and there are no known dumps in the Tail End. With regards to known or suspected unexploded ordnance, the island is reported to have been cleared of bombs and mines by the US Navy after the war, and there have been no known incidents involving UXO. Spent shells and shell fragments can be found all over the island, however. Recent trail-building work (including in the Tail End) by Philippine marines stationed on the island has been carried out without any problems.

3. Use of Corregidor Island nearshore waters by local fisherfolk. For purposes of corroborating information gathered from other sources on fishing activity in the vicinity of the BCIB alignment, Mr. Rollin was asked for his insights on the presence of local fishing boats in the waters around Corregidor Island. He reported that fisherfolk come to the island's waters from both Bataan and Cavite, but mostly Bataan. He pointed out a group of 30–40 outrigger canoes positioned about 1 km north of the ferry dock during the visit; the fisherfolk typically gather like this at a dividing line that sets up at certain times of the tidal cycle between independently circulating water masses, where the fishing tends to be particularly good. Small fishing boats were observed from shore in several places during the island visit, indicating substantial fishing activity in the project area. Mr. Rollin indicated that fisherfolk are not allowed to land or camp on the island, although this rule is sometimes broken. When camps have been discovered on the past, they have been demolished by CFI staff. Illegal fishing practices such as dynamite fishing are known to be a problem in the area around the island, and it is hoped that implementation of the Corregidor Islands Marine Park (CIMP) will put an end to this eventually.

4. Corregidor Islands Marine Park (CIMP). The current status of the CIMP was discussed briefly. Mr. Rollin reported that there hasn't been any activity with respect to installation of artificial reefs within the park's designated Artificial Reef Zone yet. He indicated that the marine environment is now seen as a significant potential tourism resource alongside the historical features of the island, and the CIMP is critical to conserving and benefiting from it. CFI foresees that watersports and nature-based recreation would be key components of a revitalized tourism on the island, and the multiple-use and dive spot zones in the CIMP reflect this interest. He noted that reef surveys conducted as part of the lead-up to the park's establishment highlighted some attractive diving areas, including some areas where a surprising density of seahorses were observed. Furthermore, although most wrecks in the area are in water too deep for most recreational divers, two substantial wrecks have been identified in suitably shallow water, and are seen as potentially viable underwater attractions.

The vision for tourism on the island, from the perspective of CFI, is to try and transition away from the (currently typical) quick 'in-and-out' partial-day historical tours, and towards a more holistic and engaging tourism experience, in which people might come to the island for overnight or longer, and enjoy both historical and nature-based experiences while there. The previous hotel concessionaire of the Corregidor Inn pulled out of its contract when COVID-19 hit, and CFI has had trouble attracting any interest from other companies, because the inn only has 30 rooms, and most operators consider 90 rooms to be the minimum viable size. So CFI is considering plans for developing an additional 70 rooms at the Corregidor Inn to make it more attractive to potential concessionaires.

5. Visual and aesthetic impacts of the BCIB on Corregidor Island. When asked how he felt—from an aesthetic perspective—about the prospect of a four-lane elevated highway running within 50 m of the shore of Corregidor Island, Mr. Rollin expressed a certain amount of dread, and also resignation: "That is the price of progress, I suppose". He went on to acknowledge that most of the visitor activity is and always will be centered on the Middleside and Bottomside portion of the island, and eastward-facing vantage points offering a close-range view of the BCIB are actually rare. When asked how the visibility of the BCIB infrastructure—particularly the high cable-stayed bridges—might change the visitor experience to the island, he said he didn't think there would be any real effect, as most people are quite accustomed to having such infrastructure in their visual space, and don't necessarily experience it as an intrusion.

5. Vehicular access expectation under the 'with BCIB' scenario. As far as CFI is concerned, private vehicles and tour buses do not belong on the island. The road system is not capable of handling any significant traffic, there is very limited parking anywhere, and traffic jams would significantly detract from the atmosphere of history and remembrance, as well as the peacefulness that characterizes so much of the island. Any vehicular breakdowns occurring on the island would be a significant hassle, as a towing service would have to come out from either Bataan or Cavite. If a link were to be established from the BCIB, the preferred access model would be for a parking lot to be built at each end of the bridge, with shuttle buses bringing visitors to and from the island.

6. Development plans under the 'with BCIB' scenario. The Tourism Master Plan has been produced and distributed amongst selected stakeholder entities, but Mr. Rollin indicated that he was not at liberty to share it with DPWH, as it is TIEZA's plan. Mr. Rollin did mention that the TIEZA plan is rather more ambitious in terms of visitor numbers and facilities than are CFI's ideas for the island, and that some proposals would be likely to push up against the realities of carrying capacity quite early on, if implemented. CFI's focus is on investing in rehabilitation, rebuilding and upgrading of on-island facilities and buildings to "bring things back up to where they were before the decline", and argued that these efforts should be considered a prerequisite for implementation of TIEZA's more scaled-up development proposals. As an example, he noted that water supply and sewage treatment are two areas in which old, non-operational and non-existing basic infrastructure simply cannot support a significant increment of tourism facilities without considerable prior work. No studies have been done to determine the extent of on-island groundwater resources and how much tourism development they could feasibly support, and the possibilities with respect to sewage treatment, electricity and solid waste management remain under-investigated. It is conceivable that the BCIB could serve as a conduit for potable water and electricity from Bataan, but the feasibility of this is unknown, and on-island distribution would remain a constraint without prior investment.

Regarding the Tail End specifically (i.e., the portion of the island that would interact most directly with the adjacent BCIB), the potential for incompatibility between planned tourist developments and the bridge (e.g., noise and emissions from the bridge affecting the aesthetic qualities of lodging or contemplative spaces) was discussed. Mr. Rollin pointed out that most of the Tail End is quite rugged, with very steep slopes in many places; there is little land that could be considered suitable for building. The air strip occupies the most readily buildable land in the Tail End, and that is expected to be rehabilitated and used as a passenger airport eventually. Hiking trails are the most likely development near the east coast of the Tail End. In view of this, the potential for incompatibilities between the BCIB and planned tourism developments in the Tail End is fairly limited.

Notes from meeting with Ms. Hazel de Guzman, Environment Officer of the Authority of the Freeport Area of Bataan (AFAB), March 23 2022
Prepared by Simeon Stairs, Senior Environment Specialist (Renardet SA)

1. The objective of this informal meeting was to learn more about the Freeport Area of Bataan's solid waste management facility, as solid waste generated in Mariveles is processed through there under an agreement between the LGU and the AFAB (Authority of the Freeport Area of Bataan). The arrangement had been reported to us the previous day by the Mariveles MENRO representative. We also took the opportunity to ask some background questions about the FAB, in relation to the road linkage situation between the FAB and the BCIB area, as well as the importance of the BCIB to AFAB's plans for the future.

2. **Waste transfer station operation.** All of the municipal solid waste collected by the LGU is brought to the transfer facility run by the FAB, under a MOA. Ms. de Guzman indicated that the formulation of the MOA was driven by or otherwise linked to the Mandamus Writ on the cleanup of Manila Bay. In accordance with national law and its own Solid Waste Plan, the LGU is supposed to conduct at-source reduction, i.e., 3R, but there is considerable doubt as to whether they are actually doing that. Ms. de Guzman said it would be in the LGU's interest to pursue at-source reduction much more aggressively, as this would save them a lot of money every year (they pay the AFAB by the bin). The LGU presently sends 80–120 bins per month to the transfer facility. The transfer station is on 1.5 ha of land, of which 1,500 m^2 is allocated to the LGU's waste (more than this is presently taken up by the LGU's waste, because of the lack of at-source reduction). Ms. de Guzman indicated that 1.5 ha is plenty of space for the waste transfer operation, and does not foresee any kind of space crunch in the event that the BCIB construction process adds significantly to the solid waste output of the LGU. It was acknowledged that the waste transfer station and MOA are limited to regular municipal solid waste; other arrangements would have to be made for demolition waste and hazardous waste generated by the BCIB construction.

The waste processed though the FAB transfer facility is sent to a sanitary landfill operated by Metro Clark (the tipping fee is reflected in the fee paid to FAB by the LGU). Hazardous waste is accepted by a hazardous waste facility also operated by Metro Clark, which reportedly consists of an 'engineered sanitary landfill', and may also do some segregated treatment of selected wastes. It was agreed that the BCIB project (or each Contractor) would have to register as a hazardous waste generator under national law, and make arrangements with accredited hazardous waste haulers and treatment/recycling enterprises. Non-recyclable demolition wastes unsuitable for use as fill would have to be transported by the Contractors to the landfill operated by Metro Clark, by arrangement with that entity.

3. **Background on FAB.** The FAB, as an institutional instrument for trade and development, is not limited to the site around the north side of Mariveles Bay, but is actually applicable to the whole province. The Mariveles site is the original and still primary site, however, and presently has about 38,000 workers employed by about 90 locator enterprises; this is down from a pre-pandemic peak of 44,000, but further growth back to the peak and beyond is expected. There are other sites under development already, including the large under-construction port and warehousing facility noted north of the Cabcaben waterfront (being developed by Seafront

Townsite Corp.), as well as a couple of smaller sites in Mt. View (away from the shore) and another site west of the BCIB alignment, near GN Power.

When asked about the importance of the BCIB to future expansion of the FAB, Ms. de Guzman was emphatic that the project is instrumental to planned expansions, as linkage to Calabarzon will greatly improve access between the FAB and a major market. When asked about plans for development of a new port in Mariveles Bay to serve the FAB, she acknowledged that there is a plan for this, said that it would be a 'huge investment', and indicated that she was not at liberty to divulge any more. As far as existing port facilities go, she said they are all operated by private entities, but the FAB does have a role in regulating their operations.

The road link between the main Mariveles FAB site and the BCIB was discussed. It was agreed that the situation with the Mariveles Diversion Rd is not a good one. She estimates that there are about 200 heavy trucks per day using the road just for the cement works; the total daily heavy truck traffic is considerably higher than that.

2022 Consultation Meeting Documentation

EIA-IEC Meeting Documentation for the Bataan-Cavite Interlink Bridge (BCIB) Project – Detailed Engineering Design (DED) Phase

1. Stakeholder consultation in Naic Cavite

Venue:	**Timalan Balsahan Basketball Court, Brgy. Timalan Balsahan, Naic, Cavite**
Date:	**25 May 2022 (Wednesday)**
Time:	**8:00 AM**

ATTENDEES						
First Name	**Last Name**	**Full Name**	**Female**	**Male**	**Municipality**	**Barangay/ Office**
Joylyn Perucho	Isorena	Joylyn Perucho - Isorena	x		Quezon City	Ecosyscorp
Michael	Garcia	Michael Garcia		x	QC	QC
Joseph	Villacasten	Joseph Villacasten		x	Quezon City	Sauyo
Cyrenne	Pelayo	Cyrenne Pelayo	x		QC	Quezon City
Erica	Juria	Erica Juria	x		Manila	Manila
Weedy	Jintalan	Weedy Jintalan	x		Naic	Bucana Malaki
Annabelle	Herrera	Annabelle Herrera	x		Quezon City	Ecosys
Frederick	Esternon	Frederick Javier Esternon (DCCD)		x	Quezon City	Quezon City
Rose	Bobis	Rose Minay Bobis	x		Naic, Cavite	Brgy. Palangue Central, Naic, Cavite
Junnel Ray	Bautista	Junnel Ray Bautista		x	N/A	Manila City (Sampaloc)
Sheila	Estacion	Sheila E. Estacion	x		Naic	Labac
Melanio	Guevara	Melanio Guevara		x	Maragondon (Cavite)	NHCP

Adrienne	De Guzman	Adrienne De Guzman	x		Ermita (Manila)	TYLin
Carl Luis	Tamayo	Carl Luis Tamayo		x	Quezon City	Culiat
Ezekiel	Calinagan	Ezekiel A. Calinagan		x	Quezon City	DPWH NCR RMC-II
Adele Michaela	Libunao	Adele Michaela Libunao	x		Quezon City	San Martin De Porres
Kristine Joy	Monillas	Tin Monillas	x		Rosario (Cavite)	Tejeros Convention
Hainess Serene	Cortez	Ness Cortez	x		Dasmariñas City (Cavite)	MERALCO
EVANGELINA	PANGILINAN	Evangelina P. Pangilinan	x		Naic	MENRO
Jesusa	Vilburn	Jesusa Vilburn	x		Naic	MENRO-Naic
Jhonnalyn	Bautista	Jhonnalyn Bautista	x		Naic	Timalan Concepcion
Teresita	Bautista	Teresita Bautista	x		Naic	Timalan Balsahan
Tin	Monillas	Tin Monillas	x			Meralco
Francis	Custodio	Francis Custodio		x		Meralco
Emilio	Poblete	Emilio Poblete		x	Naic	Makina
Mary John Claire	Nepomuceno	Mary John Claire Nepomuceno	x		Naic	Malainen Bago
Clemente	Nepomuceno	Clemente Nepomuceno	x		Naic	Malainen Bago
Josephine	Haboc	Josephine Haboc	x		Naic	Timalan Balsahan
Donna Ross	Del Monte	Donna Ross Del Monte	x		Naic	Timalan Balsahan
Chona	Antonio	Chona B. Antonio	x		Naic	Timalan Balsahan
Grace	Apuyan	Grace Apuyan	x		Naic	Timalan Balsahan
Nannette	Nacasi	Nannette B. Nacasi	x		Naic	Timalan Balsahan
Mary Rose	Dela Cruz	Mary Rose dela Cruz	x		Naic	Timalan Balsahan
Dorriss	De Lara	Dorriss de Lara	x		Naic	Timalan Balsahan
TOTAL			25	9		

Sectors represented: Fisherfolk, Women, PWD, Senior/Elderly, Youth, Business

PROCEEDINGS	
Queries/Concerns/Suggestions/Comments	**Responses to Queries**
• **Ms. Jhonnalyn Bautista, fishing boat owner,** asked if they will be allowed to fish while the bridge construction is ongoing.	• **Engr. Erica Juria of TYLin** said that construction will be by phases, meaning construction will begin at specific parts of the alignment. Only specific portions will be restricted during construction. These areas will be delineated by buoys and markers. Fishing activities may proceed if these will be done far from the construction site and outside the markers.
• **Ms. Teresita Bautista** asked if tricycles will be allowed to pass through the highway. She added that she only asked because that area is the junction that people use to go to Timalan Concepcion.	• **Engr. Juria** said that no alterations were proposed to the design of the Antero Soriano Highway. Tricycles will still be able to pass through it. However, for the area connecting the Highway to the bridge, tricycles will not be allowed. Tricycles will be prohibited from entering the alignment. Service roads will be provided along intersections with Antero Soriano Highway, specifically along the partial cloverleaf interchange, to ensure the continuous flow of traffic along the highway. If there are terminals in those intersections, coordination will be done with respective LGUs to determine a relocation site for them. These terminals will be merely relocated, not removed.
• **Ms. Josephine Haboc** said that their house is near the water. She asked if they will be asked to leave and what is the length of the area by the water that the project will require. She said that they do not have titles to the land that they occupy. If ever they will be asked to leave, she expressed hope that they will be relocated near the water since it is also from there that they source their livelihood.	• **Ms. Annabelle Herrera of Ecosys** asked Ms Haboc if their house has a sticker. To which Ms. Haboc replied in the negative. Ms. Herrera went on to explain that only structures with stickers will be affected/displaced. If their house does not have a sticker, it means that they will not be asked to leave to make way for the project. On the concern raised regarding Ms. Haboc possessing no title for the land she occupies, Ms. Herrera said that this matter is between her and their LGU and if the property in question is privately owned. She said that their use of the property depends on the LGU.

• **Ms. Evangelina Pangilinan of Naic MENRO** asked for clarification on the plan in place regarding the waste that will be generated during the construction stage pf the project. She asked if the project will have its own solid waste management plan, especially in compliance with the requirements of the DENR and DILG.	• **Mr. Frederick Esternon of DCCD** clarified that as discussed with MENRO during the team's site visit, the project will have its own solid waste management plan. He emphasized that the current effort is part of the updating of the Environmental Management Plan (EMP) and that the project already has its Environmental Compliance Certificate (ECC). He noted that the ECC requires coordination with the LGU, which means that the project will be closely coordinating with the LGU.

SCREENSHOTS OF ONLINE PARTICIPANTS

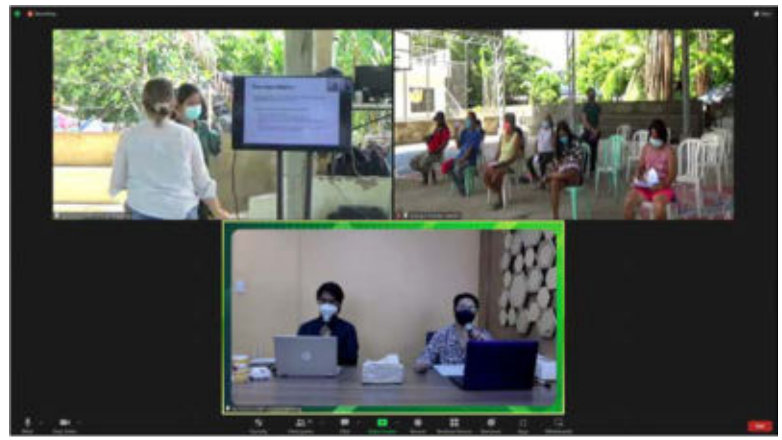



PHOTO OF ON-SITE PARTICIPANTS

ATTENDANCE SHEETS

Bataan-Cavite Interlink Bridge (BCIB) Project
Information, Education, and Communication Meeting
Barangay Timalan Balsahan Covered Court
Naic, Cavite
25 May 2022, 08:00 A.M.
ATTENDANCE SHEET

TY·LIN INTERNATIONAL
A JOINT VENTURE
PEC PRUNCHMA ENGINEERING CONSULTANTS

No.	Name	Barangay	Sex		Sector									Contact Number	Email Address	Signature
			M	F	Y	P	S	W	R	B	L	A	F			
1	TN MONILLAS	MERALCO	M	✓	Y	P	S	W	R	✓	L	A	F	09988469167	lrjrmonillas@meralco.com	[illegible]
2	NESS CORTEZ	MERALCO	M	✓	Y	P	S	W	R	✓	L	A	F	0998-9689731	hsacortez@meralco.com.ph	[illegible]
3	Francis Custodio	MERALCO	✓	F	Y	P	S	W	R	✓	L	A	F	09996937657	fscustodio@meralco.com	[illegible]
4	Emilio B. Poblete	MAKINA	✓	F	Y	P	S	W	R	B	L	A	F	0951-872-0729	4M TODA NAIC	[illegible]
5	Mary John Claire Nepomuceno	Malainen Bago	M	✓	Y	✓	S	W	R	B	L	A	F	09956047079/09351162939	mnepomuceno90@yahoo.com	[illegible]
6	Clemente Nepomuceno	Malainen Bago	✓	F	Y	P	✓	W	R	B	L	A	F	09956047079/09351162939		
7	JHONNALYN BAUTISTA	Timalan Concepcion	M	✓	✓	P	S	W	R	B	L	A	F	09632933555	Jhonnalyn 1212 @gmail	[illegible]
8	Erwin B. Bautista	Timalan Concepcion	✓	F	✓	P	S	W	R	B	L	A	F	09678174525	Jhonnalyn 1212 @gmail	Bautista
9	JESUSA [illegible]	MENRO	M	F	Y	P	S	W	R	B	L	A	F	09159911857		[illegible]
10	EVA PANGILINAN	MENRO	M	F	Y	P	S	W	R	B	L	A	F	433-5195		[illegible]
11	Donna Rose Del Monte	Timalan Balsahan	M	✓	Y	P	S	✓	R	B	L	A	F	09352910006	23dylan2017@gmail.com	[illegible]
12	Josephine Haboc	Timalan Balsahan	M	✓	Y	P	S	W	R	B	L	A	F			
13	Chona B. Antonio	Timalan Balsahan	M	✓	Y	P	S	W	R	B	L	A	✓	09366879978		[illegible]

EcosysCorp Inc.

Bataan-Cavite Interlink Bridge (BCIB) Project

Information, Education, and Communication Meeting

Barangay Timalan Balsahan Covered Court
Naic, Cavite
25 May 2022, 08:00 A.M.

ATTENDANCE SHEET

TYLININTERNATIONAL

PEC

No.	Name	Barangay	Sex		Sector									Contact Number	Email Address	Signature
			M	F	Y	P	S	W	R	B	L	A	F			
1	GRACE APUYAN	TIMALANBAL.	M	F	Y	P	S	W	R	B	L	A	F	09159091817	graceapuyan45[illegible]	[illegible]
2	NANNETTE B. NACASI	TIMALAN BAL	M	✓	Y	P	S	W	R	B	L	A	✓	09275557094		[illegible]
3	MARY ROSE DELA CRUZ	TIMALAN BAL	M	✓	Y	P	S	W	R	B	L	A	F	09122168352	WALK IN	[illegible]
4	DORRISS DC LARA	TIMALAN BAL	M	F	Y	P	S	W	R	B	L	A	F	0905 855 8295		[illegible]
5	TERESITA B. BAUTISTA	" "	M	F	Y	P	S	W	R	B	L	A	F	0918 6992123	WALK IN	[illegible]
6			M	F	Y	P	S	W	R	B	L	A	F			
7			M	F	Y	P	S	W	R	B	L	A	F			
8			M	F	Y	P	S	W	R	B	L	A	F			
9			M	F	Y	P	S	W	R	B	L	A	F			
10			M	F	Y	P	S	W	R	B	L	A	F			
11			M	F	Y	P	S	W	R	B	L	A	F			
12			M	F	Y	P	S	W	R	B	L	A	F			
13			M	F	Y	P	S	W	R	B	L	A	F			

EcosysCorp Inc.

Bataan-Cavite Interlink Bridge (BCIB) Project

Information, Education, and Communication Meeting

Barangay Timalan Balsahan Covered Court

Naic, Cavite

25 May 2022, 08:00 A.M.

ATTENDANCE SHEET

EcosysCorp, Inc.

No.	Name	Gender F	Gender M	Designation / Title	Department/Office	Contact No(s).	E-mail Address	Signature
1	MADILEN MERCADO	/		ADMIN ASST.	ADMIN	09206904280	madiequin@gmail.com	
2	ANDREA LOUISE B. PEJI	/		PC	RAP	09190020121	pejiab@gmail.com	
3	CHRISTIAN DE GUZMAN		/	REGISTRATION	ADMIN	09153370023	cdg.ecosyscorp@gmail.com	
4	Juniben Padayao		/		Admin	09193153870		
5	[illegible]		/	IS	RAP	[illegible]	[illegible]@gmail.com	
6	Jeffrey Cape		/	PCS	RAP	09266760761	jef	
7	[illegible]		/	TECH	TECH	09151564057	[illegible]@gmail.com	
8	BIMBO AVILA		/	DRIVER	TAGGING TEAM	09605457676		
9	Roger Agbait		/	Driver pogi				
10	MICHAEL GARCIA		/	HSP GWAPO	TECH/ HSP	09156778776	michaelgarcia101@gmail.com	
11	JOSEPH VILLACASTEN		/	TECH	TECH			
12								

EcosysCorp Inc.

Venue:	**Timalan Balsahan Basketball Court, Brgy. Timalan Balsahan, Naic, Cavite**
Date:	**25 May 2022 (Wednesday)**
Time:	**1:00 PM**

ATTENDEES						
First Name	**Last Name**	**Full Name**	**Female**	**Male**	**Municipality**	**Barangay/Office**
Rowena	Pajares	Rowena Oros Pajares	x		Naic Cavite	Timalan Balsahan
Adele Michaela	Libunao	Adele Michaela Libunao	x		Quezon City	DPWH
Joylyn Perucho	Isorena	Joylyn Perucho – Isorena	x		Quezon City	Ecosyscorp
Joseph	Villacasten	Joseph Villacasten		x	Quezon City	Sauyo
Meriam	Caldaira	Meriam Seballos Caldaira	x		Tanza	Biga
EVANGELINA	PANGILINAN	Evangelina P. Pangilinan	x		Naic	MENRO
Michael	Garcia	Michael Garcia		x	QC	QC
Erica	Juria	Erica Juria	x		Manila	Manila
Jad	Zamora	Jad Zamora	x		Ermita	TYLin
Jan Michael	Elbit	Jan Michael Elbit		x	Dasmarinas City	Paliparan 2
Cyrenne	Pelayo	Cyrenne Pelayo	x		QC	Quezon City
Annabelle	Herrera	Annabelle Herrera	x		Quezon City	EcosysCorp
Junnel Ray	Bautista	Junnel Ray Bautista		x	A	Manila City (Sampaloc)
Frederick	Esternon	Frederick Javier Esternon (DCCD)		x	Quezon City	Quezon City
Carl Luis	Tamayo	Carl Luis Tamayo		x	Quezon City	Culiat
Ivan Aristotle	Digal	Ivan Aristotle		x	Maragondon	Bucal 1 Maragondon Cavite

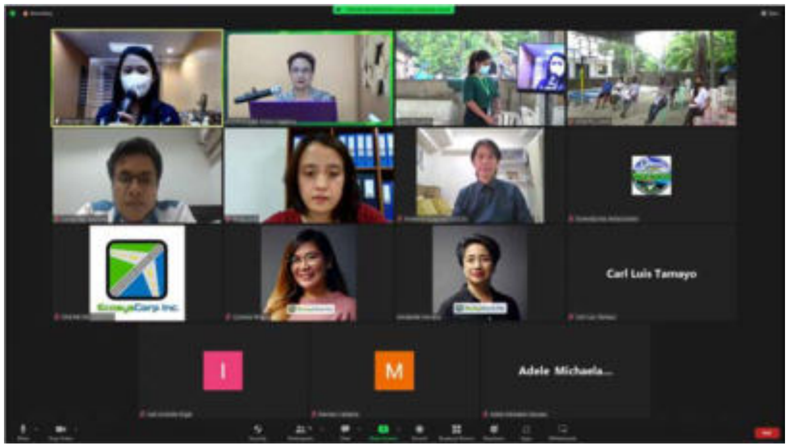
Ismael	Diaz	Ismael Diaz		x	Naic	Timalan Balsahan
Ryan	Mateo	Ryan Mateo		x	Naic	Labac
Edgar	Valenzuela	Edgar Valenzuela		x	Naic	Timalan Concepcion
Maureen	Macas	Maureen Macas	x		Naic	Timalan Concepcion
Jenifer	Meniel	Jenifer Meniel	x		Naic	Timalan Balsahan
TOTAL			11	10		

Sectors represented: Fisherfolk, Faith-based, Women

PROCEEDINGS	
Queries/Concerns/Suggestions/Comments	**Responses to Queries**
• **Ms. Jenifer Meniel** asked about what to do should a resident be interested to be employed by the project. Ms. Meniel asked how they will know if the Proponent is already looking for applicants.	• **Engr. Junnel Ray Bautista of DPWH** said that a livelihood restoration study for the DED stage of the project. After said study is done, DPWH will provide details/guidelines to residents interested to work for the project. Engr. Bautista said that once the construction is ongoing, DPWH will issue notices. There are also notices on job hiring for different projects that are posted on the DPWH website, which is regularly updated.
• **Mr. Ismael Diaz** asked if there are plans to provide substitute employment or source of livelihood for fisherfolk whose activities/fish catch will be affected. Mr. Diaz pointed out that he is already a senior citizen and will no longer be fit to take on construction-related work.	• **Engr. Bautista of DPWH** said that the project has a livelihood restoration program, which will try to identify the best fit alternative employment for those who will be affected. Engr. Bautista said that the project will try to find other employment that will suit the capacity/skills of those who will be displaced/affected by the project.
• **Mr. Edgar Valenzuela, President of fisher folk in the area,** asked the type of jobs that the project will offer. He added that some of the fishermen are likely interested to work as welders, but they do not have sufficient skills. He asked if the project would provide them skills training so they can become qualified for positions needed by the project.	• **Engr. Bautista** said that DPWH can coordinate with TESDA and other relevant institutions to provide skills training to affected fisher folk. • **Ms. Herrera of Ecosys** added that the concern raised is already part of the livelihood restoration program and that as presented earlier, training needs assessment will be conducted. Meetings will be organized as the construction start date nears to help identify who are interested to work for the project and also for the DPWH to facilitate coordination with relevant agencies.

• **Ms. Meniel** asked if flooding will not be a problem in the area once the bridge has been constructed.	• **Engr. Bautista of DPWH** shared that a Drainage Engineer has been employed at the DED stage to study the slope and flow of water in the area and make sure that the project will not cause any flooding. Engr. Juria of TYLin confirmed that the project has a Drainage Engineer who studies the drainage system in the project area and makes recommendations to the design team accordingly.
• **Ms. Meniel** asked how others can have access to the information provided in the IEC meeting.	• **Ms. Herrera** said that the study team disseminated about 500 flyers and even made postings in barangay halls. She added that it was disappointing that only a handful could attend the IEC meeting. She encouraged the residents of Timalan Balsahan and Timalan Concepcion to actively participate in IEC meetings being organized for the project. She also said that all the information presented during the IEC meeting can be accessed using the QR codes found in the flyers and Project Information Brochures. She asked the participants again to attend meetings being organized by DPWH regarding the project.
• **Ms. Evangelina Pangilinan of Naic MENRO** asked how the project took into consideration the existing seabed quarrying in Manila Bay.	• **Ms. Herrera** said that the matter on the seabed quarrying is a matter that should be settled by the DENR and DPWH. She noted that the topic was not raised during the public hearing for the BCIB Project. She said that she thinks that the matter will be resolved once the DENR's concerned units, the EMB and MGB, provide clarification on the matter. She noted that the EMB is the unit that issues ECC while the MGB issues permits for quarry projects.
• **Ms. Pangilinan** asked about the mitigating measures to be put in place in the context of the BCIB Project and seabed quarrying in the area.	• **Ms. Herrera** said that it should be up to the DENR to advice project proponents to recognize the projects already awarded with ECC and to discourage applicants from intervening with projects already awarded with ECC. She added that in the case of the BCIB, which has already been issued its ECC, no other projects or activities, especially quarrying, should be done within or around its foundations.

SCREENSHOTS OF ONLINE PARTICIPANTS



ATTENDANCE SHEETS

Bataan-Cavite Interlink Bridge (BCIB) Project

Information, Education, and Communication Meeting

Barangay Timalan Balsahan Covered Court

Naic, Cavite

25 May 2022, 01:00 P.M.

ATTENDANCE SHEET

TY·LIN INTERNATIONAL
A JOINT VENTURE
PEC Pyunghwa Engineering Consultants

No.	Name	Barangay	Sex		Sector									Contact Number	Email Address	Signature
1	DAZ, ISMAEL	TIMALAN BALSAHAN	/	F	Y	P	S	W	/	B	L	A	F	09163039655		
2	MATEO KYAI J.	LABAC	/	F	Y	P	S	W	R	B	L	A	/	09675166721		
3	EDGAR R. VALENZUELA	TIMALAN CONCEPCION	/	F	Y	P	S	W	R	B	L	A	/	09959703513		
4	Maureen Macas	Timalan Concepcion	M	/	Y	P	S	W	R	B	L	A	/	09773904190		
5	JENIFER MENIEL	TIMALAN BALSAHAN	M	/	Y	P	S	/	R	B	L	A	F	09122477730		
6			M	F	Y	P	S	W	R	B	L	A	F			
7			M	F	Y	P	S	W	R	B	L	A	F			
8			M	F	Y	P	S	W	R	B	L	A	F			
9			M	F	Y	P	S	W	R	B	L	A	F			
10			M	F	Y	P	S	W	R	B	L	A	F			
11			M	F	Y	P	S	W	R	B	L	A	F			
12			M	F	Y	P	S	W	R	B	L	A	F			
13			M	F	Y	P	S	W	R	B	L	A	F			

Bataan-Cavite Interlink Bridge (BCIB) Project

Information, Education, and Communication Meeting

Barangay Timalan Balsahan Covered Court

Naic, Cavite

25 May 2022, 01:00 P.M.

ATTENDANCE SHEET

EcosysCorp, Inc.

T·Y·LIN INTERNATIONAL
A JOINT VENTURE
PEC PYUNGHWA ENGINEERING CONSULTANTS

No.	Name	Gender		Designation / Title	Department/Office	Contact No(s).	E-mail Address	Signature
		F	M					
1	MADILEN MERCADO	✓		ADMIN ASST.	ADMIN	09208904280		
2	ANDREA LOUISE B. PEJI	✓		PC	RAP	09190020120		
3	CHRISTIAN DE GUZMAN		✓	REGISTRATION	ADMIN	09953370023		
4	JUNIBEN PADAYAO		✓		ADMIN	09193153870		
5	RUPERT DOCENA		✓	PSS	RAP	09306547806		
6	JEFFREY CAFE		✓	PSS	RAP	09266780761		
7	ARTHUR RAMIREZ		✓	TECH	TECH	09151864059		
8	BIMBO AVILA		✓	DRIVER	TAGGING	09605457676		
9	ROGER AGBAYAT		✓	DRIVER				
10	[redacted]EL GARCIA		✓	HSP	TECH / HSP	09568878760		
11	[redacted] VILLACASTEN		✓	TECH	TECH			
12								

EcosysCorp Inc.

Venue:	**Timalan Concepcion Basketball Court, Brgy. Timalan Concepcion, Naic, Cavite**
Date:	**28 May 2022 (Saturday)**
Time:	**1:00 PM**

ATTENDEES						
First Name	**Last Name**	**Full Name**	**Female**	**Male**	**Municipality**	**Barangay/Office**
Joseph	Villacasten	Joseph Villacasten		x	Naic	MENRO
Michael	Garcia	Michael Garcia		x	QC	QC
Erica	Juria	Erica Juria	x		Manila	Manila
Adrienne	De Guzman	Adrienne De Guzman	x			TYLin
Cyrenne	Pelayo	Cyrenne Pelayo	x		QC	Quezon City
Annabelle	Herrera	Annabelle Herrera	x		Quezon City	EcosysCorp
Edna Lyn	Ngo	Edna Lyn Ngo	x		Quezon City	DPWH
Frederick	Esternon	Frederick Javier Esternon		x	Quezon City	DCCD
Carl Luis	Tamayo	Carl Luis Tamayo		x	Quezon City	TYLin
Raphael	Pedroso	Raphael Pedroso		x	Manila	DPWH
Joylyn Perucho	Isorena	Joylyn Perucho - Isorena	x		QC	Ecosyscorp
Carl Escel	Eyas	Carl Escel M. Eyas		x	Taguig City	Pinagsama Village
Ma. Fe	Laryestan	Ma. Fe Laryestan	x		Naic	Timalan Concepcion
Arnold	Escotote	Arnold Escotote		x	Naic	Timalan Concepcion
Carolina	Nazareno	Carolina Nazareno	x		Naic	Timalan Concepcion
Renson	Paño	Renson Paño		x	Naic	Timalan Concepcion
Joseph	Llagas	Joseph Llagas		x	Naic	Sabang
Jun	Cultivo	Jun Cultivo		x	Ternate	Sapang
Violeta	Constantino	Violeta Constantino	x		Naic	Timalan Concepcion

Maribel	Peregrina	Maribel Peregrina	x		Naic	Timalan Concepcion
Wilson	Barco	Wilson Barco		x	Naic	Timalan
Chester	Jinayon	Chester Jinayon		x	Naic	Timalan Concepcion
Marco	Castro	Marco Castro		x	Tanza	
Camilo	Pluma	Camilo Pluma		x	Naic	Timalan
Adelma	Perea	Adelma Perea	x		Naic	Timalan
	De Nuestra	De Nuestra	x		Naic	Timalan Balsahan
Mercado	Vañeza	Mercado Vañeza	x		Naic	Timalan Concepcion
Joshua	Aniel	Joshua Aniel		x	Naic	Timalan Concepcion
Feldornia	Enriquez	Feldornia Enriquez	x		Naic	Timalan Concepcion
Narcisa	Mariano	Narcisa Mariano	x		Naic	Timalan Balsahan
TOTAL			15	15		

Sectors represented: Fisherfolk, Women, Senior, Business, Youth

PROCEEDINGS	
Queries/Concerns/Suggestions/Comments	**Responses to Queries**
• **Mr. Chester Jinayon** said that his property is within the proposed cloverleaf interchange. He asked if the government would acquire his property.	• **Mr. Carl Tamayo of TYLin** explained that for safety and accessibility reasons, properties within the cloverleaf will be acquired by DPWH.
• **Mr. Jinayon** asked if a figure could already be shared since his concern is that his property is under loan through PAGIBIG. He wanted to know how much he could possibly receive for his property should it be acquired.	• **Ms. Annabelle Herrera of Ecosys** said that the mortgage must first be released from PAGIBIG and that whatever has already been paid for by Mr. JInayon will be divided between him and PAGIBIG.
• **Mr. Jinayon** clarified that he was asking about the appraisal because he can just simply pay the whole amount since he thinks it would be confusing if there will still be division of cost between him and PAGIBIG.	• **Ms. Herrera of Ecosys** confirmed that the property has been appraised and that another appraisal will be done to get the latest valuation of the property. This is required by the law. She said that Mr. Jinayon's plan to fully pay the whole amount is better since there will be no need any more to share the cost between PAGIBIG and Mr. Jinayon. She said that his plan is better so that DPWH ned only to talk to him.

• **Mr. Jinayon** asked where and with whom he could make follow ups.	• **Ms. Herrera** asked Mr. Jinayon how he came to know about the meeting. She then explained the tagging process, which requires a structure to put the sticker on. For properties without any structure yet, she said that the parcellary survey applies to it, a process that helps identify property owners. In the case of Mr. Jinayon, it was confirmed that his property is still under PAGIBIG and has not yet been transferred to his name, which explains why his name does not appear yet in the parcellary survey. She informed Mr. Jinayon that he could get in touch with the contact details identified in the flyers and Project Information Brochure that were disseminated in the barangays.
• **Mr. Marco Castro** asked about the bridge's ability to withstand earthquakes.	• **Engr. Erica Juria of TYLIn** said that studies on it have been done while finalizing the design. She explained that these designs are submitted to DPWH PMO, which then shares it with other concerned units within the department to ensure its safety. She mentioned the various studies done, as well as the Independent Checking Engineer hired by the DPWH to review the submissions of the design team.
• **Mr. Jinayon** asked when the cut-off date is.	• **Ms. Herrera** explained what the cut-off date is. She pointed out that it only applies to occupants of properties that they do not own.
• **Mr. Jun Cultivo of Ternate** asked how those who will be displaced will be compensated by the government once the project starts, if they will be provided assistance on their source of livelihood.	• **Engr. Juria** said that part of the studies being done for the project is the formulation of a livelihood restoration plan/program. She explained the process of how this livelihood restoration plan will be executed under the coordination between the DPWH and concerned LGUs. • **Ms. Herrera** clarified if Mr. Cultivo was interviewed, to which he answered in the negative. She said that the resettlement action plan that was mentioned earlier contains plans on how these issues will be addressed and that budget has been allocated for specifically for its implementation. Said Plan covers project-affected persons, including those whose businesses will be affected.
• **Ms. Adelma Perea, representative of a project-affected person (Enriquez),** opined that housing may not be appropriate for them with properties and sources of livelihood/businesses that will be affected by the project.	• **Ms. Herrera** clarified if the person that Ms. Perea represents was interviewed, which was answered in the affirmative. Ms. Herrera explained that the interview aims to determine the kind of entitlement or assistance that an affected person should receive. She said that there is the livelihood restoration component of the project for those with affected businesses. She added that the determination of entitlement considers two things: first is the immediate solution, or compensation for lost income for a certain number of months and second, what the new source of livelihood could be for the project-affected person. She said that these concerns are included in the Livelihood Restoration and Improvement Program of the project and that the DPWH,

	together with the host LGUs of Naic and Mariveles, will be ensuring its implementation.
• **Mr. Cultivo** asked the type of vehicles that will be allowed to pass by the bridge and if there will be toll fees.	• **Engr. Juria** said that there will be no toll fees but that there will be weighbridges to determine if passing vehicles are within the allowed weight limit. She added that there will be border control points to help ensure that only allowed vehicles will pass through the bridge. She said that single motors below 400 cc and tricycles are not allowed within the bridge. Bike lanes, according to her, are also not included in the bridge design for safety reasons.
• **Ms. Narcisa Mariano, chair of the Samahan ng Magtatalaba at Mangingisda ng Timalan Balsahan and chair of MFARMC of Naic,** asked about fishermen's access once construction begins and compensation for fisherfolks whose source of livelihood will be affected. She added that there already are ongoing discussions with the municipal government of Naic regarding the project's impacts on fisherfolks. She said that the younger fishermen can be employed in the construction.	• **Engr. Juria** said that construction will be done in phases, which means that restriction will only be imposed on areas with ongoing construction activities. She said that markers and buoys will be used to mark restricted areas. She clarified that fishermen's will not be restricted by the project but that for safety reasons, they will not be allowed to go near or within areas with ongoing construction activities. On the question about compensation, she said that concerns raised by affected communities are well documented by the study team and that these will be consolidated to be forwarded to the DPWH, which will then communicate with the concerned LGUs for appropriate action.
• **Mr. Wilson Barco** clarified if payment will be given directly to those who will be affected.	• **Ms. Herrera** said that monetary compensation will be given to the person named in the identification of project-affected persons. She also clarified that based on the new law, compensation for affected structures will be based on current price for materials that will be used in constructing said structure.

PHOTO OF ONSITE PARTICIPANTS

ATTENDANCE SHEETS

Bataan-Cavite Interlink Bridge (BCIB) Project

Information, Education, and Communication Meeting

Barangay Timalan Concepcion Covered Court
Naic, Cavite
28 May 2022, 01:00 PM

ATTENDANCE SHEET

No.	Name	Barangay	Sex		Sector									Contact Number	Email Address	Signature
1	Ma-fe Laryestan	Timalan Concepcion	M	F	Y	P	S	W	R	B	L	A	F	09654687860	fe-kitty@yahoo.com	
2	Arnold N. Escototc	TIMALAN CONCEPCION	M	F	Y	P	S	W	R	B	L	A	F	09654687860		
3	CAROLINA NAZARENO	Timalan Con	M	F	Y	P	S	W	R	B	L	A	F	09065369558	carolinanazareno @ yahoo.com	
4	Renson Pani	Timalan, Con	M	F	Y	P	S	W	R	B	L	A	F	09979325722		
5	JOSEPH V. LLAGAS	SABANG NMC.	M	F	Y	P	S	W	R	B	L	A	F	09120003214		
6	jun Cubiro D	Sapong Ternate	M	F	Y	P	S	W	R	B	L	A	F	09485839714	Sapang-2 Ternate, Cavite	
7	VIOLETA E. CONSTANTINO	TIMALAN CON	M	F	Y	P	S	W	R	B	L	A	F	09368829983	VIOLETA CONSTANTINO@gmail.com	
8	MARIBEL F. PEREGRINA	TIMALAN CON	M	F	Y	P	S	W	R	B	L	A	F	09183224324	MARIBEL PEREGRINA@gmail.com	
9	WILSON BARCO	TIMALAN	M	F	Y	P	S	W	R	B	L	A	F	09350283337		
10	CHESTER JINAYON	T-Calubcub	M	F	Y	P	S	W	R	B	L	A	F	09224840328	JINAYON.CHESTER @ GMAIL.COM	
11	MARCO V. CASTRO	TANZA CAVITE	M	F	Y	P	S	W	R	B	L	A	F	09293173612	mc0043727@gmail.	
12	CAMILO R. Pluma	Timalan	M	F	Y	P	S	W	R	B	L	A	F			
13	ADELMA R. PEREA	timalan	M	F	Y	P	S	W	R	B	L	A	F	09354301729		

EcosysCorp Inc.

Bataan-Cavite Interlink Bridge (BCIB) Project

Information, Education, and Communication Meeting

Barangay Timalan Concepcion Covered Court

Naic, Cavite

28 May 2022, 01:00 P.M.

ATTENDANCE SHEET

TYLININTERNATIONAL

PEC PYUNGHWA ENGINEERING CONSULTANTS

No.	Name	Barangay	Sex		Sector									Contact Number	Email Address	Signature
1	Mikkia Ena de Mucs[illegible]	T. Balsahan Naic, Cav	M	F ✓	Y	P	S	W ✓	R	B	L	A	F	09456011161	mikkadanw@gmail.com	[illegible]
2	Mercado Vañeza	T. Concepcion	M	F ✓	Y ✓	P	S	W	R	B	L	A	F	09754353392	mercadovaneza@gmail.com	[illegible]
3	Joshua Aniel	T. Concepcion	M ✓	F	Y ✓	P	S	W	R	B	L	A	F	09754353392	joshuaaniel1997@gmail.com	[illegible]
4	FEDERNIA [illegible] TC		M	F ✓	Y	P	S ✓	W	R	B	L	A	F			[illegible]
5	Narcisa A. Mariano	T. Balsahan	M	F ✓	Y	P	S	W	R	B	L	A	F ✓	09957631418		[illegible]
6			M	F	Y	P	S	W	R	B	L	A	F			
7			M	F	Y	P	S	W	R	B	L	A	F			
8			M	F	Y	P	S	W	R	B	L	A	F			
9			M	F	Y	P	S	W	R	B	L	A	F			
10			M	F	Y	P	S	W	R	B	L	A	F			
11			M	F	Y	P	S	W	R	B	L	A	F			
12			M	F	Y	P	S	W	R	B	L	A	F			
13			M	F	Y	P	S	W	R	B	L	A	F			

EcosysCorp Inc.

Bataan-Cavite Interlink Bridge (BCIB) Project
Information, Education, and Communication Meeting
Barangay Timalan Concepcion Covered Court
Naic, Cavite
28 May 2022, 01:00 PM
ATTENDANCE SHEET
EcosysCorp, Inc.

TYLIN INTERNATIONAL
PEC Pyunghwa Engineering Consultants

No.	Name	Gender F	Gender M	Designation / Title	Department/Office	Contact No(s).	E-mail Address	Signature
1	MAHALAEL GARUZ		✓	CAT	ECOSYS CORP	09271206337	garuzmike@gmail.com	
2	ROGER AGBISIT		✓	CAT	ECOSYS CORP	09361830349		
3	CHRISTIAN DE GUZMAN		✓	ADMIN / REG	ADMIN	09953370023	cdg.ecosyscorp@gmail.com	
4	MADILEN MERCADO	✓		ADMIN ASST.	ADMIN	09208904260	ecosysmadi@gmail.com	
5	Jeffrey Cape		✓	PSS	Ecosys Corp	09266780761		
6	ANDREA PEJI	✓		PC	RAP	09190020121	pejio16@gmail.com	
7	[illegible] Dorena		✓	BS	RAP	[illegible]		
8	MICHAEL GARCIA		✓	HSP / TECH	TECH	09568387876	michaelgarcia101@gmail	
9	JOSEPH VILLACASTEN		✓	HSV / TECH	TECH	09063777[illegible]		
10								
11								
12								

EcosysCorp Inc.

2. Stakeholder consultation in Mariveles, Bataan

Venue:	**Alas asin Basketball Court, Brgy. Alas asin, Mariveles, Bataan**
Date:	**15 June 2022 (Wednesday)**
Time:	**8:00 AM**

First Name	Last Name	Full Name	Female	Male	Municipality	Barangay/Office
Gemma R.	Bautista	Gemma R. Bautista	x		Mariveles	Alas- Asin
Norma R.	Lalunio	Norma R. Lalunio	x		Mariveles	Alas- Asin
Bibiana S.	Caliboso	Bibiana S. Caliboso	x		Mariveles	Alas- Asin
Claitz	Lezada	Claitz Lezada		x	Mariveles	Alas- Asin
Bavani	Mariano	Bavani P. Mariano		x	Mariveles	Alas- Asin
Donato	Anda	Donato Anda		x	Mariveles	Alas- Asin
Vincente	Aguilar	Vincente Aguilar		x	Mariveles	Alas- Asin
Jimmy	Venturina	Jimmy Venturina		x	Mariveles	Alas- Asin
Juancholito	Baal	Juancholito Baal		x	Mariveles	Alas- Asin
Isagani	Adona	Isagani Adona		x	Mariveles	Alas- Asin
Geraldine	Reyes	Gelrdine Reyes		x	Mariveles	Alas- Asin
Rheda Kathleen	Caguiat	Rheda Kathleen Caguiat	x		Mariveles	Mt. View
Reneo	Barlis	Reneo Barlis		x	Mariveles	Alas- Asin
Elena F.	Temaje	Elena F. Temaje	x		Mariveles	Alas- Asin
Mary Jean	Ilanto	Mary Jean Ilanto	x		Mariveles	Alas- Asin
Leojean	Ponte	Leojean Ponte	x		Mariveles	Alas- Asin
Melvin	Ponte	Melvin Ponte		x	Mariveles	Alas- Asin

Jenezyn	Abon	Jenezyn Abon	x		Mariveles	Alas- Asin
Cornelio	Pineda	Cornelio Pineda		x	Mariveles	Alas- Asin
Rodalie	Pajarilao	Rodalia Pajarilao	x		Mariveles	Alas- Asin
Ligaya C.	Dones	Ligaya C. Dones	x		Mariveles	Alas- Asin
Margie	Enriquez	Margie Enriquez	x		Mariveles	Alas- Asin
Christine	Pepito	Christine Pepito	x		Mariveles	Alas- Asin
Frederick	Esternon	Frederick Esternon		x	Quezon City	Marilag
Ezekiel	Calinagan	Ezekiel Calinagan		x	QC	DPWH
Annabelle	Herrera	Annabelle Herrera	x		QC	Ecosys
Cyrene	Pelayo	Cyrene Pelayo	x		QC	Quezon City
Banjo	Laurel	Banjo Laurel		x	Manila	Port Area
Niccole Anne	Bumagat	Nicole Anne Bumagat	x		Manila	DPWH
Edna Lyn	Ngo	Edna Lyn Ngo	x		Manila	DPWH
Erica	Juria	Erica Juria	x		Manila	TYLI
Carl Luis	Tamayo	Carl Luis Tamayo		x	Quezon City	Culiat
Mike	Garcia	Mike Garcia		x	Quezon City	Ecosyscorp
Ellaine	Rabot	Ellaine Rabot	x		N/A	Manila
Adrienne	De Guzman	Adrienne De Guzman	x		Ermita	TYLin
Allain	Caasi	Allain Caasi	x		Ermita	1579/ TYLIN International
Joseph	Villacasten	Joseph Villacasten		x	QC	Sauyo
Andrea Louise	Peiji	Andrea Louise Peiji	x		QC	Ecosysq

Test	Test	Test	x		QC	Qc
Adele Michaela	Libunao	Adele Michaela Libunao	x		Metro Manila	DPWH
TOTAL			23	17		

PROCEEDINGS	
Queries/Concerns/Suggestions/Comments	**Responses to Queries**
• **Mr. Chester Jinayon** said that his property is within the proposed cloverleaf interchange. He asked if the government will acquire his property.	• **Mr. Carl Tamayo of TYLin** explained that for safety and accessibility reasons, properties within the cloverleaf will be acquired by DPWH.
• **Mr. Rene Barlis of Mt. View** asked which particular agency should residents go to should accidents occur. **Mr. Barlis** requested to publicly disclose the contact details, adding that agencies concerned usually tend to give people the runaround.	• **Engr. Nicole Bumagat of DPWH** said that the Project Information Brochure on the project that was distributed contains information on who to call and what number should residents have any concern about the project. • **Ms. Annabelle Herrera of Ecosys** asked the site team to show the requested contact details on the screen. She also said that the ECC contains provision on Environmental Guarantee Fund (EGF), which will serve as fund source for unexpected incidents or accidents related to the project. She said that aggrieved parties may go to the DENR to access the EGF.
• **Ms. Norma Lalunio** clarified if all structures bearing stickers are already confirmed to be affected. • **Ms. Lalunio** added if relocation will be provided for those who will be displaced.	• **Ms. Herrera of Ecosys** advised the participants to wait for meeting notices in the future. • **Ms. Herrera** explained that

ATTENDANCE SHEETS

Bataan-Cavite Interlink Bridge (BCIB) Project
Information, Education, and Communication Meeting
Barangay Alas-asin Covered Court
Mariveles, Bataan
15 June 2022, 08:00 A.M.

ATTENDANCE SHEET

EcosysCorp, Inc.

TYLIN INTERNATIONAL
PEC

No.	Name	Gender F	Gender M	Designation / Title	Department/Office	Contact No(s).	E-mail Address	Signature
1	MADILEN MERCADO	✓		ADMIN ASST.	ADMIN	09208904280		
2	CHRISTIAN DE GUZMAN		✓	RECS / ADMIN	ADMIN	09953370023		
3	JUNIBEN B. PADAYAO		✓		ADMIN	09193153870		
4	JOSE MONTE DE RAMOS		✓		DMT	[illegible]		
5	KIM LAWRENCE C. DIVINA		✓		DMT	09162576070		
6	PALOMARIA, REINNERE		✓		CAT	0905 449 1313		
7	ARTHUR RAMIREZ		✓		TECH	[illegible]		
8	Peji, Andrea Louise B	✓		PC	RAP	0919 002 0121		
9	Isorna, Joylyn	✓			TECH	[illegible]		
10	EFREN IBARDALOZA		✓	PSG	CAT	[illegible]		
11	MICHAEL GANUT		✓	HSP / TECH	TECH / HSP	[illegible]		
12	JOSEPH VILLACASTEN		✓	HSP / TECH	TECH	[illegible]		

EcosysCorp Inc

Bataan-Cavite Interlink Bridge (BCIB) Project
Information, Education, and Communication Meeting
Barangay Alas-asin Covered Court
Mariveles, Bataan
15 June 2022, 08:00 A.M.
ATTENDANCE SHEET

TYLININTERNATIONAL
A JOINT VENTURE
PEC Pyunghwa Engineering Consultants

No.	Name	Barangay	Sex		Sector									Contact Number	Email Address	Signature
1	GEMMA R. BAUTISTA	ALAS-ASIN	M	F	Y	P	S	W	R	B	L	A	F	09383831268		
2	NORMA J. LALUNIO	ALAS-ASIN	M	F	Y	P	S	W	R	B	L	A	F	09166315074		
3	Bibiana S. Calibogo	Alas-asin	M	F	Y	P	S	W	R	B	L	A	F	09150657176		
4	LEZADA, CLAITZ	ALAS-ASIN	M	F	Y	P	S	W	R	B	L	A	F	09232126690		
5	BAYANI P. MARIANO	ALAS-ASIN	M	F	Y	P	S	W	R	B	L	A	F	09208884665		
6	DONATO ANDA	ALAS-ASIN	M	F	Y	P	S	W	R	B	L	A	F	09301932862		
7	VICENTE AGUILAR	"	M	F	Y	P	S	W	R	B	L	A	F	09813074069		
8	JIMMY VENTURINA	"	M	F	Y	P	S	W	R	B	L	A	F	09989124859		
9	JUANCHOLITO BAAL	"	M	F	Y	P	S	W	R	B	L	A	F	0948 378 2080		
10	ISAGANI ADONA	"	M	F	Y	P	S	W	R	B	L	A	F	09771414419		
11	Gelerdin Reyes	"	M	F	Y	P	S	W	R	B	L	A	F	0910 633 6277		
12	Rheda Kathleen Caguiat	mt. View	M	F	Y	P	S	W	R	B	L	A	F	09672664798	/ BRGY CLERK	
13	RENEO BARLIS	- do	M	F	Y	P	S	W	R	B	L	A	F	09098473048	/ ~~BSW~~	

EcosysCorp Inc.

Bataan-Cavite Interlink Bridge (BCIB) Project

Information, Education, and Communication Meeting

Barangay Alas-asin Covered Court

Mariveles, Bataan

15 June 2022, 08:00 A.M.

ATTENDANCE SHEET

T.Y.LIN INTERNATIONAL — A JOINT VENTURE — PEC Pyunghwa Engineering Consultants

No.	Name	Barangay	Sex	Sector	Contact Number	Email Address	Signature
1	Elena F. Temaji	Alasasin	M F	Y P S W R B L A F	09129963420		[illegible]
2	Mary Stelr Llanto	Alasasin	M F	Y P S W R B L A F	09114755723		[illegible]
3	Leojean Ponte	Alasasin	M F	Y P S W R B L A F	09976380157		[illegible]
4	Melvin Ponte	Alas-asin	M F	Y P S W R B L A F	09067984527		[illegible]
5	Abon, Jenelyn	Alasasin	M F	Y P S W R B L A F	09586812194		[illegible]
6	Pineda Cornelio	Alas-asin	M F	Y P S W R B L A F	09774152293		[illegible]
7	Rosalie Pasarilo	Alasasin	M F	Y P S W R B L A F	09176327521		[illegible]
8	Ligaya C. Dones	Alasasin	M F	Y P S W R B L A F	09951818537		[illegible]
9	Enriquez Margie	alas-asin	M F	Y P S W R B L A F	0916[illegible]159		[illegible]
10	Pepito Christian	Alas-asin	M F	Y P S W R B L A F	09076855479		[illegible]
11			M F	Y P S W R B L A F			
12			M F	Y P S W R B L A F			
13			M F	Y P S W R B L A F			

Venue:	**Alas asin Basketball Court, Brgy. Alas asin, Mariveles, Bataan**
Date:	**18 June 2022 (Saturday)**
Time:	**8:00 AM**

ATTENDEES						
First Name	**Last Name**	**Full Name**	**Female**	**Male**	**Municipality**	**Barangay/Office**
Noelito M.	Rea	Noelito M. Rea		x		Mt. View
Ricardo V.	Maghanay	Ricardo V. Maghanay				Townsite
Almario C.	Quizon	Almario C. Quizon		x		Mt. View
Ernesto V.	Austria	Ernesto V. Austria		x		Alas- Asin
Cornelia	Cruz	Cornelia Cruz	x			Alas- Asin
Teresita	Gervacio	Teresita Gervacio	x			cabcaben
Adelle Michaela	Libunao	Adelle Michaela Libunao	x		Metro Manila	DPWH
Cyrenne	Pelayo	Cyrenne Pelayo	x		QC	Ecosys
Frederick	Esternon	Frederick Esternon		x	QC	Marilag
Erica	Juria	Erica Juria	x		Manila	TYLI
Carl Luis	Tamayo	Carl Luis Tamayo		x	Manila	TYLin
Adrienne	De Guzman	Adrienne De Guzman	x		Manila	TYLin
Jad	Zamora	Jad Zamora	x		Manila	TYLin
Elenor	De Leon	Elenor De Leon	x		NA	Ecosys
Ellaine	Rabot	Ellaine Rabot	x		Manila	DPWH
Junnel Ray	Bautista	Junnel Ray Bautista		x	Manila	Manila City (Sampaloc)
Annabelle	Herrera	Annabelle Herrera	x		QC	Ecosys
TOTAL			10	6		

Sectors represented: Women, Senior/Elderly, and Local leaders

PROCEEDINGS	
Queries/Concerns/Suggestions/Comments	**Responses to Queries**
• **Mr. Noelito Rea** asked if those from the informal sector who will be displaced by the project will be compensated by the government.	• **Ms. Annabelle Herrera of Ecosys** explained that part of the preparation for the formulation of the resettlement plan is the conduct of structure tagging. She added that if the houses of those informal settlers have been tagged or have colored stickers, it means that they will be affected/displaced by the project. She added that white stickers were used to tag structures during the feasibility study stage. She clarified that based on Philippine laws and on ADB's policies, qualified informal settler families are entitled to receive compensation. She said that the DPWH will review their qualifications and should they qualify, they will be entitled to relocation. She added that DPWH will be working closely with the local government of Mariveles to address said concern.
• **Mr. Ernesto Austria** asked about the steps that will be undertaken by the project to minimize its adverse impact on the environment.	• **Mr. Frederick Esternon of DCCD** explained that baseline study on the water, air, marine life, etc. was undertaken during the feasibility study stage, results of which served as bases for determining the actual status of the environment in the project-affected area, which should be maintained according to the standards of the Environmental Management Bureau (EMB) of the Department of Environment and Natural Resources (DENR). He said that an environmental impact statement (EIS) was produced during the feasibility study stage, which underwent thorough validation by the EMB and served as basis for the issuance of the project's environmental compliance certificate (ECC). The ECC will serve as the planning tool or the project's guide in protecting the environment. He said that the ECC contains conditions, which the project must fulfill or meet. He also clarified that affected trees will also be treated similar to the structure tagging earlier explained. He then explained the permitting process being done by the DENR in issuing tree cutting permits and in ensuring that cut trees will be properly replaced. • **Ms. Herrera** added that adverse environmental impacts cannot be avoided during the construction period and that it will likely take time before certain aspects of the affected environment will go back to its initial condition. She added that interested community members may join the multi-partite monitoring team (MMT) so they can witness the sampling activities and see for themselves if conditions worsen or not.

	• **Mr. Esternon** confirmed that temporary changes in the environment should be expected.
• **Kgd Almario Quitong of Mt. View** asked what how the project will compensate the fisherfolk who stand to be adversely affected by temporary changes to the environment and by the construction activities. He also asked how coral reefs will be protected.	• **Mr. Esternon** said that construction activities will be done progressively and that measures will be established to ensure safety of fisherfolk and avoid limiting their access. On the question on the coral reefs, Mr. Esternon cited the result of the study that determined the presence of coral reefs in the area but although the project will not affect these, he assured Kgd. Quitong that appropriate steps will still be undertaken to avoid any adverse impact on these. • **Engr. Erica Juria of TYLin** confirmed what Mr. Esternon said about the progressive conduct of construction activities and the considerations being undertaken to minimize adverse impacts to fisherfolks. • **Ms. Herrera** added that based on the study done by experts, fishing grounds will not be affected by the project. She said that fisherfolks' access will not be limited. She confirmed the management plan that will be followed during the construction stage to ensure that access will not be limited. She also said that livelihood interventions will also be taken for those who will be displaced by the project.
• **Mr. Rea** asked how far away from the bridge, once it is finished, will fishermen be allowed to fish.	• **Ms. Herrera** said that it is important for the BFAR and concerned groups to discuss the navigational routes in the area. • **Engr. Junnel Bautista of DPWH** said that the DPWH will coordinate with BFAR and local agencies to discuss safety of fisherfolks and specify guidelines on fishing activities.
• **Mr. Austria** asked about the exact restrictions that will be imposed on fisherfolks.	• **Engr. Bautista** said that security personnel will be installed to ensure the strict implementation of regulations around the bridge.
• **Kgd. Quitong** asked about the project timeline so he can advise fisherfolks.	• **Engr. Bautista** said that the DED stage will be finished by the first quarter of 2023. He added that the project is divided into packages and that procurement will take about two to three quarters, including loan negotiations. He said that **considering** said timeline, construction activities are expected to start on the last quarter of 2023 up to the first quarter of 2024.
• **Mr. Austria** asked if employees from Bataan will be prioritized for the project.	• **Ms. Herrera** pointed out that priority will be given to residents from affected areas and that this is indicated in the Resettlement Plan as well as in the ECC. She also added that based on the provision of RA 6685, for any government project, 50% of unskilled laborers and 30% of skilled laborers should come from the area where construction is being undertaken.

	• **Mr. Esternon** added that affected areas include Cavite City and Naic and that distribution among these areas will be done.

ATTENDANCE SHEETS

Bataan-Cavite Interlink Bridge (BCIB) Project
Information, Education, and Communication Meeting
Barangay Alas-asin Covered Court
Mariveles, Bataan
18 June 2022, 08:00 A.M.
ATTENDANCE SHEET
EcosysCorp, Inc.

T.Y.LIN INTERNATIONAL
A JOINT VENTURE
PEC PYUNGHWA ENGINEERING CONSULTANTS

No.	Name	Gender F	Gender M	Designation / Title	Department/Office	Contact No(s).	E-mail Address	Signature
1	CHRISTIAN DE GUZMAN		/	ADMIN / REGS.	ADMIN	09953378023		
2	Andrea Louise B. Peji	/		PC	RAP	0919 002 0121		
3	MADILEN MERCADO	/		ADMIN ASST.	ADMIN	09208904280		
4	PALOMARIA, REIN		/	LINE MARSHALL ~~CAT~~	CAT	09057441513		
5	Juniben B. Padayao		/		ADMIN	09193153870		
6	MICHAEL C. GARCIA		/	SO1 / TECH	TECH / HSP	09568878764		
7	JOYLYN ISORENA	/		Tech	TECH	09162404932		
8	JOSEPH VILLARANTON		/	TECH	TECH	[illegible]		
9	[illegible]		/	TECH	TECH	09151864057		
10	MAHARAEL GARUZ		/	CAT	CAT	09271265337		
11	ROGER ALBISIT		/	CAT	CAT	09836183034		
12	EFREN IBARDALOZA JR.		/	PCS	CAT	09457386819		

EcosysCorp Inc.

Bataan-Cavite Interlink Bridge (BCIB) Project

Information, Education, and Communication Meeting

Barangay Alas-asin Covered Court
Mariveles, Bataan
18 June 2022, 08:00 A.M.

ATTENDANCE SHEET

TYLIN INTERNATIONAL
A JOINT VENTURE
PEC Prudhvi Engineering Consultants

No.	Name	Barangay	Sex		Sector									Contact Number	Email Address	Signature
1	NOELITO M. REA	MT. VIEW	M ✓	F	Y	P	S	W	R	B	L ✓	A	F	09207027791	NARRA/IPIL HOA	
2	RICARDO V MAGHANAY	TOWNSITE	M	F	Y	P	S	W	R	B	L	A	F	09568747093	'	
3	ALMARIO C. QUITONO	MT. VIEW	M ✓	F	Y	P	S	W	R	B	L ✓	A	F	09617347963	CATODA	
4	ERNESTO V. AUSTRIA	ALAS-ASIN	M ✓	F	Y	P	S ✓	W	R	B	L	A	F	0938-281-2381	DHOAI	
5	CORNELIA CRUZ	ALAS-ASIN	M	F ✓	Y	P	S	W ✓	R	B	L	A	F	09632849817		
6	Teresita Gervacio	cabcaben	M	F ✓	Y	P	S	W ✓	R	B	L	A	F		kal, pe	
7			M	F	Y	P	S	W	R	B	L	A	F			
8			M	F	Y	P	S	W	R	B	L	A	F			
9			M	F	Y	P	S	W	R	B	L	A	F			
10			M	F	Y	P	S	W	R	B	L	A	F			
11			M	F	Y	P	S	W	R	B	L	A	F			
12			M	F	Y	P	S	W	R	B	L	A	F			
13			M	F	Y	P	S	W	R	B	L	A	F			

EcosysCorp Inc.

APPENDIX 2 : Screenshots of the BCIB Online Survey Form

BCIB - Public Perception Survey (Detailed Design Stage)

Show Visual Renders/Photographs

☐ Yes

Show in Tagalog

☑ Yes

Ang Bataan-Cavite Interlink Bridge (BCIB) ay proyekto ng Depatment of Public Works and Highways (DPWH). Ito ay may haba na 32 kilometro at magsisilbi bilang isang napakahalagang tulay na magdudugtong sa lalawigan ng Bataan, simula sa Bayan ng Mariveles patungo sa Naic, sa lalawigan ng Cavite, habang bumabaybay sa bukana ng Manila Bay. Ang four lane na BCIB ang magiging pinaka mahabang tulay sa Pilipinas. Itinatayang mababawasan ang tagal ng biyahe mula sa dalawang lalawigang nabanggit mula sa limang oras, ay magiging 45 minuto na lamang. Ito ay makapagdudulot ng malaking kabawasan sa pagsikip ng trapiko at magsusulong ng pag-unlad sa mga rehiyon na pinagdudugtong nito.

DATA PROCESSING AND DATA PRIVACY

Lahat ng impormasyon na malilikom sa survey na ito ay gagamitin lamang sa Environmental Impact Assessment at hindi sa ano pa mang layunin. Ang mga sagot na makukuha galing sa mga respondents ay pananatiliing strictly confidential at ipoproseso sa pamamaraan na naaayon sa mga probisyon ng Republic Act 10173 o Philippine Data Privacy Act.

A. INTRODUCTION AND CONSENT

Read the following introduction:

"Isinasagawa ang survey na ito ukol sa persepsyon ng publiko sa Bataan–Cavite Interlink Bridge (BCIB) project na isinusulong ng Department of Public Works and Highways. Nilalayon nitong pag-ugnayin ang Bataan at Cavite sa pamamagitan ng isang tulay na tatawid sa Manila Bay. Ang bridge project na ito ay kasalukuyang nasa design stage at kasabay nito ay pagsasagawa nitong survey na bahagi naman ng Environmental Impact Assessment, o pag-aaral ukol sa maaring maging epekto ng proyekto sa kapaligiran. Ang impormasyon na makukuha mula sa participants ng survey ay makakatulong sa assessment team upang maunawaan ang mga maaring maging epekto (potential impacts) ng proyekto, gayundin ang pananaw ng mga tao na maaaring maapektuhan ng pagpapatupad ng proyekto. Maari po ba naming makuha ang inyong pananaw sa pamamagitan ng pagsali sa survey na ito? Ito ay gugugol ng mga lima hanggang sampung minuto lamang ng inyong oras. Sa inyong pagsali, ang inyong katauhan ay magiging anonymous; hindi namin isisiwalat ang inyong pagkakakilanlan at ang inyong detalyeng isasagot sa survey. Maari po ba naming makuha ang inyong pananaw sa pamamagitan ng pagsali sa survey na ito?"

☐ Nauunawaan ko ang impormasyong inilahad sa taas. Pumapayag akong sumali sa Perception Survey.

B. INFORMANT PROFILE

1.Petsa

1.Date (dd/mm/yyyy) *

10/25/2022

2.Oras nagsimula

2.Time started *

01:08 PM

3.Oras na natapos

3.Time finished

4. Name of interviewer

5.Location of respondent: *

○ Mariveles ○ Naic

Instruction: Under 'Locality', record nearest intersection or known place, e.g., 'town hall', 'fishing port', 'x' sub-division, so distribution of interviews can be mapped.

Brgy: *

Locality: *

6.Pangalan ng respondent

6. Name of respondent: *

First Middle Last

7. Mobile number of respondent: *

09123456789

8.Edad ng respondent

8. Respondent's age:

0 of 2 max characters

9. Respondent's gender: *

○ Female ○ Male ○ Non-Binary

APPENDIX 3 : Screenshot of the flyer used to attract online respondents to the survey


Bataan-Cavite Interlink Bridge (BCIB) Project
The proposed Bataan-Cavite Interlink Bridge (BCIB) Project will be a four-lane median-separated roadway spanning a total length of 32 km, 26 km of which would be over the waters of Manila Bay. This highway will only be accessible via two interchanges: the north interchange from Roman Super Highway at Barangay Alas-Asin in Mariveles, Bataan, and the south interchange from Antero Soriano Highway at Barangay Timalan Balsahan in Naic, Cavite.
We want your feedback! Please go to this link to answer the survey:
https://www.ecosyscorp.ph/bcib-perception-survey-dd/
See more photos of the proposed bridge by scanning the QR codes at the back of this flyer.

Bataan-Cavite Interlink Bridge Project

Stakeholder and Public Engagement

Environmental Workshop and Public Meetings

October 03, 2023

Prepared By:

TYLin PEC

A JOINT VENTURE

T.Y. Lin International | Pyunghwa Engineering Consultants Joint Venture

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Revisions:

Date	Description	Revision	Originator	Reviewer	Approver
2023-10-03	Issue for Coordination	00	Ian Borja (TYLI) Fred Esternon (TYLI)	Sol Abasa (TYLI) Carol Choi (TYLI)	Marwan Nader (TYLI/ PEC JV)

Table of Contents

1 PROGRAMME

1.1 Cavite

Republic of the Philippines
DEPARTMENT OF PUBLIC WORKS & HIGHWAYS
CENTRAL OFFICE
Manila

Environmental Workshop and Public Meetings
August 31, 2023
Tanza Oasis Hotel, Tanza, Cavite

Time	Topic/Activity	Remarks / Persons-In-Charge
8:00 AM – 9: 00 AM	Registration	
9:00 AM – 9:15 AM	National Anthem Invocation Safety Briefing	***Gelonie Yap*** Master of Ceremony ***Hotel Safety Officer***
9:15 AM – 9:25 AM	Opening Remarks Presentation of Public Consultation Objectives Introduction of Participants	***Engr. Junnel Ray Bautista*** Deputy Project Manager, BCIB DPWH
9:25 AM – 10:45 AM	Brief Presentation of the Project Results of EIA on impacts, measures, commitments during DED Stage	***Engr. Erica Rose Juria*** Project Engineer TYLin International ***Ian Borja*** EIA Preparer
10:45 AM – 12:00 PM	Open Forum	***Frederick Esternon*** Facilitator/ ERPMP Preparer for ECC
	Managed Buffet	
12:00 PM – 12:45 PM *Over lunch*	Summary of Issues/ Concerns/ Impacts raised by the Public and response of the Proponent	***Ian Borja*** EIA Preparer
12:45 PM – 1:00 PM	Closing Remarks	***Ms. Annabelle Cayabyab*** PENRO Head, Cavite

1.2 Bataan

Republic of the Philippines
DEPARTMENT OF PUBLIC WORKS & HIGHWAYS
CENTRAL OFFICE
Manila

Environmental Workshop and Public Meetings
September 1, 2023
The Oriental Bataan Convention Center, Mariveles, Bataan

Time	Topic/Activity	Remarks / Persons-In-Charge
8:00 AM – 9: 00 AM	Registration	
9:00 AM – 9:15 AM	National Anthem Invocation Safety Briefing	***Gelonie Yap*** Master of Ceremony ***Hotel Safety Officer***
9:15 AM – 9:25 AM	Opening Remarks Presentation of Public Consultation Objectives Introduction of Participants	***Engr. Junnel Ray Bautista*** Deputy Project Manager, BCIB DPWH
9:25 AM – 9:35 AM	Welcome Remarks	***Hon. Ace Jello Concepcion*** Mariveles Municipal Mayor
9:35 AM – 10:45 AM	Brief Presentation of the Project Results of EIA on impacts, measures, commitments during DED Stage	***Engr. Erica Rose Juria*** Project Engineer TYLin International ***Ian Borja*** EIA Preparer
10:45 AM – 12:00 PM	Open Forum	***Frederick Esternon*** Facilitator/ ERPMP Preparer for ECC
	Managed Buffet	
12:00 PM – 12:45 PM *Over lunch*	Summary of Issues/ Concerns/ Impacts raised by the Public and response of the Proponent Agreements in Public Consultation Open Forum	***Ian Borja*** EIA Preparer
12:45 PM – 1:00 PM	Closing Remarks	***Hon. Gila Garcia*** Bataan 3rd District Congresswoman ***Minerva J. Martinez*** CDD Chief, DENR Region 3

2 INTRODUCTION

With sixty-five (65)[1] attendees in Cavite and eighty-four (84)[1] attendees in Bataan, the recently conducted public consultations were organized by the TYLin International, a consultant for Bataan-Cavite Interlink Bridge project. During these consultations, the DPWH presented the results of the Environmental Impact Assessment to various project stakeholders, including officials from municipal and provincial offices, NGOs, NGAs, and individuals from academic institutions. The DPWH contingent was led by Engr. Junnel Ray Bautista. The Consultants, Ms. Sol Abasa and Engr. Erica Rose Juria, along with Mr. Frederick Esternon, Mr. Ian Borja and Ms. Gelonie Grace Yap, served as resource persons and main facilitators for the event. These events took place at Tanza Oasis in Tanza Cavite, on August 31, 2023, and at the Oriental Bataan Convention Center in Mariveles, Bataan, on September 1, 2023.

Engr. Junnel Ray Bautista, representing Dir. Sharif Madsmo Hasim and PM Teresita Bauzon, officially commenced the seminar workshop He warmly welcomed and introduced the participants, extending his best wishes for a productive session. His opening remarks also encompassed the public consultation objectives.

During the Bataan public consultation, Hon. Ace Jello Concepcion, Municipal Mayor of Mariveles, delivered a welcoming message to encourage active participation, especially from the municipality's stakeholders.

Objectives and Overview. Engr. Bautista provided an overview of the seminar's objectives, which is shown above through the event’s programme, highlighting that its main goal was to present the results of the Environmental Impact Assessment conducted by BCIB's consultants. The seminar aimed to engage stakeholders in a discussion regarding the presented findings and gather their suggestions regarding the proposed mitigation measures.

[1] See Annex A for List of Participants

3 PROJECT PRESENTATION

In this session, Engr. Juria of TYLin International, gave a brief presentation about the Bataan-Cavite Interlink Bridge project. The presentation is attached as Annex B[2] and below are some of the key information regarding the project.

Project Funding and DED. The Bataan Cavite Interlink Bridge (BCIB) is being funded by the Asian Development Bank (ADB) for the Detailed Engineering Design, which is being done by the joint venture of TY Lin International and PEC, in association with Renardet S.A. and DCCD Engineering Corporation. The implementing agency for the project is the Department of Public Works and Highways (DPWH).

Project Description. The BCIB has a span of 32.15 kilometers and will be composed of four lanes, two for each north bound and south bound directions. It will connect the provinces of Bataan and Cavite from Brgy Timalan in Naic, Cavite (Southern Terminus) to Brgy. Alas-asin in Mariveles, Bataan.

Project Objective. The BCIB project aims to provide a permanent linkage between Bataan and Cavit. It is intended to reduce the journey time and ease traffic congestion through Metro Manila, South Luzon, and North Luzon gateways.

Project Components. The BCID will be comprised of seven (7) separate packages namely, (1) Bataan Land, (2) Cavite Land; (3) Marine Viaduct (North); (4) Marine Viaduct (South); (5) NCB + approaches; (6) SCB + approaches and (7) Ancillary.

Architectural perspectives and designs are presented in the portion of Project Information in Annex B.

[2] Presentation of the Results of Environmental Baseline Information and Impact Assessment

4 EIA RESULTS PRESENTATION

Proceeding from the presentation about the BCIB project, Mr. Ian Borja presented important details regarding the findings of the Environmental Impact Assessment.

According to the presentation, environmental baseline profiling was done in 2019, which was presented in the EIS and submitted as part of the ECC application. The ECC was issued last April 2021. Additional environmental baseline profiling was conducted in 2021 and 2022, which served as augmentation to the 2019 data.

Baseline environmental data for land, water, air, and people were covered. Land included land use, geology and geomorphology, terrestrial flora and fauna. Water included freshwater, ground water, marine water, and marine ecology. Air studies included climatology, climate change, air quality and noise. People include demographics, population, economy, education, and various services.

Some salient findings were presented during the consultation. However, in the interest of time, a summary of findings in terms of land, water, air, and people are shown. The table below presents the information shared during the consultation.

Table 1: EIA Findings for Bataan and Cavite

EIA Results for Bataan and Cavite	
Land - Bataan	• Moderately sloped landscaped about0-25 masl • Volcanic deposits including pyroclastic flows and ash deposits; • Grassland and scrubland, interspersed with riparian forest patches; • Native vegetation species, with mangroves along near mouths of rivers; • Low abundance of wildlife; • No physical cultural heritage site along the alignment
Land - Cavite	• Level to undulating slope • Generally agricultural, some are residential areas • Faunal abundance and diversity are low • Some mangroves along riparian zone • No physical cultural heritage site along the alignment • Corregidor Island • Volcanic island with thick vegetation of mixed forest and grassland; • Avian species abundance is low • Protected site as national shrine but not part of ENIPAS
Land - Sensitive Areas and Species	• No protected area within Bataan and Cavite side of the alignment; • Eight(8)endangered species may possibly be within Bataan and Cavite although both have marginal habitat

	• Presence of Java Sparrow (Lonchura oryzivora) in Cavite and Burmese Redwood (Pterocarpus indicus); • Critical habitat is not within the alignment.
Water - Bataan	• Stream ecology survey indicate moderate degradation due to anthropogenic activities; • Rivers within the alignment are MODIFIED habitat as per IFC classification guidelines; • Nutrification of marine waters; • Presence of cyanide in marine waters beyond the allowable limit • Coral reef habitat at the mouth of Manila Bay but in poor condition; • Reef fish abundance, diversity and biomass are low; • Potential presence of marine mammals, sharks, rays and other cartilaginous fish; • Presence of nesting sites for marine turtles but outside project area
Water - Cavite	• Rivers are estuarine with substantial water quality degradation and classified as Modified Habitat as per IFC classification guidelines; • Nutrification of marine waters; • Presence of cyanide in marine waters beyond the allowable limit • Coral reef habitat at the mouth of Manila Bay but in poor condition; • Reef fish abundance, diversity and biomass are low; • Potential presence of marine mammals, sharks, rays and other cartilaginous fish; • Presence of nesting sites for marine turtles but outside the project area; • Will cross part of the Corregidor Island Marine Park and the Naic Fish Sanctuary
Air	• Type 1 under Modified Coronas Classification System, wet from May to September, and dry from October to April; • Typhoon of around 27 for Bataan and 26 for Cavite; • Typhoon free from January to March • Potential temperature increase • Baseline results do not indicate heavily degraded airshed, based on ground level measurement; • Exceeded national allowable limits, caused by vehicles, motorized equipment
People	**Bataan** • Lively economy with presence of the Freeport Area of Bataan and other industries; • Fishery and agriculture is a minor economic contributor • Cavite

	• Main economic drivers are agriculture, fishing, and aquaculture; • Growing industrial sector **Cavite** • Main economic drivers are agriculture, fishing, and aquaculture; • Growing industrial sector

5 OPEN FORUM

After the presentation of the Environmental Impact Assessment conducted by Mr. Ian Borja (EIA Preparer), the open forum was formally opened by Mr. Frederick Esternon. The audience was advised to identify their agency before asking their questions or proving insights about the Bataan-Cavite Interlink Bridge (BCIB). Engagements are narrated in the points below:

5.1 Cavite

The open forum in Cavite commenced through the series of inquiries given by RD Noel Lacadin, a licensed geologist and OIC of MGB DENR Region 3. The table below shows the other concerns/topics being raised during the open forum.

QUESTIONS/ CONCERNS	RESPONSE/ ACTION POINT
Since there will be multiple use of the area with activities from DPWH and PRA (seabed quarry project), how will the maneuvering of boats in the area be managed during construction? Also, did BCIB consider the other projects in the area to avoid the overlapping of the projects? ***- Ms. Annabelle Cayabyab, PENRO Head*** ***Ms. Cayabyab requested*** that Since there are potential conflict due to multiple users in the area, all issues and agreements must be settled at the national level so that it will not become a burden for the local government unit agencies.	***Mr. Frederick Esternon*** responded that the construction is a progressive activity and there will be a construction plan. On the second question, he mentioned that the Manila Bay Masterplan has already considered BCIB in its list of projects and some quarry projects. He shared that in the meeting with the EMB prior to the ECC issuance, the integrity of the viaduct was discussed, and a buffer zone was declared from the center line, set at one (1) kilometer on each side. Given this, other activities should not enter the buffer zone of BCIB to ensure the integrity of the bridge. He added that on maneuvering of boats, both parties will have their own multipartite monitoring teams (MMT) to look at the activities in the area. ***Mr. Norberto of MGB*** added that the exploration permits in the area (SUBS) are coordinated with (GSQP) government seabed quarry permit areas which covers around 5,000 HA. He also added that MGB will revisit the Manila Bay Masterplan. ***Engr. Bautista of the DPWH*** agreed to have an inter-agency meeting to settle the issues. ***Mr. Esternon*** noted that the issue on multiple use conflict must also be included in the letter to the EMB when further discussions are done.
Ms. Cayabyab shared that there is a marine protected area network (MPAN) in the Corregidor area which is a "no touch zone". She asked if there is a declared buffer zone in the no-touch zone.	***Mr. Esternon*** commented that the concern is a valid point considering that MPAN is a critical habitat. He responded that the concern can be further discussed in Biodiversity Action Plan with the PENRO DENR.
Ms. Cayabyab further asked when the last public consultation on the land acquisition is conducted because there	***Ms. Sol Abasa*** responded that during the feasibility study, stakeholder consultations and IEC meeting were conducted on these dates: (1) Consultation with landowners last October

seemed to be a lot of questions being raised regarding the acquisition process.	2021 and March 17, 2022; (2) consultation meeting with non-land owners last January and April 2023. She further explained that there will be more meetings to be conducted with the affected persons. ***Engr. Bautista*** supported that DPWH is still waiting for the results of the valuation of the affected properties by the Landbank of the Philippines, the GFI engaged by DPWH. After valuation, a notice of taking will be sent out to all Aps tentatively scheduled on the 4th quarter of 2023.
After the explanation of the LARP issues, ***Ms. Cayabyab of PENRO*** once again reminded the group on the possibility of the expansion and the overlapping of issues. She stated that in the creation of the MMT, the provincial will be on both, and will work on how to resolve the issues, with CONOs and NTPs, but even as both projects have an ECC, this is just a planning tool and not a permit. Therefore, she suggested that DPWH and DENR should discuss these matters.	***Mr. Esternon*** acknowledged this suggestion and expressed his agreement to Ms. Cayabyab's recommendation.
Naic Councilor, Atty. Magay inquired on the dredging projects that are existing within the area other than the BCIB, He said approximately 10 coastal barangays are reported to be affected. He asked how these would impact the community, particularly the fisher folks. He notes that dredging affects the coastal areas, and while their municipality exerted programs on the protection of the marine area and its resources, dredging was still allowed. He asked how these improvements will be able to be balanced moving forward.	***Mr. Esternon*** answered that these fish sanctuaries were considered during the studies. During the feasibility study (FS), MENRO was present during the consultation meeting, and it was mentioned that considering the distance, it will not be affected. During the DED discussions, there had been several sessions to discuss these critical habitats – two during feasibility and two for the DED community consultation with Semion Stairs. Both meetings were attended by MENRO. Ms. Cayabyab was present during the other one meeting in the province. It was agreed that these fish sanctuaries will not be affected and will remain untouched.
Ms. Cayabyab suggested to show the proposed map of the project to show the included areas.	***MGB*** gave their response on the issue of the dredging activities: MGB agreed to take note of the limitations set by the Masterplan and consider these in the approval of dredging projects. MGB acknowledged that these activities can impact the livelihood of the people and the fisher folks.

Ms. Cayabyab added that the MMT and MRRFC are formed when the project is approved. A LONO is secured from all impacted areas and said that because the project has made progress already, it means that all areas have issued a LONO.	***MGB*** mentioned that the PRA is now suspended except for San Miguel because these are brought to the Bulacan airport, a priority project. During implementation, there is a program for grievances on livelihood and they will conduct verification in the area who may be affected. All the list of grievances is also there. They also reminded that for BCIB, if there are explorations the proponents must secure the necessary permits.
Atty. Magay asked and reminded about the workforce to be hired for BCIB. The Naic councilor emphasized that 75% of the workforce should be from Naic.	***Mr. Esternon*** confirmed that the residents and fisherfolks of Naic, Cavite will be given priority during hiring provided that their skills are aligned in the required job and available locally.
On land acquisition, ***Atty. Magay*** said that the municipality of NAIC was not duly included in the consultations or were not provided the necessary information therefore there is a lot of question from people and there is no peace of mind for the residents. As local leaders of the community, as this was not shared with them, they are unable to explain these to the people. As an example, he cited properties located along the Baybay dagat where there are no titles. He then asked, how do we guarantee them on receiving proper and fair compensation and when will they receive this. There is no clarity on the issue on the acquisition of the lands. He also asked where the local government intend to put the affected people? Is it on developments under NHA or in private subdivisions? It should be based on the adequate valuation of their properties.	***Ms. Cayabyab*** responded to this by saying that there are ongoing discussions with UP on the coastal areas study. Furthermore, to clarify sandbar structures, there is a need to have clarity on whether a structure is along the legal easement or in a replenishment area. She explained that coastal areas can replenish land, so if the residential structure is on the replenishment area, it will most likely be removed as well. ***Mr. Fred Esternon*** added that everyone can go back to the Manila Bay study and reflect on what was considered in the Mandamus study of the Manila Bay. ***Ms. Cayabyab*** reminded everyone that the BCIB is a national project and has national approval. ***Engr. Bautista of DPWH*** said that there is already ongoing discussion between DPWH and DENR's EMB and MGB on these matters.
Which office do people coordinate with to determine the status of their affected properties, and when the meeting on the directly impacted people? **- Atty. Magay, Naic Councilor**	**Engr. Bautista** responded that currently, Landbank is doing the valuation. Once this is completed, they will provide this to DPWH and then the Notice of dating from DPWH will be sent to affected landowner. After the landowners receive these, the affected landowner will be needing to submit the requirements. The Letter offer (with the price) will be provided to landowners with complete requirements. He also added that the validation of structures was completed by DPWH already.
Where in Timalan Concepcion and Arsenio Highway the bridge is most likely to pass through? There is a fiber	***Mr. Esternon*** addressed the query by sharing that the documents are being collected before the overlay. These are all being considered. Tradeoffs may happen but these will be considered.

optic line in the area, was this considered for Timalan Concepcion? **- Resident of Naic, Cavite** **Another resident, Narcisa Mariano** asked about the impact of BCIB when the posts are constructed in Timalan Balsahan, saying that 140 residents, mostly fisher folks will be affected.	 ***Mr. Borja*** explained further that while fishing may be controlled temporarily for safety purposes, this will not be on the long term. Furthermore, he said that the structures will serve as substrate for corals and can help propagate the fishes in the area. He added that there were already measures included to address the siltation in the area as well.
Narcisa Mariano also asked on the process of land acquisition and if these could be explained to them. And what will happen if the houses are located on legal easements.	***Ms. Sol Abasa of TYLin*** explained the process below: 1. Land acquisition resettlement plan is based on the resettlement policies and principles of ADB and DPWH. 2. All affected lands, structures, and trees will be duly compensated. 3. A Municipal Resettlement Implementation Committee (MRIC) was created to assist the DPWH in the implementation of the LARP specifically on the payment of affected properties and addressing complaints and grievances related to LARP. 4. A MOA between the DPWH and NHA for the resettlement of 72 informal settlers' families. These 72 ISFs will still be validated by NHA and the LGU of Naic. 5. Aside from compensation of their affected properties, APs will also receive other entitlements (e.g., income loss, inconvenience allowance). 6. If structures are located on legal easements: the AP will only be paid for the affected structures. 7. Only those identified during the cut-off date (during the DMS and SES surveys) will be the only ones who will receive compensation.
A ***representative of the fisher folks*** mentioned that the GSQP affects them. He explained that during earlier discussions, it was mentioned that they would be temporarily prohibited from fishing in some areas, and this would impact their livelihood. He inquired if the fisher folks would be considered for employment to ensure their livelihoods. He also asked how long the construction will take and when it will commence.	***Mr. Esternon*** explained that during construction, the construction areas (by phase in progressive activities) will be blocked off, but there will be areas identified as docking areas for fishing vessels. He responded that these are temporary areas and confirmed that the fisher folks from Naic will be considered for employment opportunities. ***Engr. Bautista*** shared that on construction schedule, BCIB is expected to start by the fourth quarter of this year or Q1 of 2024. BCIB is expected to be finished after six years.
A ***resident*** how will the project address the flooding in the area.	***Mr. Esternon*** explained that since flooding was raised in earlier meetings, there was a decision to elevate the structure

	post to minimize impact. The cloverleaf area of the alignment in the Cavite side will be elevated.
A ***resident*** shared that there have been a road widening in the area and further asked how this will be pursued for the other areas that will be impacted by BCIB.	***Engr. Bautista*** and ***Engr. Juria*** explained that there will be road widening. From the centerline, there will be 570 meters on road widening to expand the four lanes on the existing road near Tanza Oasis.
Ms. Cayabyab of PENRO said that for the EIA, while there is an approved ECC, there seems to be needed clarifications since there will be changes from embankment to elevated viaduct will be applied. She asked if the LGU is aware of these changes during the last consultation. ***Ms. Cayabyab*** also asked DPWH if the overlap with CALAX have been considered.	***Mr. Esternon*** responded that the resolution is actually in compliance to the request of LGU to address the flooding concern. Mayor and various heads of departments were present, including MENRO during the meeting. ***Engr. Bautista of DPWH*** confirmed that these have been considered already for the CALAX and has been coordinated with DPWH Region 4A.
Ms. Eva Pangilinan of MENRO asked how the management of the increase in waste generation and additional people/workers will, which will be incurred during construction be done since it will take six years to construct the BCIB.	***Mr. Esternon*** answered that these will be addressed, and it is part of the terms and conditions of the approved ECC. He shared that it is possible that during operations, penalties, monitoring measures, etc. on solid waste management will be imposed.

5.2 Bataan

The open forum in Bataan is started by the query asked Ms. Annabelle Cayabyab, Cavite PENRO Head. The table below shows the other concerns/topics being raised during the open forum.

QUESTIONS/ CONCERNS	RESPONSE/ ACTION POINT
As there is already an ECC, this is more of a post-mortem analysis. Since this project involves two regions connected, there seems to be no mention of the submission of an Engineering, Geological and Geohazards Assessment Report (EGGAR) which is required by DENR DAO 2000-20. Perhaps this can be submitted post-condition. We know that an ECC studies the effect of the project to the environment, but an EGGAR provides the effect of the environment on the project such as tidal waves, tsunamis, earthquakes, or storm surges. How does their ground acceleration on bedrock, soft soil, and hard soil, impact the bridge	***Mr. Frederick Esternon*** responded that the ECC was secured from the Central Office because there are two regions – 4A and Region 3 and this is considered a big-ticket project. He emphasized that they had the EGGAR covered, with the technical hearing and technical scoping completed.

and see how the bridge can withstand these natural hazards. Perhaps you can consider the EGGAR report findings in your DED. ***- RD Noel Lacadin, licensed geologist and OIC of MGB DENR Region 3***	
RD Lacadin requested the copy of the said document and asked if they can superimpose the flight path particularly the approach of the aircraft to make sure that this does not hit the highest point of the BCIB. He shared that CAAP has this approach angle, and this should be considered in the design.	***Mr. Esternon,*** in coordination with DPWH, to provide the agencies of Bataan the copy of the requested document. Regarding RD Lacadin's query, he responded that the project has long been part of the development in the area and CAAP has already issued BCIB with the permit. ***Engr. Bautista of DPWH*** also added that the CAAP permit they secured is renewable.
RD Lacadin provided additional suggestions and questions. He proposed to have the synergistic path, to make sure that it does not cross the bridge. If possible, he suggested to put this in a map as reference. If it is too late, he recommended put lights on top of the [highest points] bridge to warn aircraft. On matters of cultural heritage on the design, RD Lacadin raised a concern on Mariveles as a Km 0 of the Death March, and asked for verification if BCIB will touch on some of the Death March routes. RD Lacadin also inquired on the impact of the bridge on the tidal and wave circulation system. He asked if the bridge would cause or heighten the possibility of collisions between boats and what are the measures being made on the traffic flow for the bridges since there are cargo ships that pass through this route. Also, considering the vessel collision incident in Bataan shore last April 2023, he asked how much damage the BCIB can sustain or how the scenarios such as collisions, oil spills, fire from the oil spill begins can affect the bridge integrity.	***Mr. Esternon*** acknowledged the suggestions of RD Lacadin regarding the synergistic path. With RD Lacadin's series of questions, he responded that the BCIB is designed with a north and south channel providing a designated routes for the boats. Safe passage has been considered in the DED. Tidal wave was also considered before the FS. All agencies were coordinated. He added that the DPWH Central Office's review committee was very strict from the onset that it took some time for the review to be completed. Further to this, there had been dredging projects that came in which was actually raised as an item of concern since the dredging may actually impact the integrity of the foundation. To address this, he shared that the consultant coordinated with the Central Office to regulate the buffer zones from the centerline at one-kilometer for both sides. This is to help keep the integrity of the foundation. Discussions are also ongoing with the other agencies, particularly with MGB, EMB and DPWH to address these issues and ensure the integrity of the alignment. ***Mr. Ian Borja*** supported that regarding all the natural hazards that may impact the bridge, the consultants have been thoroughly researched and considered it for both Cavite and Bataan. Mr. Borja added that the effect of sea level rise and other climate change impacts have been done. A report has been prepared separately and was reviewed by PEC, a South Korean consultant. The Climate Change Report is part of the requirement by the Asian Development Bank (ADB).

	Engr. Bautista also shared that have already coordinated with CAAP on the construction of the Bulacan airport and a CAAP height clearance permit was released for BCIB last May 2023 that is valid until 2025. This is renewable every two years.
RD Lacadin commented that the one-kilometer buffer zone is mandated by law. What the agency (DENR Region 3) has been waiting for is the official alignment, duly signed by the geodetic engineer which will serve as their basis in their control maps and ROWD buffer zones so that they will no longer accept seabed quarry applications. He added that the sea, being a mineral reservation area means that if there is a no-extraction zone issued, it is already considered a buffer zone. He also clarified that dredging and quarrying are different. For now, the only dredging project is the one in Limay, but there are several applications. What will be done is to have a buffer zone for the project. For dredging, this is under DPWH and not DENR.	***Mr. Esternon*** responded that it was good for this to be raised in the forum again because it was being discussed with MGB the day prior that there should be a limit to the entry of seabed quarries or dredging in the area in consideration of the Mandamus or the Manila Bay Masterplan. According to Mr. Esternon, the Masterplan considers the BCIB and two other projects and therefore these should be limited to these number only to ensure the integrity of the projects. It was requested that MGB, EMB and PRA should limit the projects based on the masterplan.
Mr. Ralph de Leon, OIC of PG-ENRO of Bataan commented that in the presentation of the EIA preparer, the mitigating measures were not duly presented. He said that this could have helped in clarifying doubts that are in the minds of the public present in the consultation. The mitigating measures can help them understand the impact of negative issues and the mitigating measures that can be taken, and for a better understanding on how the positive measures can be maximized.	***Mr. Esternon*** said that the mitigating measures will be presented later. He explained that this is the fourth public hearing conducted for the project in Bataan. Some of these mitigating measures was discussed by Mr. Ian Borja directly with Mr. De Leon during the open forum.
Renato Castro of Mariveles, a representative of the fisher folks asked how the construction of the BCIB will impact the fisher folks. ***Mr. Soterdo, a councilor from Mountainview*** raised that as there had been numerous	***Mr. Borja*** explained that one impact is on the available docking areas for the fishing boats because this may be restricted when construction happens. There will be signage provided that to mark the no entry areas, but this is mostly for safety purposes. But these will be done in portions and that construction will be progressive. The same restricted area will apply for fishing activities to ensure the safety of the fishermen, but this is only temporary and will be by done by portions. ***Mr. Esternon*** added that this is why livelihood alternatives are being considered for the affected fisher folks.

discussions on fishing areas being restricted for safety reasons, the limitation of fishing sites can deeply impact the fisherman's income. He said that Mountain View barangays will be heavily affected, and asked what will be done for those people who cannot migrate or leave the area. He said that past discussions mentioned promises that fishermen and their families will be prioritized for work, he clarified on how it will be done.	***Mr. Esternon*** confirmed that around 60% or 75% will be for local hiring and this is also part of the conditions of the ECC, but these will be based on the available skills. Highly skilled individuals are pre-identified by the consultant to allocate the positions that are needed by the project. ***LGU Mariveles*** clarified that the ratio is at 70/30, and it is based on available skills. If there are none available, people from outside can be hired for these. But people from Mariveles will be prioritized. ***Mr. Borja*** reiterated that based on prioritization, the construction of the alignment is divided in seven sections, so for the Mariveles side, the priority will be to hire affected people from Mariveles. In some projects, there is prioritization based on hiring locations. First level is to hire from the host barangay, then host municipality, before it goes to the host province. This where the 70% comes from, but it depends on the LGU on how they want to conduct the hiring process. Regarding the development aid, there are programs, but they are not yet final. These items will be discussed further but rest assured that the community will once again be consulted on the trainings and livelihood programs once this is initiated. ***Mr. Esternon*** explained that these can be seen in the people portion of the study.
Ms Minerva J. Martinez, CDD Chief of DENR Region 3, then shared an input to the study. She said that they believe and expect that the study was thoroughly coordinated with the DENR local office because based on the presentation a while ago, though there are indications of low biodiversity in the area, one important concern for the regional office is the presence of nesting sites for turtles which are present in the area. It might be good to plot them in the map where the corals are, and the nesting sites so that it can be compared with what the agencies have. So that in the manner of implementing the mitigating measures, what was recommended through the EIA process can be implemented. In any recommendation that the committee provided in the study there are action plans that need to be prepared for these affected areas as there are also interventions being done to protect the biodiversity. Despite this being a priority project of the national government, the efforts of the	***Mr. Esternon*** acknowledged the inputs and explained that this is one of the primary tasks of the Multipartite Monitoring Team (MMT), which is the mapping. He stressed the need to update these maps and consolidate the maps during FS and DED. He mentioned that the local agency will most likely be part of the MMT. ***Mr. Borja*** added that the nesting sites have been considered. The information came from the LGU. The marine team are closely working with the specialist from UPLB and those working on the Manila Bay Rehabilitation program since 2019 up to present time. He explained that this may have not been thoroughly explained to Ms. Minerva when they came to visit. The low biodiversity is for the forest side. The marine has a separate one. There will also be a biodiversity action plan drafted as part of the requirement of ADB.

DENR should also be given priority so it is encouraged for the proponents to work with them closely on what should be done if ever there are poor conditions for marine resources in the area.	
Brgy. Capt Al Balan of Brgy. Alion asked on where the BCIB will exactly end in Mariveles, specifically on which *sitio*.	***Mr. Esternon*** said that the map will be projected to show the audience on where the specific area will be. ***Engr. Erica Juria of TY Lin International*** explained the map mentioning that the design is a trumpet interchange and the alignment to the shoreline shows that the distance of the alignment from God's Speed is about 662 meters.
Ralph C. De Leon, OIC-PGENRO asked if there was a dispersion modeling on the emissions (air and noise). The additional pollution load with respect to prevailing wind direction during construction or when operations begin given the additional traffic. Mariveles as an industrial area, residents suffering from the emissions from industries. Habagat season may affect other areas.	***Mr. Borja*** responded by explaining that there is none at the moment but there are available estimates on vehicle volume. He also stated that the EIA document is available on the ADB website.
Engr. Carlos dela Fuente, PEO-Bataan asked regarding the preliminary studies on the annual daily traffic, how much volume on traffic will be added from the bridge and what will be its impact on air quality? Will residents near the highway be affected more?	***Engr. Juria*** later showed the presentation mentioned that showed traffic projections until 2050, explaining that 2030 served as the baseline volume. Mitigation measures on traffic management are being discussed. Projections were shown with 2030 as the baseline volume. She also shared that there are mitigation measures being made on traffic management.
Engr. Butch Baluyot from the Provincial Planning and Desk Officer – Bataan asked on the proposed remedial measures to prevent overloading. He shared that at this time, they have no way of determining weight load of vehicles that are passing through roads. If the vehicles are overloaded, this may cause damage. He queried on how these can be addressed for the project.	***Engr. Bautista*** assured them that this is considered in the project. ***Mr. Borja*** added that a weighbridge is part of the design as there were discussions before on the location. The exact site of the weighbridge will be confirmed.
Ms Zenaida M. Manansala, President of the Association of Maharlika, Matiyagang Magsasaka, asked about the conditions of informal settlers in the affected areas.	***Mr. Esternon*** explained that the question will be included in the LARP, but explained that for informal settlers, they will be compensated only for their structures. Because there is no basis for zonal valuation in the absence of a legal land title. Mr. Esternon reiterated that only those who have been mapped already are considered. ***Mayor Jello Ace Concepcion*** explained that the tally has been conducted already and those who

	have been tagged are the only ones who will be considered and duly compensated. ***Mr. Esternon*** explained that the compensation data and information will be only come from the LARP team and be discussed further in a separate consultation.
Mr. Vonnel A. Isip, SB Member of Mariveles asked if the existing CAAP permit also considers the flight path from the Sangley airport that is being constructed in Cavite.	***Mr. Esternon*** explained that these have been considered in the CAAP height permit, with CAAP being a national agency and given the plans of the BCIB.
Mr. Noel Dominguez of DENR, PENRO Bataan asked if the project study includes the volume of quarry materials needed for the project? Is there an estimate, for land-based and water-based sources? ***Mr. Dominguez*** asked on specific volume and source. Will the materials be outsourced or will be locally within Bataan?	***Mr. Borja*** explained that on the source of material, there are 7 stages so there is a possibility of having 7 contractors. All contractors will be required to have a CEMP and part of this should indicate that the quarry site where the materials will be sourced should have a permit. The disposal sites or landfill should also have the appropriate permits. For ADB and DPWH, these will be required from the contract. The LGU should be vigilant as well in monitoring. Permits should come from MGB provincial or municipal depending on the volume. ***Ms. Sol Abasa of TYLin*** explained that the Detailed Engineering Design considers the volume of quarry materials for the project. During construction, the contractors are required to submit the Contractors Environmental Management Plan (CEMP), and all quarry sites must have permits. For disposal of waste or excess materials, it also requires permitting. Any violations can be reported to the Grievance Redress Mechanism. ***Mr. Esternon*** explained that each contractor will also have different ECC used depending on the area. ***Ms. Abasa*** explained that the Contractor's Environment Management Plan (CEMP) will be submitted by the contractor. This will only be done when a contractor has already been chosen for the project. For now, there is no CEMP yet.
Ms. Clarissa Villanueva of MGB Region 3 asked if the EGGAR and the EIA was independently prepared considering that the accountabilities are different. She then inquired if these studies are published.	***Mr. Borja*** explained that the EGGAR was independently prepared by a consultant from South Korea. The EIA publication is with the ADB. For natural hazards, such as earthquake, tsunami, extreme weather, these are included in the EIA. The sea level rise on climate change study is also included in the studies.

	Engr Grace Butol of the DPWH added that at the present time, the DPWH has yet to submit the EGGAR. They have preliminary studies but there is a need to conduct clearance with MGB. In the near future, the DPWH will submit a request to MGB to assist the proponent in conducting a geological survey so that they can prepare the EGGAR.
Mr. Noel Dominguez asked again if there is an existing study on the water source for construction.	***Ms. Abasa*** reiterated that these will be part of the Contractor's Environmental Management Plan. ***Engr. Juria*** explained that there is a material sources program that was conducted to determine the sourcing of the aggregates and other construction materials that will be used in the project. While this is not final, the study identifies that there are enough and available sources of the materials needed for the construction of the BCIB.
Mr. Climaco Jurado Jr. of PEMO Bataan, DENR Region 3 asked for a discussion on the ECC amendment.	***Mr. Esternon*** explained that the consultants are conducting an ECC amendment because of the request on the Cavite side to elevate the clover highway because of the flooding and this may consider as part of the mitigating measure. He emphasized that as part of the process, any minor changes on the design requires an ECC amendment. Based on the central office, the changes are considered as minor amendment. Mr. Esternon confirmed that this is part of the amendment but shows that consultations such as the one being conducted are indeed being considered in the DED.
Mr. Ralph De Leon raised once again the Pawikan nesting sites outside the project area that can still be affected by the project especially when it is already operational. He stated that bright lights can attract other nesters and suggested to consider low intensity light to prevent pawikan's disturbance. He also proposed for their agency work closely with BCIB to ensure that these do not result to damaging the nesting sites and reduce the number of Pawikans.	***Mr. Esternon*** encouraged sharing with the consultant these information/ data and the time schedule on when the nesting period happens so that the light on the bridges can be designed to adapt these inputs. ***Ms. Abasa*** mentioned as well that this information can also be included it in the drafted biodiversity management plan.
Ms. Ma Concepcion Chua, Brgy. Secretary of the host barangay, Brgy Alas-asin requested for support on the expected traffic for their barangay when the bridge construction and operation begin. She also mentioned that earlier discussions promised an emergency clinic in the area as it is prone to accidents.	***Mr. Esternon*** explained that one of the supports that the government will provide is the road widening. ***Engr. Bautista*** also assured them that they will ensure that the contractor will implement a strict safety monitoring.

Engr. Dela Fuente advised that the installation of warning signages has been drafted in their ordinance and the implementing rules and regulations (IRR) is currently being drafted. He also asked if the proponent would consider having a weighing scale for trucks in the entry point of BCIB in Brgy. Alas-asin.	***Engr. Bautista*** also shared that the Contractors will be required to have CEMP with high safety consciousness level and considerations, including traffic management. He also said that they will consider load monitoring by including a weigh bridge in the area in compliance with the anti-overloading law. ***Mr. Borja*** supported that the design of BCIB already considered a weigh bridge.

6 KEY MESSAGES

In the public consultation held at Mariveles, Bataan last September 1, 2023, some municipal and district leaders have participated in the event. One of the attendees of the event is **Congresswoman Gila Garcia** of **Bataan 3rd District**. Cong. Garcia was asked to deliver her key message for the people participated in the consultation. The information below presents the details of her meaningful speech.

Congresswoman Garcia started her message by highlighting the importance of the BCIB project. She said that the project is massive on its own and proves to be very important as it connects two regions that cannot be traversed easily. The bridge represents the connection of Bataan to the outside world.

She reiterated the importance of the public consultation and expressed her gratitude to the consultants and DPWH for undertaking a very transparent and open discussion for everyone to ensure that everything is ironed out even as early as the planning stage. According to her, it is very important to look at the project's impact in people's lives at present time and in the next generation.

Other than people's daily lives, she stressed the importance of looking at people's livelihood. She shared that the purpose of the consultation is to know the issues of people and how these issues can be prevented or resolved. Congresswoman Garcia emphasized that this enables them, the government rather, to plan well so that all concerns be addressed and the solutions that are already available can be utilized. She reminded everyone that in any development, there are positive and negative impacts, and people must decide altogether in weighing the benefit versus the challenges, and if the mitigation measures on the negative impacts are worth pursuing through an agreed process.

"This is why I am grateful for everyone who gave their suggestions and inputs and asked questions because we want things to be better," she said, "We heard how the BCIB can connect Region 4A and Region 3. Bataan is no longer a dead-end and a destination that is only visited for purposes of tourism or business or work. The BCIB opens a gateway to the province."

The Congresswoman expressed that it is good that the concerns are raised to allow all of stakeholders to prepare for the upcoming operations of the BCIB. However, she reminded that while all questions were directed to the consultant and DPWH, and can address them, most of the answers to these questions rely on the community themselves. There is a need to collaborate and work together to reap the benefits of this project.

In conclusion, Cong. Garcia gave her assurance that the local leaders will support and work with the local agencies, the communities, the residents, and all involved parties until everyone see the fruition of BCIB. She said that their intent in doing is to see the progress in Bataan. She emphasized the importance of teamwork/coordination by saying that if people and the government do this together with all their minds and hearts, the people and even the future generations can truly benefit from the opportunities that this project brings to Mariveles province and to the Philippines as a whole. She enjoins everyone to continue to work with each other to make this project a success and to maximize the investment of the national government.

7 SALIENT POINTS AND COMMITMENTS

The forum ended and the program proceeded to photo session and discussion of the salient points that the consultants gathered from the forum. The discussion also involves commitments of DPWH to address the various concerns raised by the stakeholders during the public consultation.

A. Cavite

Mr. Ian Borja summarized the salient points and the commitments of the proponents from the open forum. The key points include:

- Ensuring the integrity of the bridge structure by strictly imposing the one-kilometer buffer zone from the centerline to protect the foundation from damages that can result from activities in the area such as dredging and traffic of cargo ships. As a prevented measure, the DPWH commits to discussing these matters on dredging and sea-bed quarries with MGB, EMB, and PRA and to advise the local agencies concerned and the LGUs on their agreements.
- The Marine Protected Area Network (MPAN) in the Corregidor Area was also raised by both the PENRO and the local government of Naic, raising concerns about the protected marine resources in the area and the efforts of both agencies to ensure that these are preserved and sustained over time. The proponents committed to include this in the discussion of the Biodiversity Action Plan with the PENRO DENR.
- The impact on the fish sanctuaries of the coastal area of Naic was also raised, including its protection during the construction phase and the extent of the impact that affects ten barangays where most of the fisherfolks come from. According to the local official, while there are local ordinances already issued on the matter, they expect these to be honored and that the affected fisherfolks' livelihood would be prioritized. The proponents committed to ensure that the progress of construction will be duly communicated to the fisherfolks in terms of their docking areas and allowable fishing areas. Those affected by the BCIB will also be prioritized in the hiring of the necessary manpower during the construction phase of the bridge for the Naic side.
- On the issues of flooding, the proponent conveyed the adaptation of the elevated structure posts in the design to minimize the impact of floods in the area.
- The proponents also mentioned that road widening will be implemented from Tanza Oasis moving forward to accommodate the traffic once the bridge operates.
- The creation of a Multipartite Monitoring Team (MMT) is also reiterated to ensure compliance and safety in the area moving forward.
- The issues on land acquisition were noted and will be considered in future discussions on LARP.

B. Bataan

Engr. Junnel Ray Bautista summarized the salient points and the commitments of the proponents from the open forum. The key points include:

- On the submission of the Engineering, Geological and Geohazards Assessment Report (EGGAR) for the project. DPWH is in the process of submitting one after conducting a geological survey to allow them to move forward with the EGGAR. DPWH has agreed to share this document with the local agencies and the LGU once completed. The EGGAR should cover studies on the ground acceleration, tsunami, tidal wave, and other natural hazards impact to the BCIB, integrity of the bridge foundation to withstand collisions and anthropogenic events in the area.
- DENR Region 3 also asked for a copy of the official alignment, duly signed by the geodetic engineer which will serve as their basis in their control maps and ROWD buffer zones so that they will no longer accept seabed quarry applications. It was requested that MGB, EMB and PRA should limit the projects based on the Manila Bay masterplan.
- For the affected fisher folks, it was reiterated that there will be clear signs placed to mark the no-entry fishing areas, to ensure their safety during constructions, and were assured that these will be progressive. At the same time, it was confirmed that as supported by the LGU, on the 70% of the needed manpower for the BCIB construction, priority will be given to the local community, the municipality, and the province according to the availability of the skilled workers.
- The proponents also committed to address the issues raised by DENR Region 3 on the presence of nesting sites for turtles that are present in the area. It was agreed that their locations, along with corals and other marine resources will be plotted in one map for easy comparison and reference. Interventions to protect the biodiversity will also be considered in the Biodiversity Action Plan which will include mitigating measures, including the schedules of nesting in the areas to consider the impact of light from the bridge to the pawikans and other marine resources in the area.
- It was also discussed to conduct a dispersion modeling on the emissions (air and noise). The additional pollution load with respect to prevailing wind direction during construction or when operations begin given the additional traffic in the area.
- Another agreement was the placement of a weighing scale for trucks that will traverse across the BCIB.
- Road widening will also be implemented to ease the already heavy traffic in the host community even pre-operations of the BCIB.
- It was also explained that to address the sourcing of construction materials, traffic management and safety prioritization, all contractors chosen by DPWH will be required to have a CEMP and part of this should indicate that the quarry site where the materials will be sourced should have a permit. The disposal sites or landfill should also have the appropriate permits.

8 CLOSING CEREMONY

To conclude the public consultations, closing remarks are given by the officials from the agencies that joined the event.

For Cavite, **Ms. Annabelle Cayabyab** of **PENRO Region 4A** delivered the closing remarks. She extended her gratitude to everyone who participated and raised their significant concerns for Cavite and the BCIB project itself. She assured the participants that the inquiries and concerns raised in the public consultation will be addressed in coordination with DPWH and the government. The program ended by 1:40 PM.

For Bataan, the closing remarks was delivered by **Ms. Minerva Martinez** of **DENR Region 3**. In her message, Ms. Martinez emphasized the message of Cong. Garcia that in any project undertaking, this public consultation has to happen. Each and everyone's comments and issues and recommendations are important and are duly noted. She stressed that this project is very important as it connects two provinces, and it opens Mariveles to the people. The program concluded by 11:30 AM.

9 PHOTOS

9.1 Cavite








9.2 Bataan

10 ANNEXES

ANNEX A: LIST OF PARTICIPANTS AND ATTENDANCE SHEETS

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of the Bataan-Cavite Interlink Bridge (BCIB) Project
Venue: Tanza Oasis Hotel and Resort, Tanza, Cavite
Date: August 31, 2023 (Thursday)

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Manila

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BATAAN-CAVITE INTERLINK BRIDGE PROJECT
Public Consultation Meeting for the Environmental Impact Assessment (EIA) of the Bataan-Cavite Interlink Bridge (BCIB) Project
Venue: Tanza Oasis Hotel and Resort, Tanza, Cavite
Date: August 31, 2023 (Thursday)

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Venue: The Oriental Bataan, Brgy. Malaya, Mariveles, Bataan
Date: September 1, 2023 (Friday)

CONSULTANT

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26	Sherwin CRUZ			L.G.U Mariveles			
27	RONALD ZILCENA			LGU MARIVELES			
28	Susan Murillo			LGU Mariveles			
29	Carmelita Adame			P.B.	09089595183		
30	JUN VILLAPANDO	-		LnB Pres.	09209482040		
31	NIDA VALDERRAMA		✓	BRGY. BASECO	09209090289		
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38	MARVIN G. SUSMEÑA			BIAAN - Secretary	09082872344		

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NGO ~~and~~, ACADEME, NGA

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11	MC JEFFERSON M. VALERIO	✓		PPDO - PDO IV			

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ANNEX B: PRESENTATION MATERIAL

BATAAN – CAVITE INTERLINK BRIDGE PROJECT

Presentation of the Results of Environmental Baseline Information and Impact Assessment

Tanza Oasis Hotel, Tanza, Cavite
31 August 2023

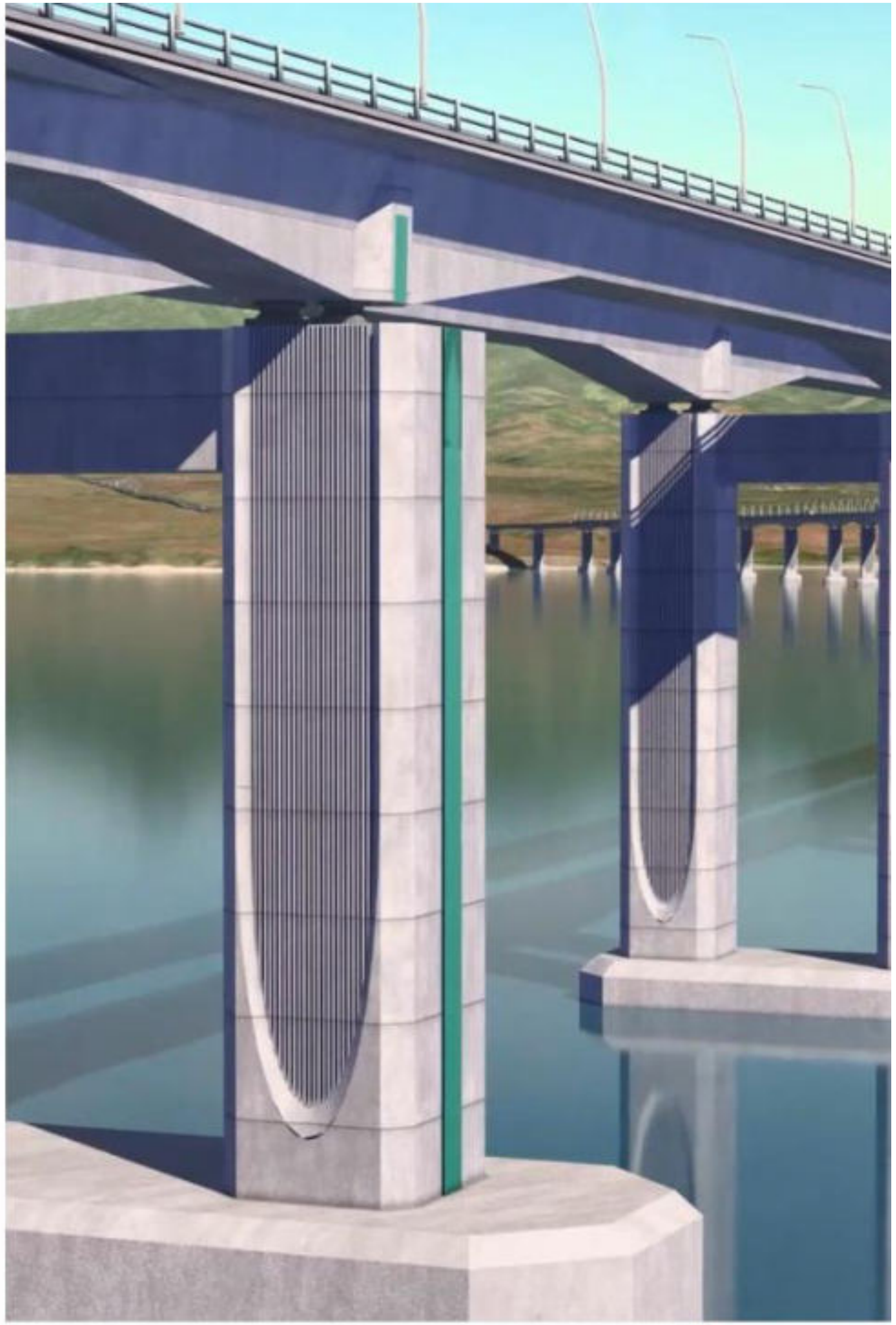
BATAAN – CAVITE INTERLINK BRIDGE PROJECT

Presentation of the Results of Environmental Baseline Information and Impact Assessment

The Oriental Bataan Convention Center, Mariveles, Bataan
01 September 2023

Outline of Presentation

- **Project Information**
- **Environmental Impact Assessment (EIA)**
  - Environmental Baseline Data Gathering
  - Baseline Environmental Conditions – Land / Water / Air / People
  - Environmental Impacts and Mitigation Measures
  - Environmental Monitoring Plan



Project Information

BATAAN-CAVITE INTERLINK BRIDGE

DED Funding Source
Asian Development Bank (ADB)
Implementing Agency
Department of Public Works and Highways (DPWH)
Detailed Engineering Design Consultant
TYLin PEC A JOINT VENTURE in association with Renardet S.A. and DCCD Engineering Corporation

BATAAN-CAVITE INTERLINK BRIDGE

Project Description:

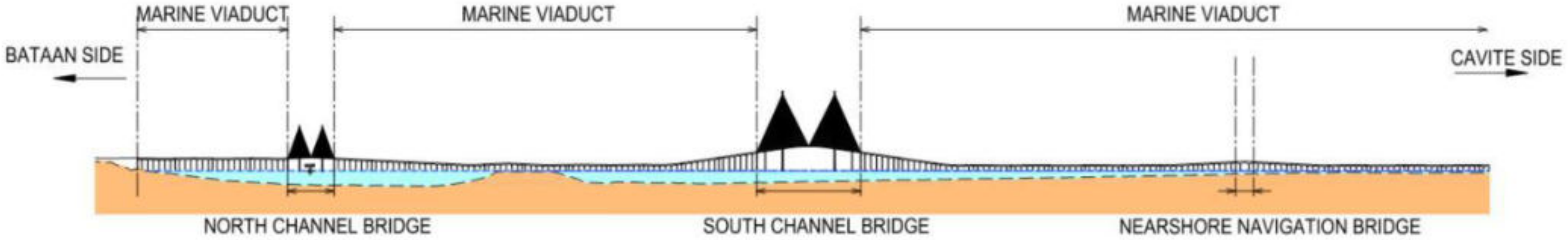
- 32.15 kms
- 4-lane (2 lanes each direction)
- Northern terminus:
  Brgy. Alas-asin, Mariveles, Bataan
- Southern Terminus:
  Brgy. Timalan, Naic, Cavite

Project Objective:

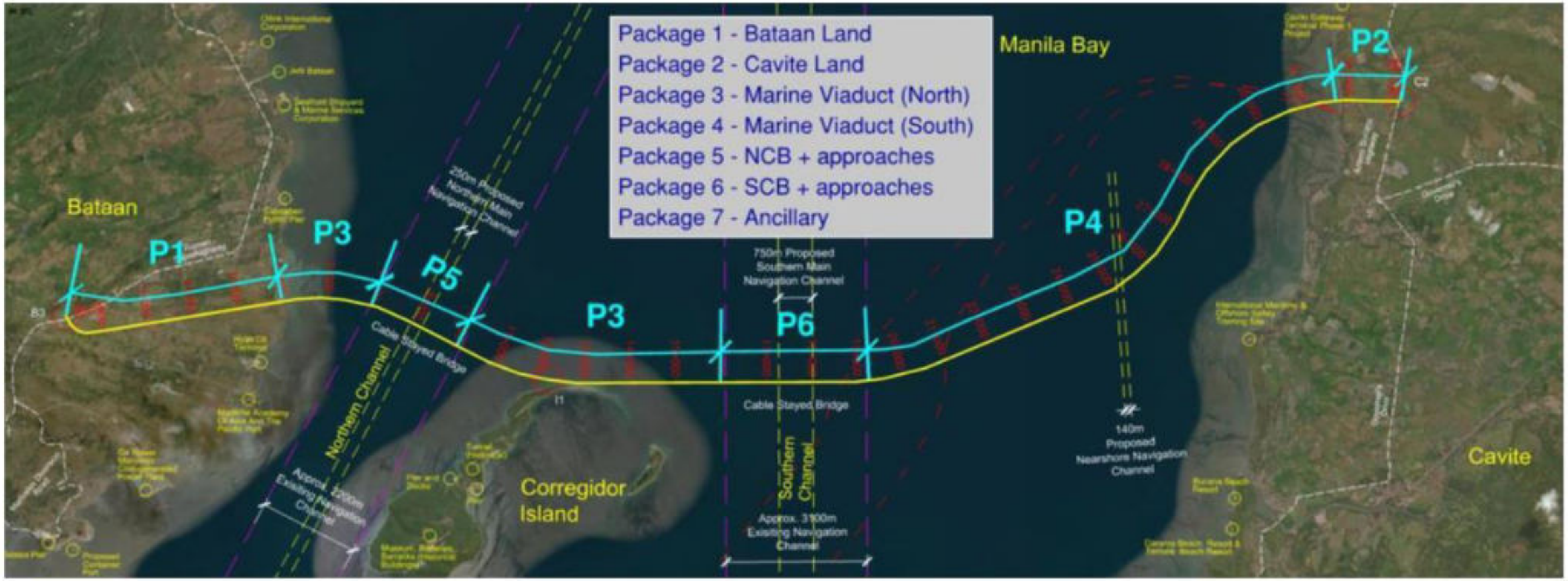
- provide permanent road linkage between Bataan and Cavite
- Aimed to reduce journey time and ease traffic congestion through Metro Manila and South Luzon and North Luzon gateway

GENERAL ALIGNMENT

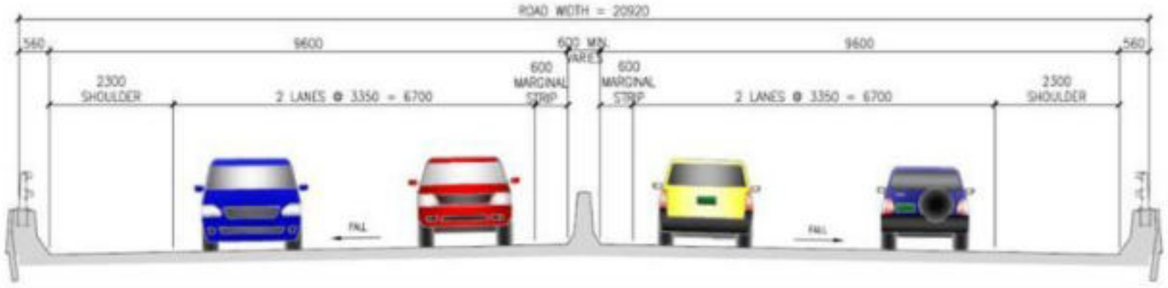
BCIB CROSS-SECTION



BCIB – SEVEN (7) SEPARATE PACKAGES



	FS Package Definition	Approx. Length (km)
Baatan Land Approach	P1	5.0
Cavite Land Approach	P2	1.3
Marine Viaduct (North)	P3	8.0
Marine Viaduct (South)	P4	12.6
North Navigation Channel Bridge + Approaches	P5	2.1
South Navigation Channel Bridge + Approaches	P6	3.1
Ancillary	P7	Projectwide



TYPICAL CROSS-SECTION

BCIB North Channel Crossing

BCIB South Channel Crossing

BCIB Marine Viaduct

View from Bataan Shore

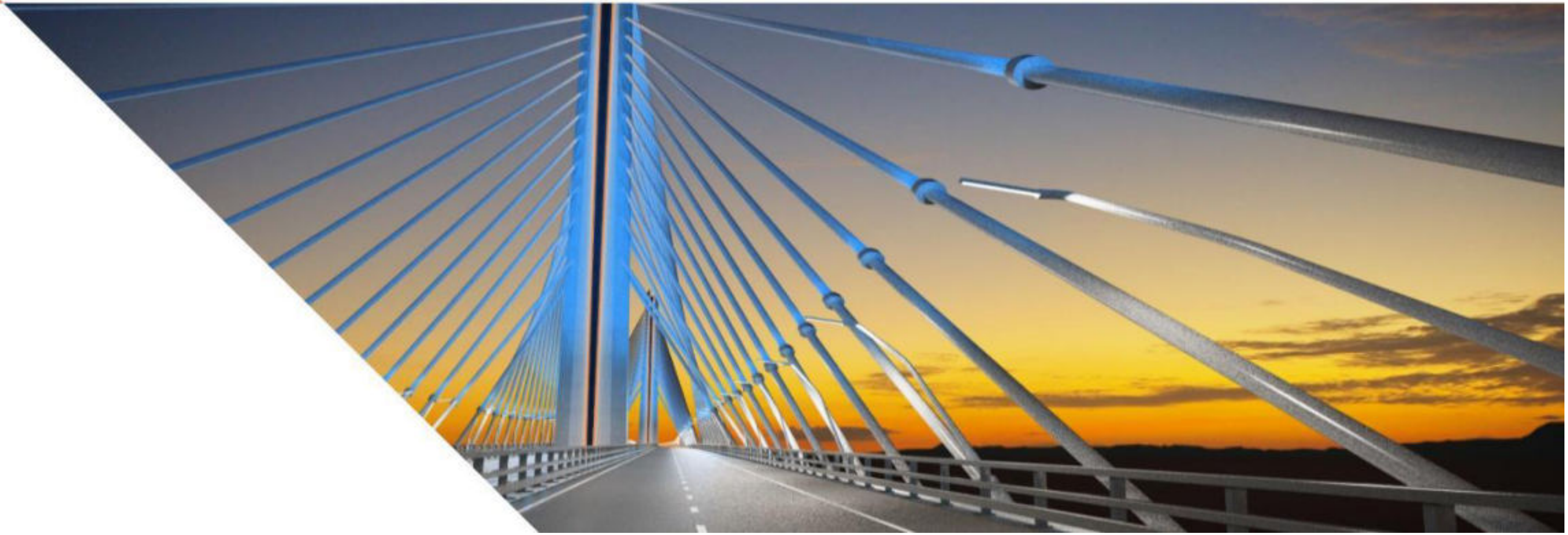
View from Cavite Shore

Artists' Renderings

Artists' Renderings

Artists’ Renderings

Environmental Impact Assessment (EIA)



Environmental Baseline Sampling

- **Environmental Baseline profiling in 2019**
  - Presented in EIS
  - Submitted as part of ECC application
  - ECC issued in April 2021

- **Additional Environmental Baseline profiling in 2021 and 2022**
  - Augment environmental baseline data from 2019
  - Included in EPRMP as part of ECC amendment application
  - Included in EIA submitted to ADB

Baseline Environmental Profile

Land
- Land Use
- Geology and Geomorphology
- Terrestrial Flora and Fauna

Water
- Freshwater
- Groundwater
- Marine Water
- Marine Ecology

Air
- Climatology
- Climate Change
- Air Quality
- Noise

People
- Demography
- Population
- Economy
- Education
- Various Services

Land – Bataan

- Moderately sloped landscaped about 0-25 masl
- Volcanic deposits including pyroclastic flows and ash deposits
- Grassland and scrubland, interspersed with riparian forest patches
- Native vegetation species, with mangroves along near mouths of rivers
- Low abundance of wildlife
- No physical cultural heritage site along the alignment

Land – Cavite

- **Naic**
  - Level to undulating slope
  - Generally agricultural, some are residential areas
  - Faunal abundance and diversity are low
  - Some mangroves along riparian zone
  - No physical cultural heritage site along the alignment

- **Corregidor Island**
  - Volcanic island with thick vegetation of mixed forest and grassland
  - Avian species abundance is low
  - Protected site as national shrine but not part of ENIPAS

Land – Sensitive Areas and Species

- No protected area within Bataan and Cavite side of the alignment
- Eight (8) endangered species may possibly be within Bataan and Cavite although both have marginal habitat
- Presence of Java Sparrow (Lonchura oryzivora) in Cavite and Burmese Redwood (Pterocarpus indicus)
- Critical habitat are not within the alignment

Water - Bataan

- Stream ecology survey indicate moderate degradation due to anthropogenic activities
- Rivers within the alignment are Modified habitat as per IFC classification guidelines
- Nutrification of marine waters
- Presence of cyanide in marine waters beyond the allowable limit
- Coral reef habitat at mouth of Manila Bay but in poor condition
- Reef fish abundance, diversity and biomass are low
- Potential presence of marine mammals, sharks, rays and other cartilaginous fish
- Presence of nesting sites for marine turtles but outside project area

Water - Cavite

- Rivers are estuarine with substantial water quality degradation and classified as Modified Habitat as per IFC classification guidelines
- Nutrification of marine waters
- Presence of cyanide in marine waters beyond the allowable limit
- Coral reef habitat at mouth of Manila Bay but in poor condition
- Reef fish abundance, diversity and biomass are low
- Potential presence of marine mammals, sharks, rays and other cartilaginous fish
- Presence of nesting sites for marine turtles but outside project area
- Will cross part of the Corregidor Island Marine Park and the Naic Fish Sanctuary

Air

- Type 1 under Modified Coronas Classification System, wet from May to September, and dry from October to April
- Typhoon of around 27 for Bataan and 26 for Cavite
- Typhoon free from January to March
- Potential temperature increase
- Baseline results do not indicate heavily degraded airshed, based on ground level measurement
- Exceeded national allowable limits, caused by vehicles, motorized equipment

People

- **Bataan**
  - Lively economy with presence of Freeport Area of Bataan and other industries
  - Fishery and agriculture is a minor economic contributor

- **Cavite**
  - Main economic drivers are agriculture, fishing and aquaculture
  - Growing industrial sector

Pre-Construction Impacts

Topic of Concern	Potential Impacts and/or Issues	Mitigation/Enhancement Measures
Permits and licenses	Project not in compliance with national and local-level regulations	Confirm that all required permits, licenses, endorsements and any other clearance items have been secured
Tree-cutting permit	Project not in compliance	Secure Tree Cutting Permit
Land acquisition and resettlement	Issues with landowners	Implement Land Acquisition and Resettlement Plan (LARP)
Coordination with Manila Bay Rehabilitation Program	Lack of coordination and consistency with programs of Manila Bay Rehabilitation Plan	Coordinate with Manila Bay Coordinating Office (MBCO) to ensure complementarity of mitigation and monitoring under project EMP and municipal and agency actions taken under the Manila Bay Rehabilitation Program
Grievance Redress Mechanisms set up	Lack a fair and transparent means of seeking redress, leading to resentment towards the project	Establish a Grievance Redress Mechanism at the start of project implementation, including land acquisition and set-up of staging areas
Carbon Sink Program formulated and funded	Condition of ECC not met; net emissions from project contribute to global climate crisis	Formulate Carbon Sink Program in collaboration with DENR-EMB Region III, DENR-EMB Region IV-A, the concerned PENROs and CENROs, and submit the program to DENR-EMB Central Office prior to the start of project implementation Allocate funds for the Carbon Sink Program's implementation
Biodiversity Action Plan	Residual impacts on critical habitat and natural habitat that require offsets and/or long-term monitoring and partnerships for adaptive management that are not appropriately addressed through the EMP	Establish necessary partnerships and institutional arrangements to ensure successful implementation of the programs specified in the ADB-approved BAP

Construction Phase Impacts

Land	• **Degradation or destruction of wildlife habitats** • **Disturbance to mangrove habitat** • **Proliferation of invasive species** • **Soil and Land contamination** • **Improper management of wastes** • **Loss of culturally significant features**
Water	• Siltation and sedimentation • Contamination and degradation of water quality • Groundwater scarcity • Disturbance to and destruction of marine ecosystem
Air	• Increase GHG emission • Degradation of air quality and airshed • Impact of noise pollution
People	• Social conflict due to migrant workers • Lack of access to private and public property • Disruption of utility services • Increase / Decrease in livelihood • Public safety risks • Increase in infectious diseases • Exposure to occupational health and safety risks • Impairment of amenity values (visual impact)

Operation Phase Impacts

Land	• **Avian mortality** • **Soil and land contamination**
Water	• Degradation of water quality • Contamination from discharge and wastes
Air	• Degradation of air quality
People	• Increase in employment and business opportunities • Public safety risks from increase vehicular movement • Occupational risks during maintenance works • Aesthetic degradation from solid waste (visual impact)

Social Development Aims

- **Construction Phase**
  - Training
  - Opportunities for employment, livelihood and local business
  - Protection of BCIB adjacent fish habitat

- **Operation Phase**
  - Employment opportunities
  - Opportunities for local businesses

Open Forum

Thank You.

ANNEX C: TARPAULINS, FLYERS AND BROCHURES

- **Tarpaulins posted in different offices prior to Public Consultation Meetings** *(printed in 8ft x 4ft)*


Republic of the Philippines
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
Unified Project Management Office (UPMO)
Roads Management Cluster II (Multilateral)
Bataan-Cavite Interlink Bridge (BCIB) Project
PUBLIC CONSULTATION FOR THE ENVIRONMENTAL IMPACT ASSESSMENT (EIA)
Venue
Tanza Oasis Hotel and Resort
Antero Soriano Highway, Tanza, Cavite
Date
August 31, 2023
08:00 AM - 01:00 PM
Agenda
To present the results of the conducted Environmental Impact Assessment (EIA) and the mitigating measures to address the possible impacts of the Bataan-Cavite Interlink Bridge (BCIB) Project to the environment and people.


DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
Unified Project Management Office (UPMO)
Roads Management Cluster II (Multilateral)
Bataan-Cavite Interlink Bridge (BCIB) Project
PUBLIC CONSULTATION FOR THE ENVIRONMENTAL IMPACT ASSESSMENT (EIA)
Venue
The Oriental Bataan - Bataan Hall
Brgy. Malaya, Mariveles, Bataan
Date
September 1, 2023
08:00 AM - 01:00 PM
Agenda
To present the results of the conducted Environmental Impact Assessment (EIA) and

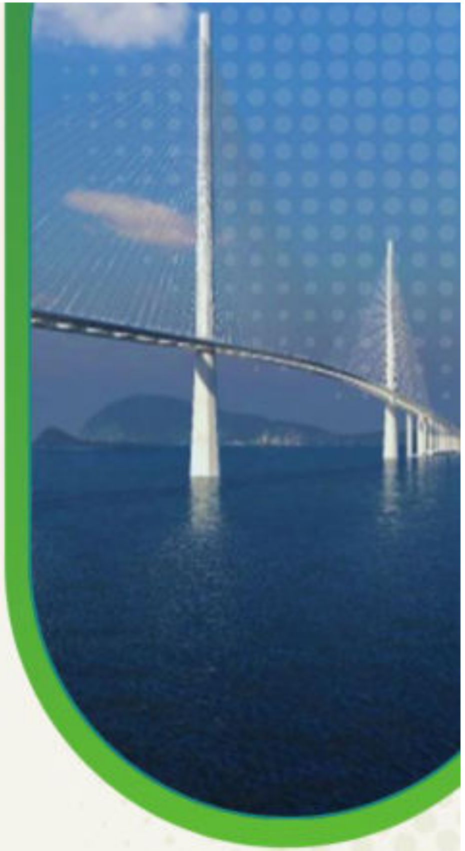
- **Flyers distributed to different offices prior to Public Consultation Meetings** *(printed in A5 size)*

Republic of the Philippines
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
Unified Project Management Office (UPMO)
Roads Management Cluster II (Multilateral)

Bataan-Cavite Interlink Bridge (BCIB) Project

PUBLIC CONSULTATION

FOR THE ENVIRONMENTAL IMPACT ASSESSMENT (EIA)



Venue **Tanza Oasis Hotel and Resort**
Antero Soriano Highway, Tanza, Cavite

Date **August 31, 2023**
08:00 AM – 01:00 PM

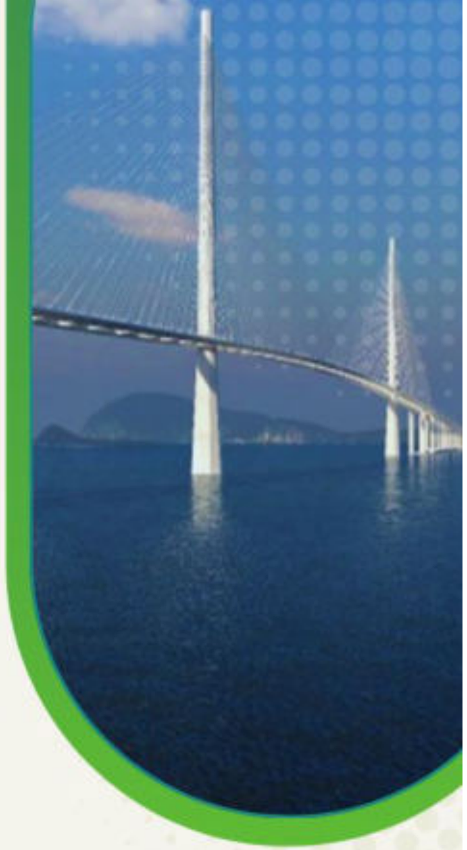
Agenda To present the results of the conducted Environmental Impact Assessment (EIA) and the mitigating measures to address the possible impacts of the Bataan-Cavite Interlink Bridge (BCIB) Project to the environment and people.

Republic of the Philippines
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
Unified Project Management Office (UPMO)
Roads Management Cluster II (Multilateral)

Bataan-Cavite Interlink Bridge (BCIB) Project

PUBLIC CONSULTATION

FOR THE ENVIRONMENTAL IMPACT ASSESSMENT (EIA)



Venue **The Oriental Bataan - Bataan Hall**
Brgy. Malaya, Mariveles, Bataan

Date **September 1, 2023**
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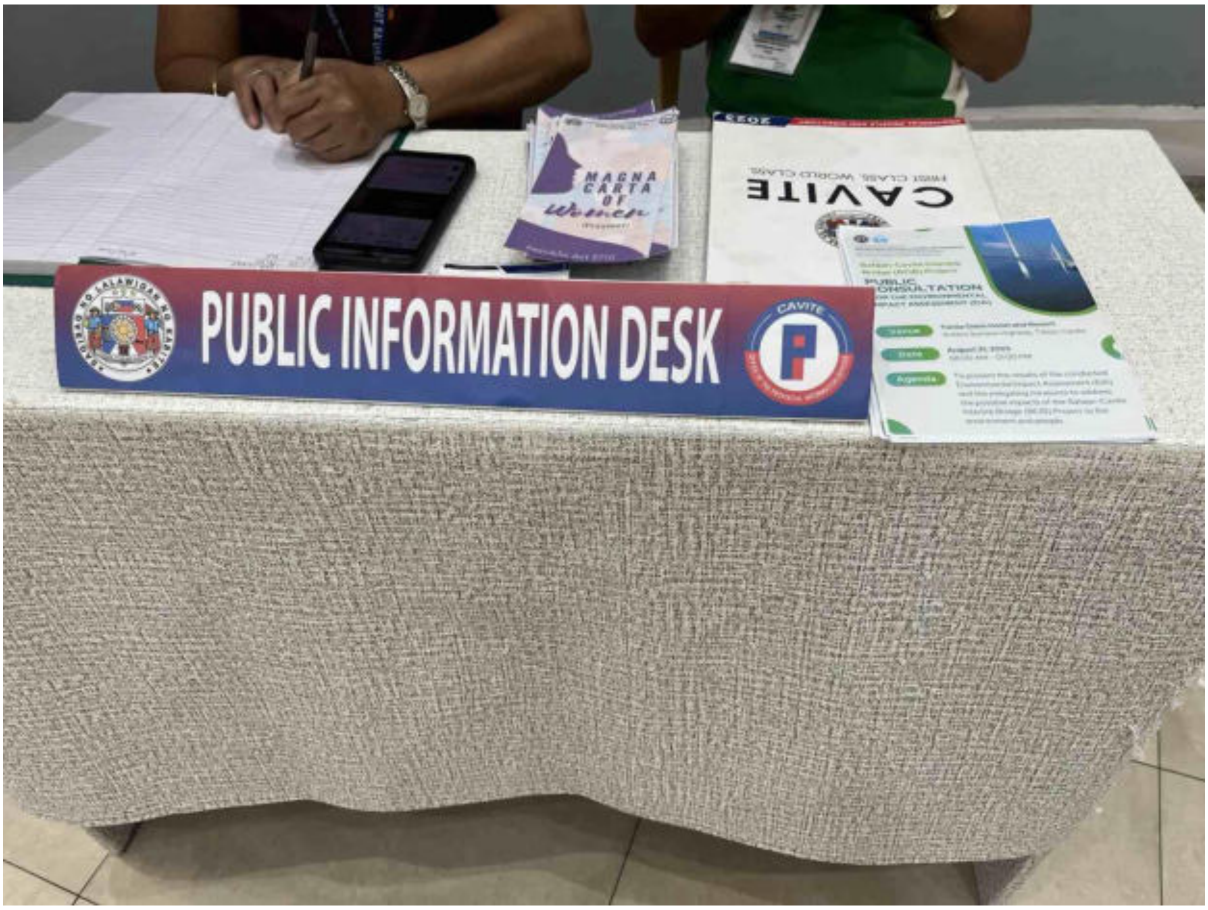
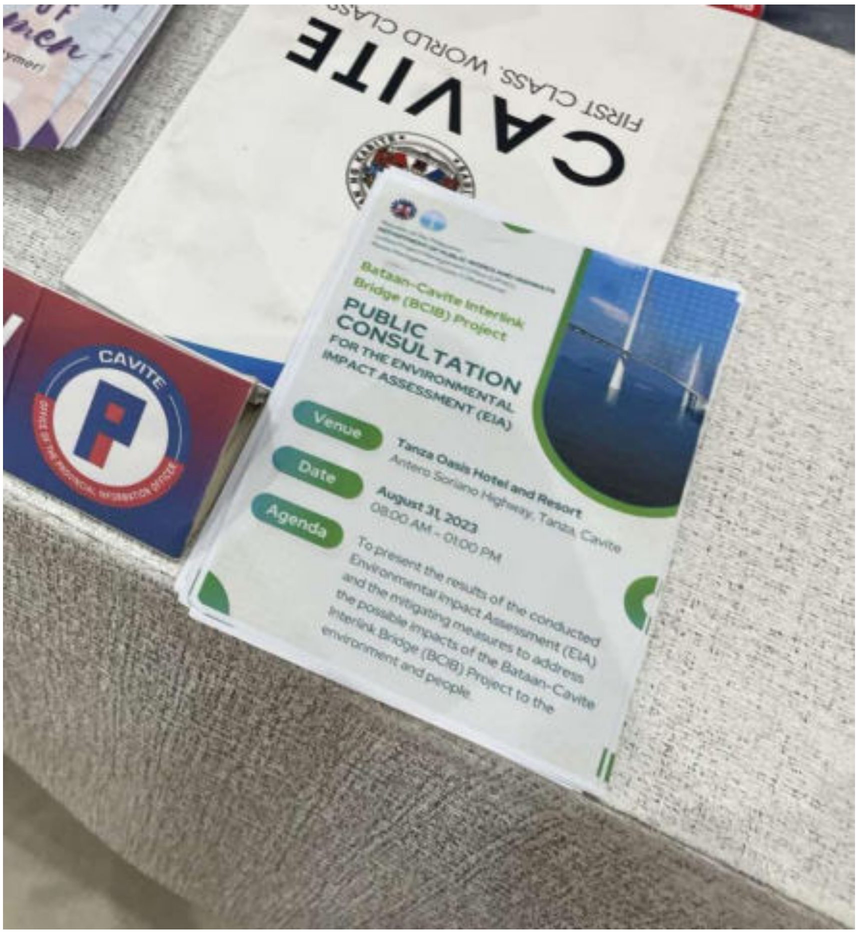
Agenda To present the results of the conducted Environmental Impact Assessment (EIA) and the mitigating measures to address the possible impacts of the Bataan-Cavite Interlink Bridge (BCIB) Project to the environment and people.



PUBLIC INFORMATION DESK
MAGNA CARTA OF Women
CAVITE
FIRST CLASS. WORLD CLASS.



CAVITE
FIRST CLASS. WORLD CLASS.
Bataan-Cavite Interlink Bridge (BCIB) Project
PUBLIC CONSULTATION
FOR THE ENVIRONMENTAL IMPACT ASSESSMENT (EIA)
Venue
Tanza Oasis Hotel and Resort
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Date
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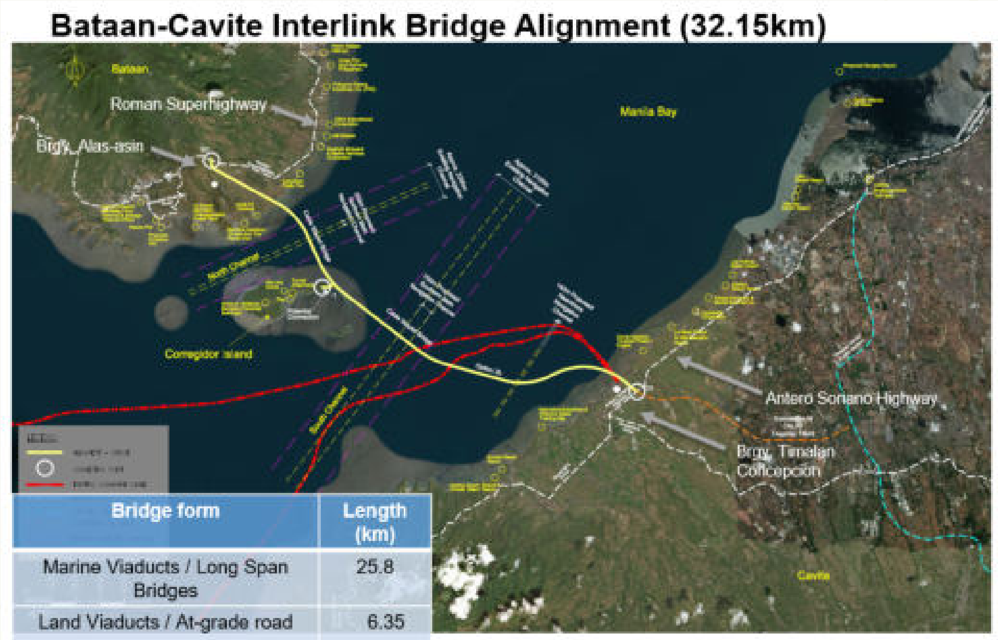
Agenda
To present the results of the conducted Environmental Impact Assessment (EIA) and the mitigating measures to address the possible impacts of the Bataan-Cavite Interlink Bridge (BCIB) Project to the environment and people

- **Brochures distributed to participants upon registration during the Public Consultation Meetings**
  (printed in A4 size paper – bifold)



Bridge form	Length (km)
Marine Viaducts / Long Span Bridges	25.8
Land Viaducts / At-grade road	6.35

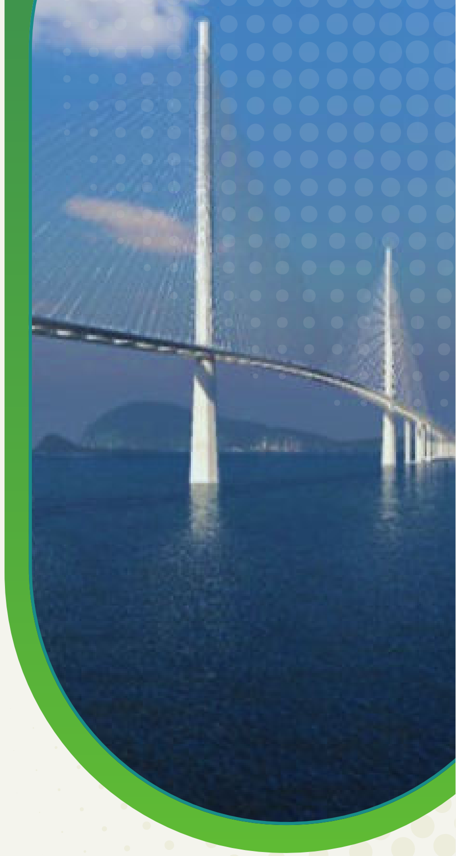
Package 1	**Bataan Land Approach** 5.0 kms
Package 2	**Cavite Land Approach** 1.3 kms
Package 3	**North Marine Viaduct** 8.0 kms
Package 4	**South Marine Viaduct** 12.6 kms
Package 5	**North Navigation Channel Bridge + Approaches** 2.1 kms
Package 6	**South Navigation Channel Bridge + Approaches** 3.1 kms
Package 7	**Ancillary (Project-wide)**

Republic of the Philippines
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
Unified Project Management Office (UPMO)
Roads Management Cluster II (Multilateral)

Bataan-Cavite Interlink Bridge (BCIB) Project

PUBLIC CONSULTATION

FOR THE ENVIRONMENTAL IMPACT ASSESSMENT (EIA)



Venue	**Tanza Oasis Hotel and Resort** Antero Soriano Highway, Tanza, Cavite
Date	**August 31, 2023** 08:00 AM – 01:00 PM
Agenda	To present the results of the conducted Environmental Impact Assessment (EIA) and the mitigating measures to address the possible impacts of the Bataan-Cavite Interlink Bridge (BCIB) Project to the environment and people.

Technical Description of the BCIB

BCIB is a 32-kilometer length bridge and one of the flagship projects prioritized by the Philippine Government with northern terminus in **Brgy. Alas-Asin, Mariveles, Bataan** and southern terminus in **Brgy. Timalan-Concepcion in Naic, Cavite.**

BCIB will provide permanent linkage between Bataan and Cavite. It aims to reduce journey time and ease traffic congestion through Metro Manila and South Luzon and North Luzon gateways.

The project will help transform the regional economies of Cavite, Bataan, and provinces located further north of Bataan through improved connectivity, new economic opportunities, and jobs.

Public Consultation Objectives

- Provide an update the local government units and other government agencies on the BCIB project based on the Detailed Engineering Design
- Disseminate the information on current environmental baseline condition within the project area and the perceived impact of the project
- Solicit feedback from the participants on the current project design and the perceived environmental impacts

PROGRAM

Time	Program of Activities	Person Responsible
8:00 - 9:00 am	Registration	
9:00 – 9:15 am	National Anthem Invocation Safety Briefing	**Gelonie Yap** Master of Ceremony Hotel Safety Officer
9:15 – 9:25 am	- Opening Remarks - Presentation of Public Consultation Objectives - Introduction of Participants	**Engr. Junnel Ray C. Bautista** DPWH
9:25 – 9:35 am	Welcome Remarks	**Ms. Anabelle L. Cayabyab** PG-ENRO
09:45 – 10:45 am	Brief Presentation of the Project Results of the EIA on impacts, measures, commitments during DED Stage	**Dante Bautista** TYLin International **Ian Borja** EIA Preparer
10:45 – 12:00 nn	Open Forum	**Fred Esternon** Facilitator / ERPMP Preparer for ECC Amendment
	Managed Buffet	
12:00 – 12:45 pm *Over lunch*	- Summary of Issues/Concerns/Impacts raised by the public and Response of the Proponent - Agreements in Public Consultation Open Forum	**Ian Borja** EIA Preparer
12:45 – 01:00 pm	Closing Remarks	**DENR Region IV-A**


EXIT

ANNEX 7: CLIMATE CHANGE STUDY – UPDATED (NOVEMBER 2023)

Bataan-Cavite Interlink Bridge Project

Final Climate Change Study Report -Updated

November 15, 2023

Prepared By:

A JOINT VENTURE

T.Y. Lin International | Pyunghwa Engineering Consultants Joint Venture

Document Code: 481714-BCIB-PS-ECOS-ENV-RPT-0003
Revision: 05

Design/ Provision Sums Reference:

Reference:
Task Order No. 16R1 “Environmental and Social Studies” Task 1 “Climate Change Study” Item No. 3 “Final Climate Change Study Report”

Revisions:

Date	Description	Rev.	Originator	Reviewer	Approver
2023-02-19	Issue for Coordination	00	Edwin Combalicer (Ecosys)	IG Park/ Y Lim/ (PEC) Jodi Ketelsen, (TYLI) Simeon Stairs, (REN)	Marwan Nader (TYLI-PEC JV)
2023-02-28	Issue to DPWH	01	Edwin Combalicer (Ecosys)	Hardik Patel & Jodi Ketelsen, (TYLI) Simeon Stairs, (REN) IG Park/ Y Lim/ (PEC) Simeon Stairs(REN)	Marwan Nader (TYLI-PEC JV)
2023-04-21	Issue to DPWH (as included in NEDA ICC Final Report)	02	Edwin Combalicer (Ecosys)	Hardik Patel & Jodi Ketelsen, (TYLI) Simeon Stairs, (REN) IG Park/ Y Lim/ (PEC) Simeon Stairs(REN)	Marwan Nader (TYLI-PEC JV)
2023-05-12	Issue to DPWH (as included in NEDA ICC Final Report - Resubmission)	03	Edwin Combalicer (Ecosys)	Hardik Patel & Jodi Ketelsen, (TYLI) Simeon Stairs, (REN) IG Park/ Y Lim/ (PEC) Simeon Stairs(REN)	Marwan Nader (TYLI-PEC JV)
2023-06-15	Issue to DPWH	04	Edwin Combalicer (Ecosys)	Hardik Patel & Jodi Ketelsen, (TYLI) Simeon Stairs, (REN) IG Park/ Y Lim/ (PEC) Simeon Stairs(REN)	Marwan Nader (TYLI-PEC JV)
2023-11-15	Issue to DPWH, with Updated from ADB Climate Change Group	05	Input from ADB	Jodi Ketelsen, (TYLI)	Marwan Nader (TYLI-PEC JV)

Major Contributors of the Current Revision:

Contributors
Edwin Combalicer (Ecosys) Rami Bushebel (TYLI) **Hardik Patel (TYLI)** Jodi Ketelsen (TYLI) Annie Mago (Self) Ojku Jeong (ABD)

ABBREVIATIONS

ADB	Asian Development Bank
AR5	fifth assessment report
AR6	sixth assessment report
AASHTO	American Association of State, Highways and Transportation Officials
BCIB	Bataan-Cavite Interlink Bridge
BMMC	Bridge Monitoring and Maintenance Compound
CCC	Climate Change Commission
CERAM	climate extreme risk assessment matrix
CHASSAM	Coastal Hazards and Storm Surge Assessment and Mitigation
CLIRAM	climate information risk analysis matrix
CISS	cast-in-steel-shell
CMIP5	Coupled Model Intercomparison Project, Phase 5
CMIP6	Coupled Model Intercomparison Project, Phase 6
CORDEX-SEA	Coordinated Regional Climate Downscaling Experiment - Southeast Asia
CRA	climate risk and adaptation
DED	detailed engineering design
DENR	Department of Environment and Natural Resources
DGCS	design guidelines, criteria, and standards
DFL	design flood level
DPWH	Department of Public Works and Highways
DO	departmental order
DOST	Department of Science and Technology
DTR	daily temperature range
ENSO	El Niño Southern Oscillation
GHG	greenhouse gas
GMSL	global mean sea level
HSDS	highway safety design standards
IPCC	Inter-Governmental Panel for Climate Change
IFIP	Infrastructure Preparation and Innovation Facility
LUD	lock-up devices
MDCR	master design criteria report
MDRRMO	Municipal Disaster Risk Reduction and Management Office
msl	mean sea level
NAIA	Ninoy Aquino International Airport
NCCAP	National Climate Change Action Plan
NCR	National Capital Region
NEDA	National Economic and Development Agency
NFSCC	National Framework Strategy on Climate Change
NOAH	Nationwide Operational Assessment of Hazards
PAGASA	Philippine Atmospheric, Geophysical and Astronomical Services Administration
PHIVOLCS	Philippine Institute of Volcanology
PAR	Philippine area of responsibility
PEISS	Philippine Environmental Impact Statement System

PGA	peak ground acceleration
PEM	Philippine earthquake model
PRECIS	providing regional climates for impact studies
PSCCA	Philippine Strategy on Climate Change Adaptation
RCM	regional climate models
RCP	representative concentration pathways
Rx1day	maximum 1-day rainfall total
SDII	simple daily intensity index
SLC	sea level change
SLR	sea level rise
SRES	special report on emissions scenarios
SRSS	square-root-sum-of-squares
SROCC	special report on the ocean and cryosphere
SSPs	shared socioeconomic pathways
TD	tropical depressions
TS	tropical storm
TX90p	fraction of hot days
TXx	warmest daytime temperature
TY	tropical typhoon
UNFCCC	United Nations Framework Convention on Climate Change

TABLE OF CONTENTS

LIST OF EXHIBITS

APPENDICES

EXECUTIVE SUMMARY

1. The Infrastructure Preparation and Innovation Facility (IPIF) is a technical assistance (TA) loan package of Asian Development Bank (ADB) for the Philippine government, which entails updating the feasibility studies conducted in 2019 for the Bataan-Cavite Interlink Bridge (BCIB) and preparing the detailed design package. The Department of Public Works and Highways (DPWH) will be implementing this project.

2. The BCIB project was classified as 'Category A' based on ADB Environment Safeguards Categories; therefore, requiring a more detailed climate risk adaptation assessment.

3. This Climate Risk and Adaptation (CRA) assessment was prepared to i) assess the climate and climate change threats to the BCIB project, ii) consider the project adaptation measures, iii) determine to what extent the performance and design are vulnerable to climate change, and iv) recommend actions that will improve the project climate resilience.

4. The BCIB project covers the construction of 32.15 km roadways and bridges, including the provision of navigational bridges, marine viaducts, interchanges, and land viaducts, bridge and monitoring facilities, and other road facilities.

5. The project location was found to be sensitive to climate conditions such as temperature increase, precipitation increase, onshore storms, sea-level rise, and wind speed increase. It experienced climate change in the past and is expected to experience these in the future. Given the Project location, the designers must consider the possibility of Climate Change effects.

6. This report relies upon the recent Philippine climate extremes data to describe the general trajectories of rainfall and temperature. The downscaled historical and projected daily extremes data were used to calculate the projected changes in 24 climate extremes indices for two Representative Concentration Pathways: RCP4.5 and RCP8.5. The annual extremes were averaged over the 20-year-time periods to come up with the climatological extreme. The projections from two scenarios, RCP4.5 and RCP8.5, were provided for three time periods: early future (2020–2039), mid-future (2046–2065), and late future (2080–2099). Based on PAGASA Climate Extreme Projection, temperatures in the project areas will increase by as much as 1.6 °C (2020-2039) for the RCP4.5 scenario and by as much as 3.6 °C (2080-2099) for the RCP8.5 scenario.

7. The maximum 1-day rainfall total (Rx1day) series (1900–2100) for the project area were downloaded from the KNMI Climate Change Atlas for CMIP5 extremes ensemble under RCP8.5 to assess the adequacy of engineering designs, which are generally based on climate extremes. The climate model outputs are separated for 1850–2005 and 2006–2100. The observed design values of Rx1day were 315 mm for the Bataan side and 260 mm for the Cavite project site. Rx1day shows an increasing trend and a non-stationarity that raises the possible need for the DPWH design return periods to be adjusted. The design values were calculated for the baseline (1986-2005) and future periods (2016-2035). A probability curve and the percentage increase in Rx1day with a 25-year return period were interpolated to determine the required percentile from the climate model ensemble. A 30% climate change factor was computed to handle 97.5% of the projected rainfall

intensity extremes. The assessment found that the design values of Rx1day for the future climate must be 409 mm for the Bataan side and 338 mm for the Cavite area.

8. The daily maximum temperature projections vary at an increasing rate from 35.5 °C (historical) to 39.3 °C (future) on the Bataan side and from 35.7 °C (historical) to 39.1 °C (future) on the Cavite side under CMIP5 ensemble of the RCP8.5 scenario. Potential climate impacts and risks on the project of higher temperatures and extreme heat can cause bridges to be stressed by thermal expansion and movement, lead to premature deterioration of the structure, and damage pavements that protect the bridge decks.

9. Climate change is projected to influence the anomaly of sea-level rise. Both the medium-low GHG concentration scenario (RCP4.5) and the high-end scenario (RCP8.5) lead to similar increases in sea level. The project estimated future regional sea level changes for the Philippines by using changes in the projections for the Global Mean Sea Level (GMSL) from the IPCC AR5 and combining them with non-uniform regional patterns of sea level change around the country. It is projected to be almost twice the magnitude of corresponding global levels at the end of the 21st century. The Special Report on the Ocean and Cryosphere (SROCC) projection of the sea level rise is likely in the range of 0.61 to 1.10 m and 1.2 to 1.6 m in 2100 and 2130, respectively. The projected sea level rise for the BCIB Project conservatively uses an increase of 1.0 m (2100) and 1.2 m (2130). However, the BCIB design has a generous freeboard to permit large vessels to pass with ample clearance regardless of the full range of projected sea level rise through 2130.

10. The BCIB project locations have been exposed to 27 tropical cyclone winds in the past 7 decades. Many of these tropical cyclones hit the area from September to October. The latest and strongest typhoon occurrences in the project areas were in November 2019 and 2020 with maximum sustained winds of 150 and 220 kph, respectively. Bataan and Cavite sections have mean wind speeds ranging from 6.61 to 7.05 m/s and from 6.60 to 7.37 m/s, respectively, while the Corregidor Island portion is exposed at rate ranging from 6.96 to 7.19 m/s. The mean wind at the Sangley Weather Station is 5.91 m/s, or about 1.2 times less than on Bataan alignment. In essence, the wind speed in Bataan could reach 231 kph considering the historically recorded peak wind speed of 194 kph in Sangley Point Station. A study on Design Tropical Cyclone Wind Speed when considering climate change indicated that wind speed during tropical cyclones increases by 1.2-1.4 times the historical record. These could increase the wind speed in Bataan section to well over 300 kph.

11. The project assessed its quantitative greenhouse gas (GHG) emissions upon which the total amount of fuel and electricity, construction materials, and/or fuels used were calculated using specific values. The project is estimated to account for about 445,200 tons of CO_2e (tCO_2e) during its construction, with an annual release of 89,049 tCO_2e. The project's construction is an an insignificant source of emissions (average of 34,700 tCO_2/year) compared to GHG emissions without BCIB.

12. The BCIB project would reduce congestion by providing an alternative route from north Luzon Island to South Island without traveling through Manila's heavy congested roadways. This would help to reduce emissions. The net change in emissions on account of the BCIB project was identified and valued, using a *with* and *without* project comparison. The assessment and computation were based on the travel activity that relies on the trip distance data, considering the

BCIB transport route system. Net changes in GHG emissions due to changed traffic flows were estimated in 2030 and 2050, representing the year the BCIB project commenced and 20 years during the project implementation. The assessment found that the BCIB project in place will decrease GHG emissions from 30,000 tCO_2 to 9,100 tCO_2 in 2030 and from 148,100 tCO2 to 34,700 tCO_2 in 2050. Results indicated GHG reductions of about 20,900 tCO_2 in the opening year and about 1.6 million tCO_2 with an annual average of 79,100 tCO_2 during the entire appraisal period (2030-2050).

13. The detailed design is anticipated to be resilient and counteract extreme weather events. Certain sections and facilities that would be exposed to risks have been reviewed and design considerations have been incorporated and will be implemented during the construction and operation phases. Design considerations and adaptation measures that address or counter climate change and associated risk on the project's physical infrastructure and assets as currently designed are summarized below:

(i) Increases in very hot days and heat waves, decreased precipitation

Design Considerations

- The flexible pavement type is considered due to environmental and weather exposure, traffic loading, and constructability (i.e., Package 1: 920 mm, Package 2: 750 mm, Package 3 and 4: 80 mm, Package 5 and 6: 50 mm).
- The PSMA's Performance Grade is PG76-22, a material that can maintain durability for seven (7) days at the maximum design temperature of 76 °C and the minimum design temperature of -22 °C.

Adaptation Measures

- Tree replacement - GHG emissions offsetting through the enhanced National Greening Program of the government.
- Use of Polymer Modified Stone Mastic Asphalt and concrete due to its higher temperature resistance.
- Designate the interchange areas in Cavite and Bataan as a green urban corridor.
- Preservation and easement retention of natural drainage waterways.
- Adapt Antero Serrano Highway Interchange (Package 2).

(ii) Extreme Precipitation Events, Flooding

Design Considerations

- Construction of Mt View Waterway Bridge
- Provision of the typical drainage at grade road portion of the crossing.
- Construction/Installation of box and pipe culverts, roadside and median ditches, and gutter flow.
- Surface run-off from the deck (marine viaducts) and bridge deck (long span bridges) will be collected and drained at the low points of the deck surface into Manila Bay.

Adaptation Measures

- Installation of infiltration trenches along roads
- Construction of slope protection measures on natural slopes and man-made structures, such as road embankments and cuttings.
- Preservation and Restoration of Natural Drainages.

- Adapt Antero Serrano Highway Interchange (Package 2).
- Tree replacement - GHG emissions offsetting through the enhanced National Greening Program of the government.

(iii) Sea Level Rise, Storm Surge

Design Considerations

- Package 1: The terrain ground condition has a steep slope from abutment towards the shoreline, and column heights vary from 8 m to 17 m high.
- Package 2: The terrain ground condition is flat, and the shoreline and column heights vary from 6 m to 7 m high
- Packages 3 – 6: Designed to clear a compounded effect of high tide, sea level rise, storm surge and typhoon-generated tidal waves.
    - Highway Alignment Level: Northern Main Navigation Channel = + 47.4m mean sea level (msl); Corregidor Interchange = +31.1m msl; Fast Ferry to Corregidor Island = +20.9m msl
    - The vertical profile of the mainline varies from +21.5m msl to +23.0m msl near Corregidor Island.
    - P4: Southern Main Navigation Channel = +72.3m msl; Nearshore Navigation Channel = +23.1m msl; and Non-navigation Span = +14.5m msl.
    - Highway Alignment Level: +81.7m MSL; Nearshore Navigation Channel = +32.5m msl; and Non-navigation Span = +21.5m msl.
    - P5: Air Draft above msl (m): Northern Main Navigation Channel = +40.5m;
    - Highway Alignment Level: Northern Main Navigation Channel = + 47.4m msl;
    - P6: Northern Main Navigation Channel = +40.5m; Corregidor
- The project design adopts the Philippine Coast Guard-approved navigational clearance for the project.
- Vessel collision force has been applied considering both current conditions and conditions with 1.6 m of SLR.

Adaptation Measures

- Coastal wall protection.
- Raise piles by the amount of SLR.
- Preservation and easement retention of natural drainage waterways.
- Enhancement and retention of areas within certain distances along the banks of rivers, streams, and shores of seas for environmental protection.

(iv) Increase of storm intensity and wind speed

Design Considerations

- Use of a flexible pavement to be more resistant to weather and climate extremes.
- Wind design criteria: 1700-year wind standard– industry standard for cable bridges.
- The horizontal alignment near the landing point at Bataan and Cavite is designed to be perpendicular to the shoreline and perpendicular to the Northern and South Main Navigation Channel.
- Exposure category D (‘flat unobstructed areas and water surfaces’) was applied.

- Speeds are reported at a reference deck height above sea level for the BCIB project.
- Wind Speed at Deck Heights (87.6 m) for BCIB (South Channel Bridge)
    - Hourly Mean: 71.0 m/s (255 kph)
    - 10 Minute Mean 72.7 m/s
    - 3s-Gust: 95.8 m/s (345 kph)
- Wind Speed at Deck Heights (48.4 m) for BCIB (North Channel Bridge)
    - Hourly Mean: 67.2 m/s (242 kph)
    - 10 Minute Mean 68.8 m/s
    - 3s-Gust: 91.9 m/s (331 kph)

Adaptation Measures

- Coastal wall protection.
- Wind fairings and shields (Package 5 and 6).
- Installation of security items.

14. The BCIB Project estimated a total of US$ 52.1 million of the civil works on addressing (adaptation) climate change risks.

15. The assessment recommended additional adaptation measures during the project implementation and operation stages such as i) nature-based solutions (mangroves can provide coastal protection), ii) installing the nonstructural (soft) barriers to flooding that reduce coastal flooding, erosion, and storm surge impacts, iii) develop green corridors to the interchange areas and the existing riparian galleries, iv) communicate through community-based adaptation options and activities, and v) build early warning systems and information networks to support community disaster information and awareness.

1. DESCRIPTION OF THE PROJECT

1.1 Background

16. The IPIF is a TA loan package of ADB for the Philippine government (the "borrower/ client"). This entails updating the feasibility studies conducted in 2019 for the Bataan-Cavite Interlink Bridge (BCIB) and preparing the detailed design package which includes engineering design, study on environment and social safeguards, preparing the bid documents, and carrying out due diligence requirements to support the Philippine government and ADB in project processing and procurement.

17. The Department of Public Works and Highways (DPWH) of the Philippines signed a contract with T.Y. Lin International and Pyunghwa Engineering Consultants Joint Venture (hereinafter called "TYLI/PEC") and in association with Renardet S.A. and DCCD Engineering Corporation for the Detailed Engineering Design (DED) of the Bataan–Cavite Interlink Bridge Project (BCIB). Under Package 1, the Climate Change Study (Climate Risk and Adaptation Assessment) is included as an additional work in the BCIB project detailed engineering design.

18. The BCIB is one of the major projects of the Build Build Build Program of the national government. The project aims to provide a permanent road linkage between the provinces of Bataan and Cavite to reduce travel time and ease traffic congestion between Metro Manila and the South Luzon and North Luzon gateways. It will provide opportunities for expansion outside Metro Manila for economic growth and support the development of seaports of Cavite and Bataan as premier international shipping gateway to the country. The BCIB originates from Brgy. Alas-Asin to Bgry. Mt. View of Mariveles, Bataan in Central Luzon; crosses the Manila Bay with the possible connection at Corregidor Island and touches down at Barangays Timalan Concepcion and Timalan Balsahan, Municipality of Naic, Cavite with a total length of 32.15 km (Exhibit 1-1).

1.2 Project Components

19. Along the 32.15 km long BCIB, the marine section's structures are categorized into different components as shown in the sketch below. On Bataan and Cavite land area, both at grade roads and land viaducts are required. Generally, the structures are categorized into the following different components:

(i) Navigation bridges – The main structure that provides the necessary navigation clearance for safe operation of shipping at the project site. For BCIB, the navigation bridges are the North Channel Bridge and South Channel Bridge.

(ii) Marine viaducts – The typical viaduct structures which will be constructed above sea water with varying column heights and water depth. Constant span arrangement is adopted to have standardized construction methodologies and minimize the duration of the construction program.

(iii) Interchanges and viaducts on land – These are the viaduct structures which will be constructed on land to provide the connection to the existing road networks.

(iv) Ancillary facilities – These are Bridge Monitoring and Maintenance Compound (BMMC) on a 0.5-hectare site on the Bataan side, electrical service building, technical shelter, emergency response office, guard outposts, utilities, fuel pump shed, water tank, portable sewage treatment plant, and fenced open areas for parking and yard.

Exhibit 1-1: The BCIB Project Alignment

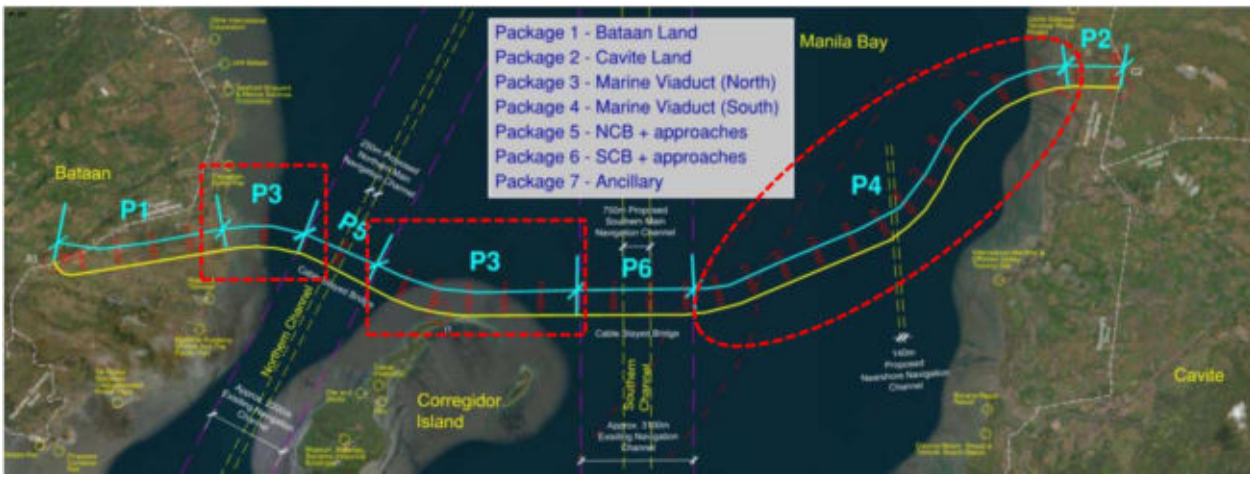
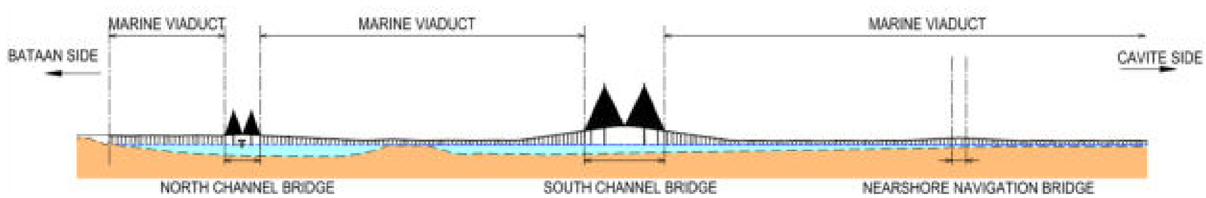


Exhibit 1-2: Structure Component Types along BCIB



Sources: Bataan – Cavite Interlink Bridge (BCIB) Project – Environmental Impact Assessment Report. p.81.

20. Brief descriptions of the project structures of each Work Package are presented in Exhibit 1-3.

Exhibit 1-3: The BCIB Main Project Structures

Package and Project Structure	Brief Description
Package 1 - Bataan Land Approach[a]	The alignment is 5.4 km long and its major structure components include the trumpet interchange that connects the BCIB with Roman Highway, Roman Interchange Bridge, the Alas-Asin reinforced concrete box culvert, Alas-Asin Overpass Bridge, Mt. View Overpass Bridge, Mt. View Waterway Bridge, and the Bataan land viaduct.
Roman Interchange Bridge	The Roman Interchange Bridge is located along the Bataan Roman Highway and will be constructed at-grade and passing above the expressway. It forms part of the trumpet

Package and Project Structure	Brief Description
	interchange. The bridge span articulation is a typical 2@25m span, and the longitudinal alignment has a small curvature, and has a 13-degree skew angle.
Alas-Asin Reinforced Concrete Box Culvert	A reinforced concrete box culvert serves as both a drainage facility and as a farm crossing for the local community.
Alas-Asin Overpass Bridge	A local road bridge crossing is provided for communities to access either side of the BCIB.
Mt. View Overpass Bridge	A local road bridge crossing is provided for communities to access either side of the BCIB.
Mt. View Waterway Bridge	There is a gully along the alignment and the bridge structure is a 4@25m span and has a 25-degree skew angle to match the waterway alignment.
Bataan Land Viaduct	The Bataan land viaduct connects with the marine viaduct at the shoreline. The articulation developed for the structure is 5@40m span on a composite deck slab.
Package 2 – Cavite Land Approach[b]	The alignment is 1.38 km long and its major structure components include the partial clover leaf that connects the BCIB with Antero Soriano Highway, the Antero Soriano Interchange Bridge, Tramo Underpass, Timalan-Balsahan Underpass, and the Cavite Land Viaduct.
Cavite Land Viaduct	The Cavite Land Viaduct is the land approach at the Cavite side and connected to the marine viaduct at the shoreline. The articulation developed for the structure is 2@40m span on composite deck slab.
Timalan-Balsahan Underpass	A reinforced concrete box culvert underpass will be constructed for the local road along Timalan Balsahan Road.
Tramo Underpass,	A reinforced concrete box culvert underpass will be constructed for the local road along Tramo Road.
Antero Soriano Interchange Bridge	The Antero Soriano Interchange Bridge is located at the Antero Soriano Highway and will be constructed above grade and forms part of the interchange. The bridge span articulation is a typical 2@25 m span, the longitudinal alignment is straight and skewed at a 17.4-degree angle.
Package 3 and 4 – Marine Viaduct[c]	The alignment of Package 3 and Package 4 are divided into two areas, that is, shallow water areas and deep-water areas. The shallow water areas where water depth is less than 10 m, are in three (3) separate zones, i.e., nearshore Bataan, Corregidor Island, and Cavite. The alignment length of each shallow water area is estimated to 0.88 km (nearshore Bataan), 1.09 km (Corregidor Island), and 6.48 km (Cavite). The areas are with main span of 100m and 60 m in deep water and shallow water areas. A special navigation span near Cavite, with a main span length of 100m also adopts a haunch at the piers to allow navigation for Coastguard vessels and other small vessels sailing near the shore.
Package 5 - North Channel Bridges + Approaches[d]	The North Channel Bridge is situated between Bataan and Corregidor Island, a smaller version compared to the south channel, with a 400 m long main span cable stayed bridge,

Package and Project Structure	Brief Description
	with two 168 m long back spans, and the total length of the bridge is 736 m. The bridge features two monopole style towers which stand about 190m tall above the seabed and about 140 m above the sea level.
Package 6 - South Channel Bridges + Approaches[e]	The South Channel Bridge is situated between Corregidor Island and Cavite, the largest of two proposed cable-stayed bridges. With a span of 1800m between the two (2) pylons, it creates an opening for ships to pass through as they go in and out of Manila Bay. The bridge features two (2) monopole style towers which stand about 346 m tall above the seabed and about 306 m above the sea level. Near Cavite shoreline, a smaller "Nearshore Navigation Channel" is provided for the vessel traffic. The Nearshore Navigation Channel is 150 m wide and 23.1 m high above msl.
Package 7 – Ancillary Facilities	Bridge Monitoring and Maintenance Compound (BMMC) on a 0.5-hectare site on the Bataan side, featuring a 2-story, 475-m2 maintenance building; electrical service building; technical shelter; emergency response office; guard outposts; utilities, fuel pump shed, water tank, portable sewage treatment plant; and fenced open areas for parking and yard. Other associated facilities may include a substation on either side of the bridge, although solar energy is proposed to supply most lighting needs. The project anticipates enlarging the BMMC by another 0.5 hectare at a later date for future maintenance and operation purposes, and establishing a border control point and weigh stations on either side of the BCIB.

[a] T.Y. Lin International/Pyunghwa Engineering Consultants (2021). Bataan-Cavite Interlink Bridge Project. Package 1: Preliminary Engineering Design
[b] T.Y. Lin International/Pyunghwa Engineering Consultants (2021). Bataan-Cavite Interlink Bridge Project. Package 2: Preliminary Engineering Design
[c] T.Y. Lin International/Pyunghwa Engineering Consultants (2022). Bataan-Cavite Interlink Bridge Project. Baseline Design Report: P3 & P4: Marine Viaduct.
[d] T.Y. Lin International/Pyunghwa Engineering Consultants (2022). Bataan-Cavite Interlink Bridge Project. Baseline Design Report: North Channel Bridge.
[e] T.Y. Lin International/Pyunghwa Engineering Consultants (2022). Bataan-Cavite Interlink Bridge Project. Baseline Design Report: South Channel Bridge.

1.3 Objectives

21. The Climate Risk and Adaptation Assessment aims to i) assess the climate and climate change threats to the BCIB, ii) assess the adaptation measures that are proposed in the BCIB design, iii) determine to what extent the performance and design of BCIB is vulnerable to climate change, and iv) recommend measures that will improve the climate resiliency of the project.

1.4 Methodology

22. Preparing this Climate Risk and Adaptation Assessment involves the following steps:[1]

(i) Understand the problem being addressed by the baseline project (the BCIB) including the climate-related challenges.

(ii) Review the current DPWH design criteria and adequacy to future climate change (rainfall, temperature, and wind).

(iii) Understand the BCIB including its evolving nature as it progresses and endeavors to meet challenges and opportunities. This also includes understanding the BCIB's approach to climate risk.

(iv) Determine how climate change may influence the BCIB; and identify gaps, if any, in the BCIB approach to climate risks, and make recommendations.

23. Likewise, the framework and steps must be in accordance with the principles of climate risk management for climate proofing projects in the transport sector.[2] For this assessment, it follows the steps below.[3]

(i) Review, based on literature of the sensitivity of major subproject types to specific climate parameters (i.e., which climate parameters are critical to performance and durability, and in what way are existing assets already being affected by increasing variability and extremes in these parameters under the current climate).

(ii) Using model-based projections, assess how the critical climate parameters are expected to change relative to historical (1986–2005) and future: early future (2016–2035), mid-future (2046–2065), and late future (2086–2100), including levels of confidence based on degree of agreement among the models used.

(iii) Collect sea level data within Manila Bay along with future projections.

(iv) Conduct conditional survey of existing roads to identify deterioration and failures due to weather events.

(v) Conduct small number of key informant interviews or focus group discussions at local project locations to confirm/deny suspected climate patterns to enhance the credibility of the climate data.

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1 Stated in the Climate Change Study proposal.

2 Relevant ADB publications: i) Climate proofing ADB investment in the transport sector: initial experience, 2014, ii) Information Sources To Support ADB Climate Risk Assessments and Management, 2018, iii) Principles of Climate Risk Management for Climate Proofing Projects, 2020.

3 Items iii to vi are stated scope of work for Climate Change Study under Package 1.

(vi) Collect additional data on extreme weather event projections, to include tropical cyclones, heat waves, droughts, and wildfires with determinations of implications on the BCIB project.

(vii) Determine and calculate the embedded emissions during construction (i.e., processing and transport of cement, steel, and asphalt) and operation (i.e., lighting, building cooling, and maintenance), for determination of total GHG emissions attributed to the project.

(viii) Identify adaptation measures needed during the detailed engineering design stage.

(ix) Identify gaps in the current design standards viz climate change.

24. The assessment focuses on the climate risk of the project under climate change scenarios (RCP 4.5 and RCP 8.5) as used by the Department of Science and Technology (DOST) - Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) and the KNMI Climate Change Atlas. It does not compare climate risk on a with-project or without-project basis, but rather directly examines the project risks and impacts based on the preliminary engineering designs, location, and other relevant factors.

2. FRAMEWORK FOR CLIMATE CHANGE

2.1 Climate Change Modelling and Emissions Scenarios

25. In 2011, PAGASA released the report, "Climate Change in the Philippines".[4] The main outputs of this report were: a) the observed climate trends using historical data from 1951 to 2010 and climatic normal (1971–2000) as a reference value, and b) the climate projections in 2020 and 2050 in the Philippines using the PRECIS (Providing Regional Climates for Impact Studies) climate model developed by the Hadley Centre of UK Met. Simulation outputs used three Special Report on Emissions Scenarios (SRES) such as A2 (high-range), A1B (mid-range), and B2 (low-range). Further, climate projections for each province in the Philippines were presented in terms of temperature increase and rainfall change by seasons (e.g., DJF or northeast monsoon, MAM or summer season, JJA or southwest monsoon, and SON or transition from southwest to northeast monsoon season).

26. In 2018, PAGASA updated the Climate Change in the Philippines report with its existing set of local climate information using the latest climate models.[5] PAGASA summarized a seasonal

[4] DOST- PAGASA. 2011. *Climate Change in the Philippines*. Philippine Atmospheric, Geophysical and Astronomical Services Administration. Quezon City, Philippines.
[5] PAGASA. 2018. *Observed and Projected Climate Change in the Philippines*. Philippine Atmospheric, Geophysical and Astronomical Services Administration, Quezon City, Philippines.

climate projection data for each province of the Philippines using Representative Concentration Pathways (RCPs) through Department of Science and Technology (DOST) - PAGASA's recently developed Climate Information Risk Analysis Matrix (CLIRAM) with the following scenarios: i) RCP4.5 – moderate level of GHG emissions scenario, and ii) RCP8.5 – high level of GHG emissions scenario. The CLIRAM provides the projected changes in climate variables (particularly for rainfall, mean, minimum and maximum temperature) in both the mid-21st century (2036–2065) or the late-21st century (2070–2099) relative to the 1971–2000 baseline period.

27. Recently, DOST-PAGASA in partnership with the Manila Observatory and the Ateneo de Manila University published the Philippine Climate Extremes Report 2020, introducing the Climate Extreme Risk Assessment Matrix (CERAM), a complimentary risk assessment tool to assist local government units in creating their plans. The report features the results from the "Multitemporal and extremes analysis of modeled climatology over the Philippines in the SEA-CORDEX domain project. This is part of the Analyzing CORDEX-SEA (Coordinated Regional Climate Downscaling Experiment – Southeast Asia) Regional Climate Simulations for Improved Climate Information over the Philippines: SST Influence, Variability and Extremes, Tropical Cyclone Activity" Program.[6] In the report, the downscaled historical and projected daily extremes data were used to calculate the projected changes in 24 climate extremes indices for two Representative Concentration Pathways: RCP4.5 and RCP8.5. Historical simulations for the baseline period (1986–2005) served as the threshold. The multi-model ensemble consisted of 12 models with three regional climate models (RCMs) forced with data from 10 global climate models (GCMs) from the Coupled Model intercomparison Project- Phase 5 (CMIP5) archive. SA-OBS, a daily gridded observational dataset for Southeast Asia based on the Southeast Asian Climate Assessment & Dataset project was used as the historically observed baseline data.

28. The Philippine Climate Extremes Report 2020 also presents information on historical and projected annual climate extremes indices of the country and demonstrates their relevance to sector-specific climate impacts assessment. The report extends the climate projection information released by DOST-PAGASA in 2018 which used the 10th, 50th, and 90th percentile thresholds of temperature and rainfall to describe the average annual and seasonal changes in future climate scenarios. The annual climate extremes indices were used to identify areas and sectors which are most at risk to climate extremes, and thus require rapid disaster risk assessment and climate adaptation planning to minimize current and future impacts.

29. These trends and scenarios, which are further discussed in the succeeding chapters, indicate that the country and the project location will not be spared by the impacts of climate change given its geographical location, archipelagic formation, biophysical characteristics, and population distribution. Additionally, even if GHG emissions are drastically reduced, the magnitude of GHG presence in the atmosphere is irreversible. Stabilizing these GHGs will take time and climate change impacts will continue to be felt for the years to come.

[6] DOST-PAGASA, Manila Observatory and Ateneo de Manila University. 2021. *Philippine Climate Extremes Report 2020: Observed and Projected Climate Extremes in the Philippines to Support Informed Decisions on Climate Change Adaptation and Risk Management*. Philippine Atmospheric, Geophysical and Astronomical Services Administration, Quezon City, Philippines. 145pp.

2.2 Climate Change Policy in the Philippines

30. In 2009, the Climate Change Act (Republic Act 9729) was enacted creating the Climate Change Commission (CCC) to help mainstream climate change into government policy formulations and establish framework strategies and actions towards adaptation and mitigation. After a year, the National Framework Strategy on Climate Change (NFSCC) was adopted to serve as a reference point to steer national mitigation and adaptation strategies. In line with the NFSCC, the Philippine Strategy on Climate Change Adaptation was prepared to guide the country's climate change adaptation actions.

31. In 2011, the National Climate Change Action Plan (NCCAP) outlined the priority areas for adaptation and mitigation.

32. In 2012, the People's Survival Fund (RA 10174) was passed to finance adaptation programs and projects based on the NFSCC. Important strategy documents include the NFSCC (2010–2022) and the NCCAP (2011–2028), which set out policies related to food and water security, environmental stability, human security, climate smart industries and services, sustainable energy, and knowledge and capacity development.

33. In terms of greenhouse gas (GHG) emissions, the Philippines emits an average of 1.98 metric tons of carbon dioxide equivalent per capita in 2020, or way below the global average of four (4) metric tons per capita. The Philippines commits to a projected GHG emissions reduction and avoidance of 75%, of which 2.71% is unconditional and 72.29% is conditional, representing the country's ambition for GHG mitigation for the period 2020 to 2030 for the sectors of agriculture, wastes, industry, transport, and energy. This commitment is referenced against a projected business-as-usual cumulative economy-wide emission of 3,340.3 $MtCO_2e$ for the same period.[7]

34. The Philippines ratified the Paris Agreement on 23 March 2017 and submitted its Nationally Determined Contributions to the United Nations Framework Convention on Climate Change (UNFCCC) in 2016. The Philippines submitted its Second National Communication to the UNFCCC in 2014, identifying agriculture, water resources, infrastructure, and human health as sectors highly vulnerable to climate change.[8]

2.3 PAGASA Climate Extreme Projection

35. Climate projections are necessary for climate change impact assessment and national planning. In particular, the impacts of climate change on road projects for the coming years are critical. With this, the project utilized the recent Philippine Climate Extremes Report 2020 published by DOST-PAGASA in partnership with Manila Observatory and the Ateneo de Manila University.

36. In the PAGASA 2021 report, the downscaled historical and projected daily extremes data were used to calculate the projected changes in 24 climate extremes indices for two Representative

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7 https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Philippines%20First/Philippines%20-%20NDC.pdf

8 Based on the Climate Risk Country Profile: Philippines

Concentration Pathways: RCP4.5 and RCP8.5. The annual extremes are averaged over the 20-year time periods to come up with the climatological extreme. The observed data is based on the SA-OBS gridded data for 1986–2005 while the projected changes are based on the ensemble median of the 12 models. The projections from two scenarios, RCP4.5 and RCP8.5, are provided for three time periods: early future (2020–2039), mid-future (2046–2065) and late future (2080–2099).

37. Based on DOST-PAGASA, climate extreme indices provide additional information that can describe the magnitude, frequency, and duration of extremes, which could help in the assessment of possible adaptation options. Extreme indices are grouped by variable (rainfall and temperature) and by attribute (magnitude, frequency, and duration).

2.4 Global Climate Extreme Projection

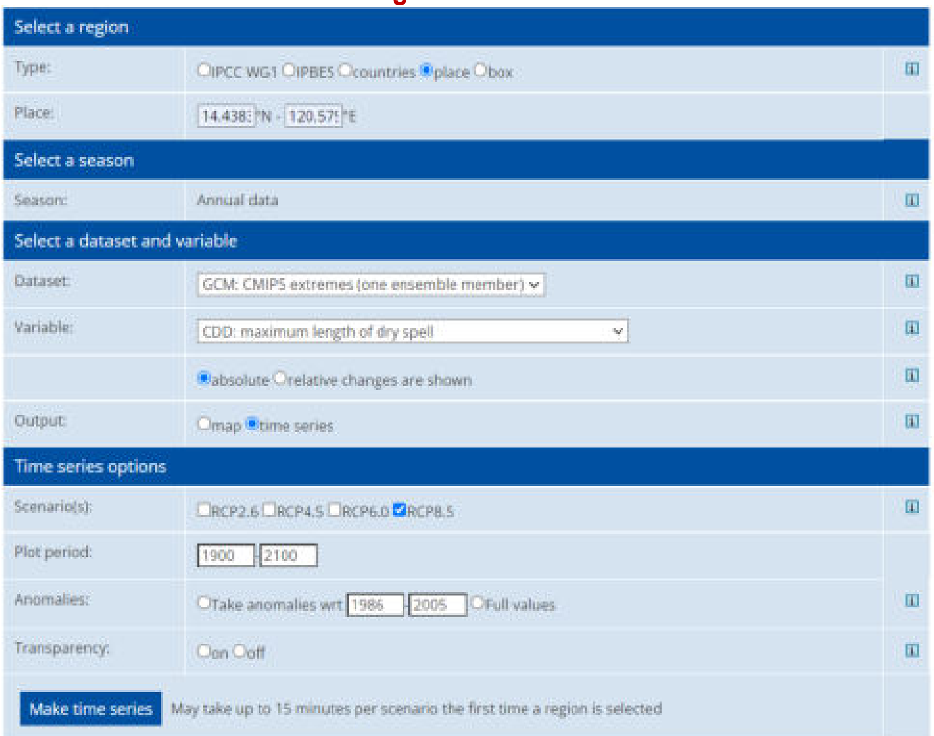
38. It is worthy to note that the use of projected average climate extremes published by PAGASA provides a good set of data to describe the general trajectories of rainfall but not to assess the adequacy of engineering designs that are generally based on climate extremes. In this assessment, extreme rainfall and temperature data were downloaded from the KNMI Climate Explorer, which provides 25 CMIP5 climate model results for the project.[9] The projected climate change was assessed based on the representative concentration pathways (RCP) 8.5 representing the high emission scenario.

39. The main objective is to comply with the DPWH standards of design flood frequency of 50 years. However, the assessment can achieve this objective by recognizing increased rainfall, typhoon, and flooding in the project area. A historical 1-day annual maximum daily rainfall (Rx1day) was adopted in the project. The level of precaution in the climate projection was set at 90.0 percentile and a stress test level of 97.5%.

40. Rx1day series (1900–2100) for the project area were downloaded from the KNMI Climate Change Atlas for CMIP5 extremes ensemble under RCP8.5 with the setup illustrated in Exhibit 2-1. The climate model outputs are separated for 1850–2005 and 2006–2100. Individual model results are provided in each subfolder for the specified RCP8.5 scenario. For the project site, 23 CMIP5 climate models are available and used in the assessment.

[9] The KNMI Climate Explorer is a tool to investigate the climate. http://climexp.knmi.nl/plot_atlas_form.py

Exhibit 2-1: KNMI Climate Change Atlas



2.5 Institutional Framework for Climate Change

41. Climate change risk assessment for road and bridge projects has not been much referred to in drawing up Philippine regulations and strategy. Currently, there are more requirements for projects to review climate change risk. Some of these are outlined below:

(i) Presidential Decree 1586 – Philippine Environmental Impact Statement System (PEISS) requires all agencies and instrumentalities of the national government, government- owned or controlled corporations, as well as private corporations, firms, and entities to conduct an environmental impact assessment for every proposed project and undertaking which significantly affects the quality of the environment. The PEISS requires the identification of direct and indirect impacts of a project on the biophysical and human environment and the development of appropriate environmental protection and enhancement measures to address adverse impacts and risks.

(ii) Republic Act No. 10121 (RA 10121), also known as the Philippine Disaster Risk Reduction and Management Act of 2010, to deal specifically with disaster risks.

(iii) The People's Survival Fund (RA 10174) was passed to finance adaptation programs and projects based on the NFSCC.

(iv) National Framework Strategy on Climate Change (2010–2022) and the National Climate Change Action Plan (2011–2028), which set out policies related to food and water security, environmental stability, human security, climate smart industries and services, sustainable energy, and knowledge and capacity development.

(v) Philippine Green Building Code, which aims to improve efficiency of building performance through a framework of standards that will enhance source environmental and resource management through efficient use of resources, site selection, planning, design, construction, use, occupancy, operation, and maintenance.

(vi) Republic Act 8749 – Philippine Clean Air Act of 1999, which aims to achieve and maintain healthy air for the people. It addresses air pollution coming from stationary sources such as fuel burning equipment and industrial plant; mobile sources such as motor vehicles; and other potential sources of air pollutants; and includes certain limits/standards and its corresponding penalties.

(vii) Republic Act 9275 – Philippine Clean Water Act of 2004, which provides the comprehensive water pollution policy and applies quality management in all water bodies in the Philippines. It aims to protect the country's water bodies from pollution from land-based sources (industries and commercial establishments, agriculture and community/household activities) and covers all water bodies such as fresh, brackish, and saline waters, and includes but not limited to aquifers, groundwater, springs, creeks, streams, rivers, ponds, lagoons, water reservoirs, lakes, bays, estuarine, coastal, and marine waters.

42. The highway designs and standards are considered when undertaking climate change risk assessment for transport projects. For the BCIB project, the primary design guidance is found in the Design Guidelines, Criteria and Standards (DGCS) Volumes 3, 4 and 5 (DPWH 2015), DGCS - DPWH Volume 2A, Geohazard Assessment 2015, American Association of State, Highways and Transportation Officials (AASHTO) (2020), National Structural Code of the Philippines 2015, and Highway Safety Design Standards (HSDS) of DPWH (2012).[10]

43. Various DPWH Departmental Orders (DO) have also been adopted as basis of design where relevant. Applicable DOs, but not limited to, are shown below:

Exhibit 2-2: DPWH Department Orders as it Relates to Climate Change

Department Orders	Title	Anticipated Climate Change Parameters
DO No. 88 s. 2020	Guidelines on the Design of Bicycle Facilities Along National Roads	GHG reductions, Change in temperature
DO No. 21 s. 2019	Amendment to the Guidelines on Price Adjustment on Payments for Projects with Non-Compliance with the Prescribed IRI Value	Rainfall, Temperature
DO No. 35 s. 2018	Revision on the Adoption of the DPWH Standard Specifications for Highways, Bridges and Airports, Volume II; for Public Works Structures, Volume III; Special Items of Work (SPLs) in DPWH Projects	Rainfall, Temperature

[10] Design standards and references are listed in the preliminary detailed designs report of each package for the BCIB project.

Department Orders	Title	Anticipated Climate Change Parameters
	and Revised Standard Pay Item List for Infrastructure Projects	
DO No. 116 s. 2018	Environmental Impact Assessment (EIA) for DPWH Projects and Tree Cutting Permit Application	GHG emissions, Change in temperature
DO No.166 s. 2016	Navigational Clearance for Bridges over Navigable Waterways	Water level, Flooding, Storm frequency
DO No. 53 s. 2016	Minimum Vertical Clearance Above the Roadway for Railway, Flyover, Bridge, and Footbridge Structures along and Crossing National Highways	Water level, Flooding, Rainfall intensity
DO No. 45 s. 2016	Bridge Seismic Design Specifications (BSDS), 1st Edition, 2013 with 2018 interim revisions	Typhoon, Surge
DO No. 41 s. 2016	Amended Policy Guidelines on the Maintenance of Roads and Bridges	Rainfall, Temperature
DO No. 32 s. 2016	Guidelines on the Use of Dowel Bars in Portland Cement Concrete Pavement	Increase in temperature
DO No. 8 s. 2016	Adopting Uniform Transition Joints on High Type Pavement Surfacing Along National Roads and Local Street	Change in temperature, Storm frequency
DO No. 135 s. 2015	Strict Compliance to Road Works Safety and Traffic Management and Construction Safety and Health Requirements during Construction and Maintenance of Roads and Bridges	Rainfall, Temperature
DO No. 90 s. 2015	Revised Guidelines on the Installation of Road Right-of- Way (RROW) Boundary Marker, Kilometer Post, and Street Name along National Highways on Rural and Urban Areas	Wind, Typhoon frequency
DO No. 47 s. 2015	Adoption of International Roughness Index Values for all National Primary Roads	Increase in temperature
DO No. 94 s. 2014	Technical Manuals and Guidelines on Road and Bridge Maintenance and Inspection	Water level and discharge, Rainfall
DO No. 40 s. 2014	Prescribing Minimum Design Standard for Portland Cement Concrete Pavement (PCCP) in Arterial and Secondary National Roads and Access Roads Leading to Ports	Change in temperature, Increase in precipitation, Storm frequency
DO No. 68 s. 2012	Prescribing Guidelines on the Design of Slope Protection Works	Landslide, Storm frequency
DO No. 41 s. 2012	Adoption of the Revised Manual on DPWH Highway Safety Design Standards, May 2012 Edition	Flooding, Storm frequency
DO No. 40 s. 2012	Guidelines on Shoulder Paving along National Roads	Flooding, Increase in Rainfall
DO No. 22 s. 2011	Minimum Pavement of Thickness and Width of National Roads	Storm frequency, Rainfall, Temperature
DO No. 245 s. 2003	An Act to Social and Environmental Management Systems 2016	Rainfall, Temperature, Wind speed, Water level,

3. CLIMATE RISK SCREENING AND ASSESSMENT

3.1 Climate Risk Screening

44. The BCIB project is classified as a 'Category A' project based on the ADB Environmental Safeguards Categories.[11] Category A projects are those that are likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented. Category A projects are those whose impacts may extend beyond the boundaries of the project or those of the project facilities.

45. Based on ADB climate risk screening checklists, the project climate risk classification is high, which means that it is extremely sensitive to climate impacts. A more detailed climate risk screening was prepared by ADB using AWARE for Investment that complements the information provided in the REA. Two sets of AWARE screening reports (AWARE BATAAN and AWARE CAVITE) were utilized for CRA report of the project.[12]

46. The exposure to climate hazards of the project locations is also high.[13] The project location has a high risk for precipitation increase, flood, sea level rise, landslide, wind speed increase, and onshore category storms and a medium risk for precipitation decrease. The study also identified drought and wildfires are climate risks but had minimal effect on the project design. A risk spider chart for Bataan, which is the same as Cavite, supports the high climate risk categorization of the project (Exhibit 3-1).

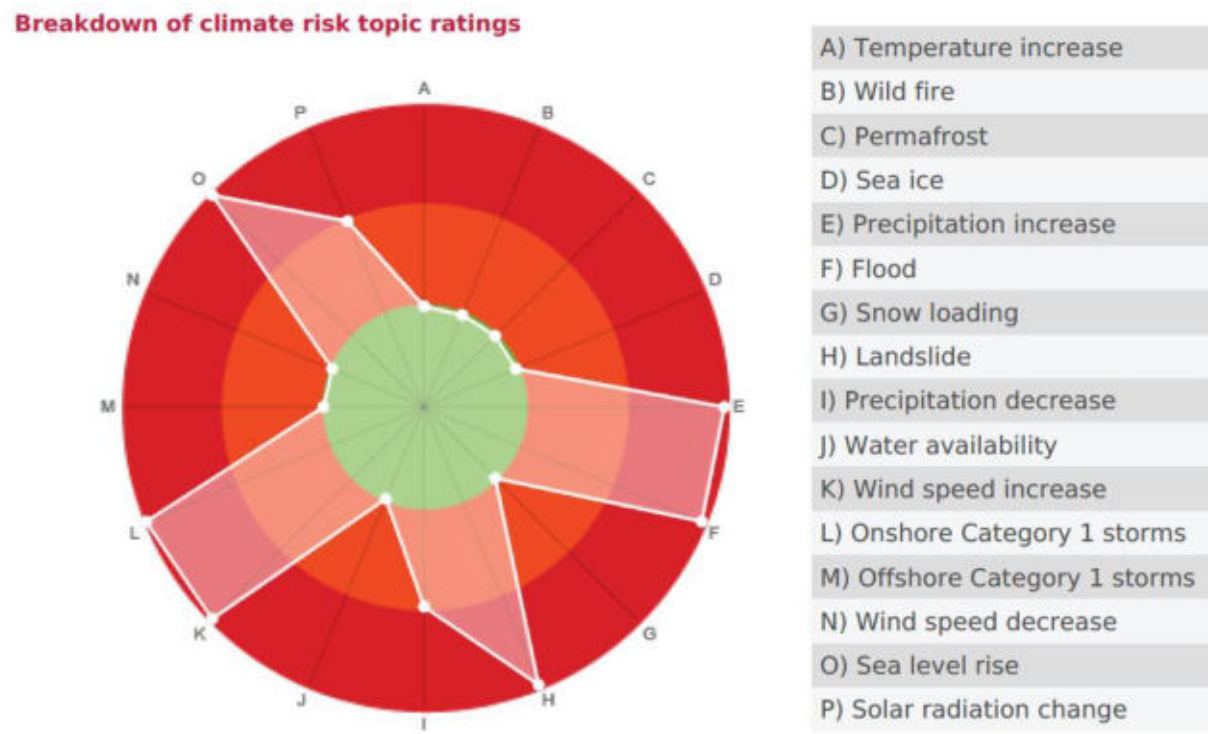
47. The potential impacts of climate hazards on the project's physical infrastructure and assets as currently designed is high. Climate hazards have the potential to significantly impact the structural integrity, materials, siting, longevity, and overall effectiveness of the investments.

3.2 Climate Risk Assessment

48. Climate model projections agree to the increasing temperature, high intensity and frequency of heavy rainfalls, increased frequency of typhoons, sea level rise and storm surge in the project locations. The annual rainfall will likely decrease, but Rx1day will increase its magnitude. Also, climate change is projected to influence the anomaly of sea level rise. Engineering designs and specifications need to take into consideration the impact of climate change on the risks to the project.

[11] The environment categorization was made in conformance with ADB Safeguard Policy Statement 2009 during the environment impact assessment preparation for the BCIB project.
[12] AWARE for Bataan and Cavite projects created, and report generated by Carlito Mendoza Rufo, Jr., Asian Development Bank. February 05, 2022.
[13] Climate and Disaster Risk Screening Report for Bataan-Cavite Interlink Bridge Project.

Exhibit 3-1: The Project Climate Risk Ratings



49. The transport sector particularly bridges is vulnerable to changes in climate variables, expected changes in the frequency and intensity of extreme weather events, and increased sea level. IPCC's AR5 describes that climate change may negatively affect roads and bridges infrastructure in a variety of ways, including the following:[14]

(i) Changes in temperature – both gradual increase in temperature and an increase in extreme temperatures are likely to impact bridge deck material (for example, heat-induced heaving and buckling of joints).

(ii) Changes in sea water levels will impact bridge foundations and structures.

(iii) Extreme weather events such as stronger and/or more frequent storms will affect the capacity of drainage and overflow systems to deal with stronger or faster velocity of water flows.

(iv) Increased wind loads and storm strengths will impact long-span bridges, especially suspension and cable-stayed bridges.

(v) Increased storm surges will significantly impact all components of the coastal transportation infrastructure.

[14] Climate Proofing ADB Investment in the Transport Sector

(vi) Increased salinity levels will reduce the structural strength of pavements and lead to precipitated rusting of the reinforcement in concrete structures.

50. Based on the design standards adopted for the BCIB project detailed designs, the road and bridge design criteria are robust to meet the context of the Manila Bay geotechnical conditions, large expanse of the crossing and secure against the potential for vessel collision, and therefore additional measures for climate change mitigation and adaptation are not necessary.

3.3 Sensitivity of Project Components to Climate/Weather Conditions and Sea Level

51. The project components are likely to be exposed to climate conditions such as precipitation increase, changes in temperature, flood, landslide, wind speed increase, sea level rise, and onshore category 1 storms and medium risk for precipitation decrease. The key components of the project have been reviewed for the potential to be affected by climatic conditions during construction and the project lifetime as shown in Exhibit 3-2.

Exhibit 3-2: Project Components and their Sensitivity to Climate Conditions

Project Components	Sensitivity to Climate Conditions
Navigation bridges – The main structure that provides the necessary navigation clearance for safe operation of shipping at the project site.	**Sea Level Rise.** Climate change is expected to contribute to more rapid sea level rise. It will impact the horizontal and vertical navigational clearances over navigable waters. **Storm Surge and Waves**. Storm surge is caused by strong winds and pressures, which lead to a rise in water surge. Storm surge during powerful storms or hurricanes can reach over 20 feet (6 m) in elevation and can cause significant damage to bridges.[15] Additionally, waves are more powerful and have higher arches, which can cause considerable damage to bridges. Since most infrastructure design is based on historical data and experience, the asset design is not always capable of withstanding such impacts. **Wind Speed Increase**. Increased storm surges will significantly impact all the components. Increased wind loads and storm strengths will impact roadside street lightings, traffic barriers, and cable-stayed bridge structures. **Tropical Storms/Typhoon.** Bridges may encounter stronger and more powerful storm surges and waves causing direct physical damage. **Increase in Temperature.** Both a gradual increase in temperature and extreme temperature - are likely to impact bridge pavements. Bridges are subject to many modes of heat transfer and variation in the average daily temperature can cause bridges to extend or shorten.
Marine viaducts – The typical viaduct structures which will be constructed above sea water with varying column heights and water depths. Constant span	The sensitivity to climate conditions of the navigational bridge has similar impacts to the marine viaducts. However, marine viaducts are also sensitive to the following:

[15] NOOA, National Hurricane Center: Storm Surge overview. Retrieved from http://www.nhc.noaa.gov/surge/ on September 9, 2015.

Project Components	Sensitivity to Climate Conditions
arrangement is adopted to have standardized construction methodologies and minimize the duration of the construction program.	**Sea Water Levels.** It will impact bridge foundations and structures and navigation span for small vessels sailing near the shore. **Coastal Scouring**. Extensive damage associated with scour can cause a bridge to collapse. Scour causes stabilizing material to move away from the bridge substructure, causing instability of the bridge's foundation.
Interchanges and viaducts on land – These are the viaduct structures which will be constructed on land and provide the connection to the existing road networks.	**Increase Precipitation.** Heavy rainfall may affect the optimal number of bridges and culverts and bridge and culvert design adequacy. Increased frequency of heavier short duration rainfalls is expected to cause more frequent and severe flash floods. Higher flow rates can create erosion and carry debris (large boulders and trees) that can create dams behind bridges or directly impact the footings of the bridge and cause it to collapse. **River Scouring**. Extensive damage associated with scour can cause a bridge to collapse. Scour causes stabilizing material to move away from the bridge substructure, causing instability of the bridge's foundation. **Landside.** Heavy rainfall may also affect soil saturation which can cause landslides along with the sloping areas of the project sites. **Tropical Storms/Typhoon.** Extreme weather events, such as stronger and/or more frequent storms, will affect the capacity of drainage and overflow systems to deal with stronger or faster velocity of water flows. Increased flooding events may adversely affect the road and waterway bridge infrastructure if not designed adequately. **Wind Speed Increase.** Increased wind loads and storm strengths will impact roadside street lightings, traffic barriers and tree landscapes.

4. DESCRIPTION OF ENVIRONMENT AND CLIMATE

4.1 Local Climate (Baseline)

52. This section describes the climatic characteristics based on records from two different weather stations near the project location. First is the Sangley Point station in Cavite located at the southern side with geographic coordinates of 14°29'29.23" north latitude and 121°53'54.90" east longitude, and about 20 km away from Cavite interchange station. Second is the Cubi Point station on the northern side at the coordinates of 14°47'30.43" north latitude and 121°16'15.24" east longitude and approximately 45 km away from the Bataan interchange project.

53. Aside from two (2) stations datasets, the baseline climate conditions of the project areas at the provincial scale are taken following the latest Philippine Climate Extreme Report.

54. In terms of climate classification, the prevailing winds and topography constitute the major climatic controls that forge the climate in the area (Exhibit 4-1). The provinces of Bataan and Cavite, including Corregidor Island, are under Type I climate based on Modified Corona's Classification. This climate type is characterized by two pronounced seasons, wet and dry. It is relatively dry from November to April and wet during the rest of the year. These two provinces are influenced by the southwest monsoon (*habagat*) that is generally enhanced by passing typhoons or tropical depressions. The northeast monsoon (*Amihan*) occurs from October to April due to the Philippines' geographical location. It is also a perennial path of typhoons crossing the Philippine archipelago.

4.1.1 Rainfall

55. The average rainfall from the PAGASA daily data indicates that the total monthly rainfall is constantly low during the first quarter of the year, then escalates from May, reaching its highest value in August, then declines until December. The highest average monthly rainfall reached 492 mm at Sangley Point and 837 mm at Cubi Point, both in August, while the lowest recorded was 15 mm at Sangley Point in March and 4 mm at Cubi Point in February (Exhibit 4-2). This is similar to the recorded climatological normal in 1981–2010, where trends consistently follow the Type I climate category description.

56. The total average rainfall based on 1991–2020 records was about 2,100 mm, with an annual average number of 130 rainy days at Sangley Point. The total average rainfall recorded (1994–2020) at Cubi Point was about 3,400 mm with an annual average number of rainy days of 125. The highest annual rainfall at Sangley Point was recorded in 2013 with 3,562 mm. The daily maximum total was 475 mm on 19 August 2013. At Cubi Point, the highest recorded was in 2011 with 5,463 mm rainfall while the daily maximum total was 432 mm on 5 July 2016.

4.1.2 Temperature

57. The temperature recorded from Sangley Point and Cubi Point has the lowest value in December then increases from January to May (Exhibit 4-3). Sangley Point recorded an annual temperature that ranges from 26.67 °C to 27.9 °C, with the highest temperature in 1998 and the lowest temperature in 1999. During the same period, Cubi Point recorded an annual temperature range of 27.69 °C to 28.55 °C, with the highest temperature in 2020 and the lowest in 1993 (Exhibit 4-4). The difference between the highest and lowest temperatures over last 30 years is 1.23 °C (Cavite) and 0.89 °C (Zambales).

Exhibit 4-1: Climate Map of Luzon, Philippines

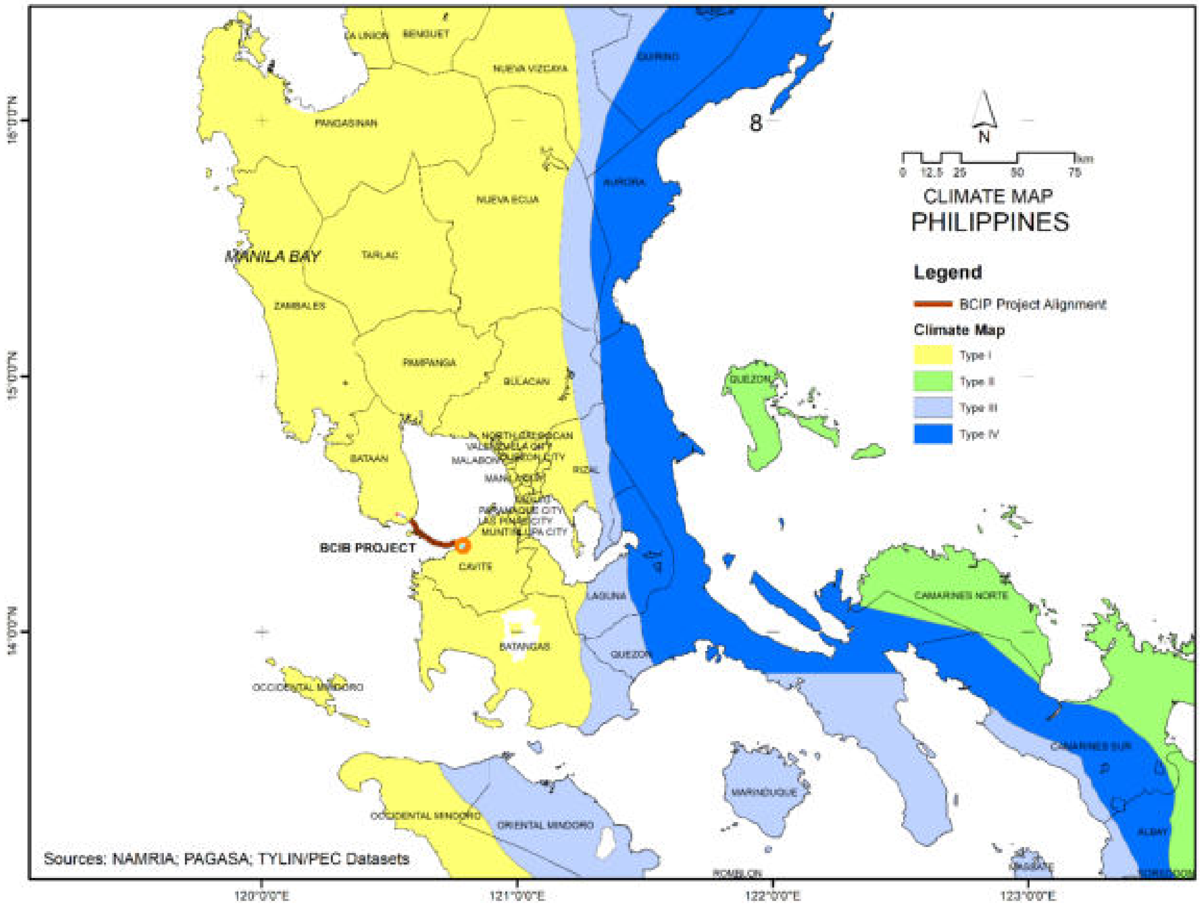
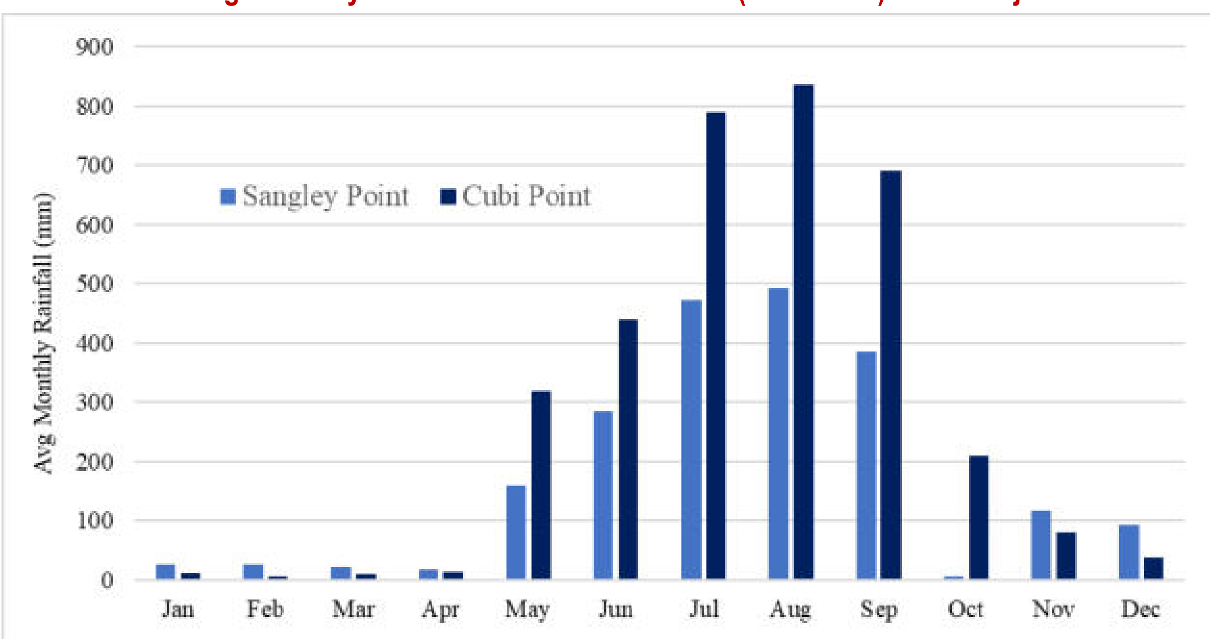
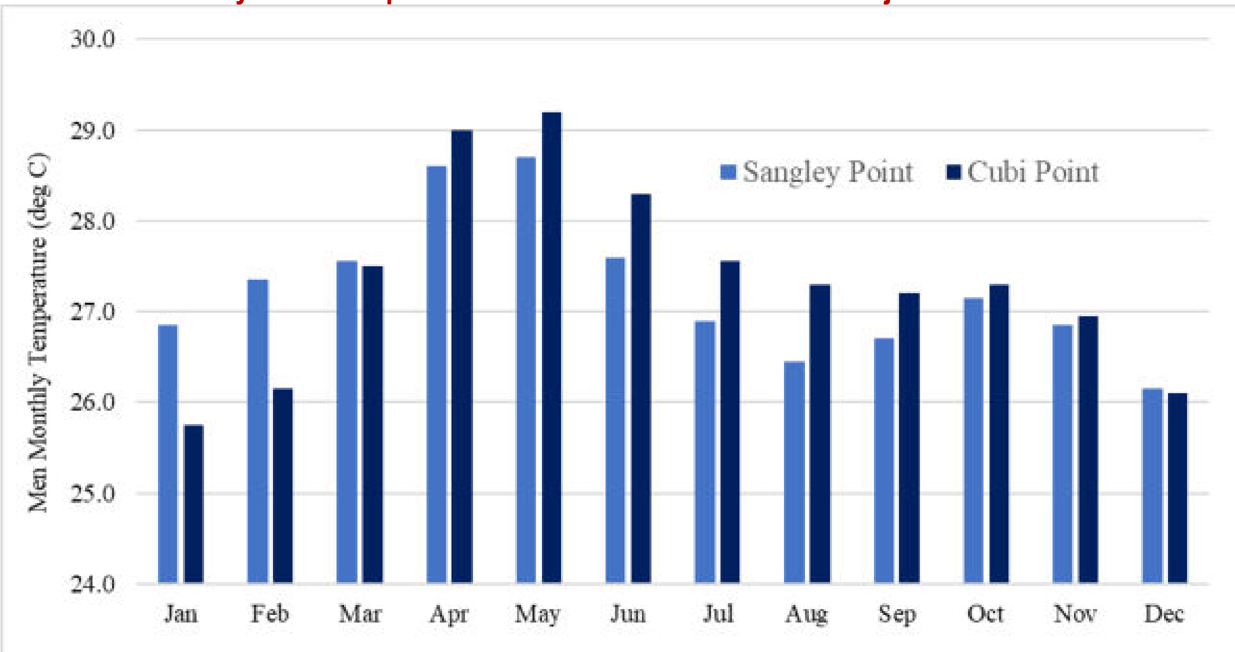


Exhibit 4-2: Average Monthly Rainfall for the Last 30 Years (1991–2020) in the Project Areas



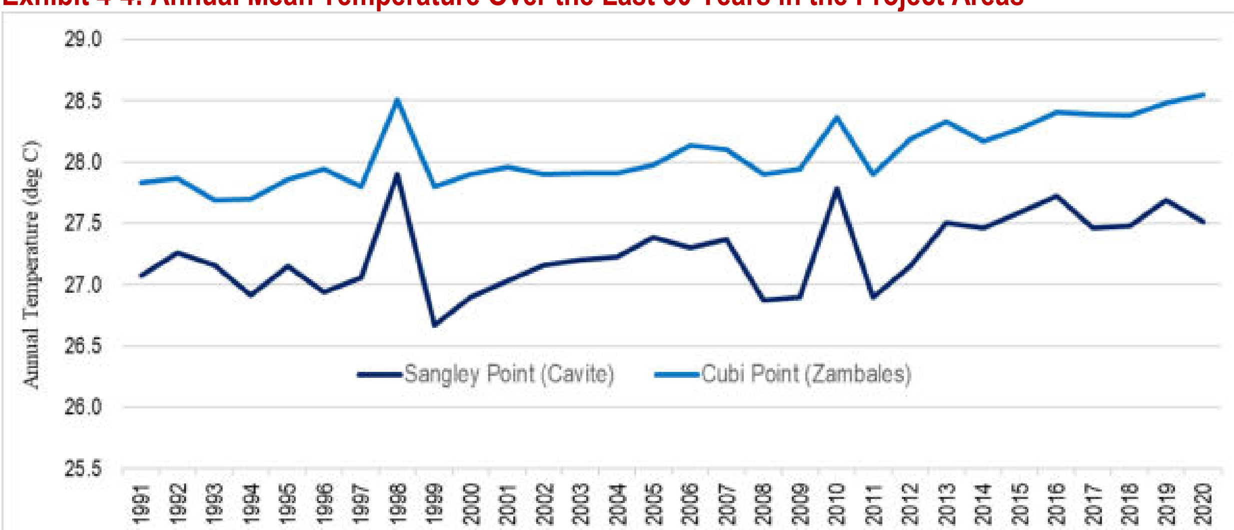
Note: Interpolated based on DOST-PAGASA datasets (1991-2020)

Exhibit 4-3: Monthly Mean Temperature for the Last 30 Years in the Project Areas



Note: Interpolated based on DOST-PAGASA datasets (1991-2020)

Exhibit 4-4: Annual Mean Temperature Over the Last 30 Years in the Project Areas



4.1.3 Wind Regime

58. A wind rose analysis is included to describe the prevailing wind in the project areas based on wind speed and direction from the PAGASA weather stations. From October to April, ESE winds dominate the region and shift from the westerly direction from May to September. Average wind speed during *Amihan* ranges from 3.1m/s–3.5m/s and during *Habagat,* 2.8 m/s – 3.1 m/s.

According to the Beaufort Wind Force Scale, this wind intensity is described as light (Exhibit 4-5 and 4-6).

Exhibit 4-5: Windspeed and Direction during *Amihan* Season

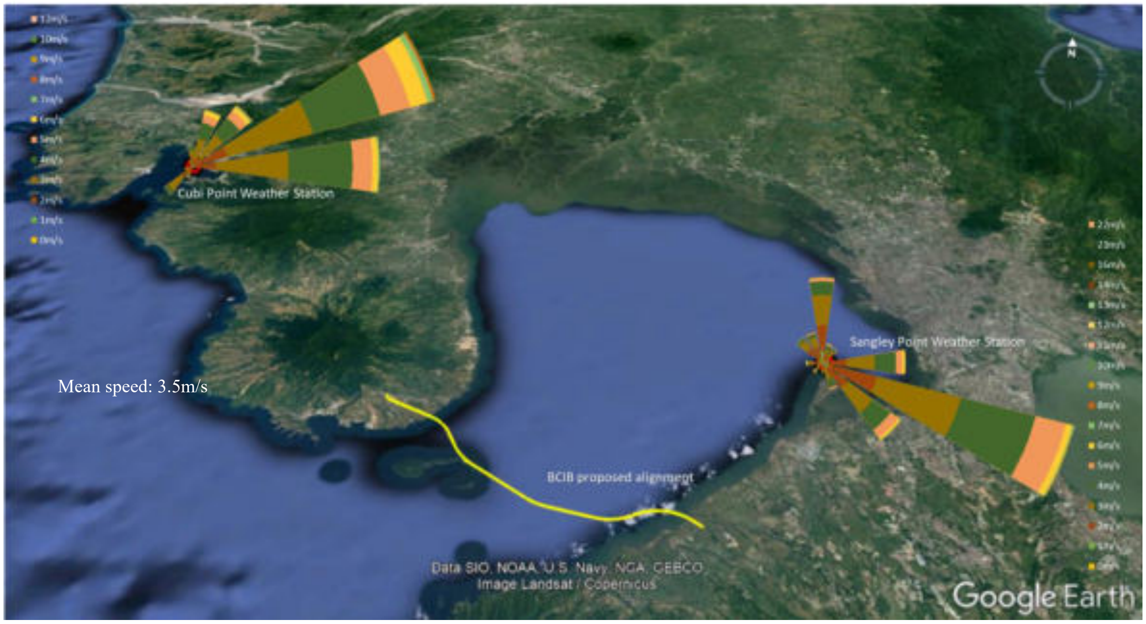


Exhibit 4-6: Windspeed and Direction during *Habagat* Season

4.1.4 Magnitude of Extreme Events

59. The climatological extreme values of the monthly and annual summaries of temperature, rainfall, and wind speed influencing the project locations are presented in Exhibits 4-7 and 4-8. In

Sangley Point station in Cavite, the recorded annual extreme high and low temperatures (1974–2020) were 38.5 °C on 16 May 1987 and 18.0 °C on 01 February 1982, respectively. The most significant daily rainfall recorded was 475 mm on 19 August 2013. The strongest wind recorded was on 13 July 2010 at 54 m/s blowing at an easterly direction.

60. In Cubi Point station in Zambales, the recorded annual extreme high and low temperatures (1994 – 2020) were 39.2 °C on 15 April 2018 and 17.3 °C on 03 February 2020, respectively. The most significant daily rainfall recorded was 436 mm on 22 July 2018. The strongest wind was recorded on 03 November 1995 at 40 m/s towards the east-north-east direction.

61. Comparing the baseline magnitude of rainfall and temperature extremes for Cavite and Bataan, the recorded and observed (baseline) values are not distinct. It must be noted that the baseline datasets only cover the period from 1986 to 2005, and it was the average of the 20-year observation. Extreme rainfall events from Sangley Point in Cavite (475 mm) and Cubi Point in Zambales (436 mm) stations were recorded in 2013 and 2018, respectively, beyond the baseline period. It was recorded on a single-day rainfall event and reached as much as 480 mm over the project areas (Exhibit 4-9).

62. The magnitude of extreme temperatures (low and high) was recorded later than the baseline period. Other details are presented in Exhibit 4-10.

4.1.5 Cyclone Frequency and Magnitude

63. The most number of cyclones occur from June to December. These tropical cyclones are associated with the occurrence of low-pressure areas typically originating over the North-Western Pacific Ocean side of the Philippine Area of Responsibility (PAR) and generally moving northwestward. Tropical cyclones also develop in the West Philippines Sea. These cyclones have unusual motions and are rare, with just 32 occurrences in more than 70 years. PAGASA categorizes cyclones based on their sustained winds as i) tropical depressions (TD) with wind speeds of up to 61 kph or less; ii) tropical storm (TS) with wind speeds of 62 – 88 kph, iii) severe tropical storm (STS) with a wind speed of 89 – 117 kph, iv) tropical typhoon (TY) with wind speeds of over 118–220 kph, and v) super typhoon with a wind speed of more than 220 kph.

64. With a medium to high risk, Bataan and Cavite are hit by one typhoon per year (Exhibit 5-11). In 2020, for instance, the project areas were among those that were affected by Super Typhoon *Rolly*[16] or Goni (international name) that occurred in the PAR on 29 October 29–01 November 2020. Super typhoon *Rolly* had sustained winds of more than 220 km/h. It made its first landfall over Bato, Catanduanes, and second landfall in Tiwi, Albay. It weakened into a typhoon and made its third landfall in San Narciso, Quezon, and fourth landfall in Lobo, Batangas on 01 November 2020. It eventually continued to weaken and became a tropical storm. Before leaving the Philippine Area of Responsibility, Super Typhoon *Rolly* also left damage in Southern Luzon and the south of Metro Manila. In particular, 2,030,130 persons from regions 1–3, CALABARZON, MIMAROPA, Region V, Region VIII, CAR, and NCR were affected by Super Typhoon *Rolly*. There were 25 dead, 399 injured, and six missing. A total of 170,773 houses were damaged. The total cost of damage in infrastructure amounted to about Php 13 Billion and Php 5 Billion in agriculture. The

[16] Typhoon Rolly is the most powerful storm recorded worldwide in 2020 and intensified into a super typhoon.

super typhoon caused various incidents/situations, namely: 23 flooded areas, two landslide/soil collapses, one maritime incident, seven places with uprooted trees/fallen posts and one lahar flow.[17]

65. In November–December 2019, typhoon *Kammuri*, with local name *Tisoy*, hit Central Luzon and Bataan with maximum sustained winds of 150 kph and gustiness of up to 185 kph which caused moderate wind damage all over these provinces. Still another strong typhoon was *Rammasun* (local name typhoon *Glenda*), which hit the country in 2014. Its winds peaked at 120 kph and gustiness at 165 kph and caused widespread flooding due to heavy downpours.

66. On 8 September 2021, Severe Tropical Storm *Jolina* made another landfall in San Juan, Batangas. Despite interaction with land in South Luzon, the system maintained strength while traversing CALABARZON region. It then weakened as its low-level circulation center became disorganized over Manila Bay, with the PAGASA downgrading it into a tropical storm. Tropical Storm Jolina made its last landfall in the Philippines in Mariveles, Bataan, at 17:00 PHT, with winds at 120 km/h (75 mph).

67. From 1948 to 2020 (more than 70 years), PAGASA recorded an annual average of 20 tropical cyclones in the PAR, with nine passing through Philippine landmasses. For instance, PAGASA tracked 27 tropical cyclones that crossed Bataan while 26 tropical cyclones crossed the Province of Cavite from 1948–2020 as shown in Exhibits 4-12 and 4-13. The months from September to October see many tropical cyclones traversing the project location (Exhibit 5-14).

68. Thirteen typhoons, or about 48% of tropical cyclones and 11 tropical storms are recorded to have crossed Bataan from 1948 to 2020. Likewise, 11 typhoons, or about 42% of tropical cyclones and 12 tropical storms were recorded to have crossed the province of Cavite. The pattern shows no indication of an increase in the frequency, but a slight increase in the number of tropical cyclones with maximum sustained winds of greater than 150 kph and above (typhoon category) are observed to occur during El Nino years. Other details are shown in Exhibit 4-15.

Exhibit 4-7: Climatological Extremes Recorded (1974 -2020) at Sangley Point Station in Cavite Province

Month	Temperature (°c)				Greatest daily rainfall (mm)		Strongest winds (mps)		
	High	Date	Low	Date	Amount	Date	Spd	Dir	Date
Jan	34.8	01-25-1999	19.0	01-03-1982	94.0	01-12-1977	17	ESE	01-19-2010
Feb	35.2	02-28-1998	18.0	02-01-1982	45.8	02-06-2016	15	ESE	02-27-1992
Mar	36.6	03-29-1981	19.1	03-25-1980	102.2	03-21-2018	24	ESE	03-23-1998
Apr	37.8	04-07-1983	21.5	04-03-2007	53.9	04-24-1975	16	ESE	04-05-1996
May	38.5	05-16-1987	22.0	05-15-1980	237.1	05-26-1997	27	SW	05-22-1976
June	38.4	06-04-1987	22.0	06-16-1981	172.4	06-27-1985	25	SE	06-08-2011
July	36.3	07-25-2007	21.2	07-15-1982	231.4	07-20-2002	54	E	07-13-2010
Aug	36.5	08-16-2009	22.0	08-02-1994	475.4	08-19-2013	30	W	08-18-1990
Sep	35.6 35.6	09-02-1996 09-11-2020	21.0	09-16-1979	275.4	09-22-2013	44	NNW	09-28-2006
Oct	35.8	10-08-1996	21.0	10-24-1988	260.7	10-05-1986	45	NW	10-21-1994
Nov	36.4	11-08-1978	21.5	11-26-1982	171.2	11-02-2000	49	NW	11-03-1995
Dec	34.0	12-06-1998	20.0	12-24-1985	131.3	12-10-2006	22	NNW	12-05-1993
Annual	**38.5**	**05-16-1987**	**18.0**	**02-01-1982**	**475.4**	**08-19-2013**	**54**	**E**	**07-13-2010**

[17] Dela Cruz Santos (2021). 2020 tropical cyclones in the Philippines: A review. p.193.

Source: PAGASA-DOST

Exhibit 4-8: Climatological Extremes Recorded (1994 – 2020) at Cubi Point Station in Zambales

Month	Temperature (°C)				Greatest Daily Rainfall (mm)		Strongest Winds (m/s)		
	High	Date	Low	Date	Amount	Date	Spd	Dir	Date
Jan	35.2	01-31-2007	17.5	01-25-2014	14.8	01-07-2006	25	ENE	01-05-2020
Feb	38.0	02-20-1998	17.3	02-03-2020	13.0	02-06-2008	21	NE	02-13-2018
Mar	36.8	03-28-2014	19.4	03-02-2019	46.0	03-02-2013	19	ENE	03-17-2011
Apr	39.2	04-15-2018	21.5	04-27-1997	25.0	04-25-2014	17	ENE	04-02-2017
May	38.9	05-04-2016	21.5	05-05-1997	314.5	05-26-1997	27	WSW	05-27-2003
June	38.2	06-04-2013	19.0	06-04-1995	230.0	06-06-2004	28	SW	06-24-2011
July	36.2	07-03-1995	20.0	07-31-2007	436.4	07-22-2018	29	ENE	07-16-2014
Aug	36.3	08-17-2017	21.4	08-28-2008	293.0	08-07-2012	25	SW	08-18-1997
Sep	35.7	09-28-2010	21.0	09-02-1996	401.2	09-27-2011	34	WSW	09-27-2011
Oct	35.3	10-07-2010	20.6	10-01-2012	175.6	10-23-1998	30	SW	10-23-1998
Nov	34.7	11-01-2011	20.5	11-09-2016	121.4	11-03-2000	40	ENE	11-03-1995
Dec	34.5	12-25-2016	18.5	12-26-1996	114.0	12-15-2015	20	E	12-28-2012
Annual	**39.2**	**04-15-2018**	**17.3**	**02-03-2020**	**436.4**	**07-22-2018**	**40**	**ENE**	**11-03-1995**

Source: PAGASA-DOST

Exhibit 4-9: Comparison of the Greatest Daily Rainfall Between Weather Station Values and the Baseline (Observed)

Location	Rainfall (mm)	Date
Synoptic Stations		
Sangley Point, Cavite	475.4	08-19-2013
Cubi Point, Zambales	436.0	07-22-2018
Bataan, Baseline (Observed)[a]		
Maximum 1-day total	133.1	1986-2005
Maximum 5-day total	360.6	1986-2005
Total rainfall from extremely wet days	206.5	1986-2005
Cavite, Baseline (Observed)[a]		
Maximum 1-day total	116.4	1986-2005
Maximum 5-day total	243.2	1986-2005
Total rainfall from extremely wet days	162.0	1986-2005

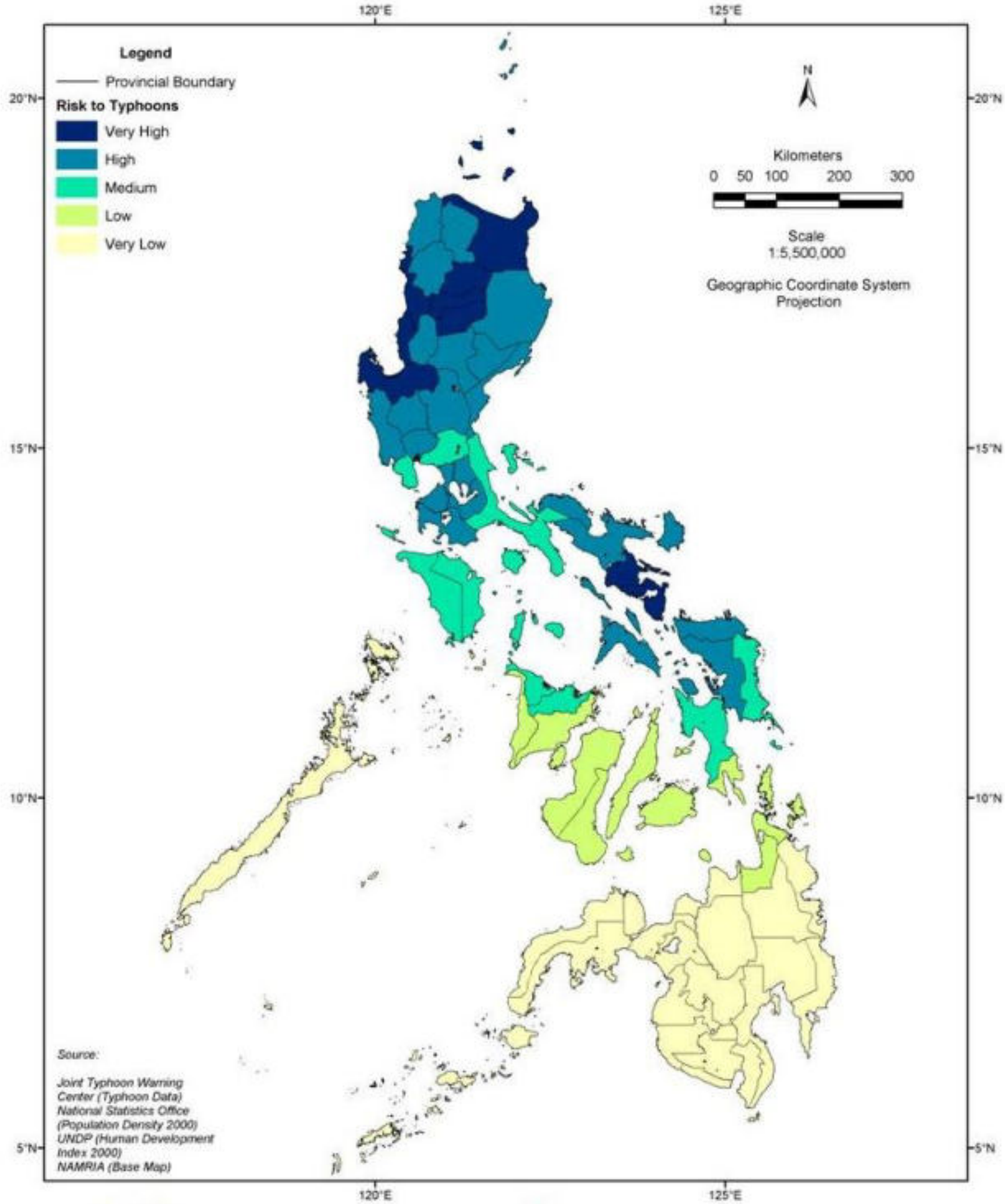
[a] Source: Philippine Climate Extremes Report 2020

Exhibit 4-10: Comparison Between the Recorded Temperature Extremes in the Weather Stations and the Baseline (Observed)

Temperature Extremes	Weather Station		Baseline[a]	
	Sangley Point, Cavite	Cubi Point, Zambales	Bataan	Cavite
Temperature (low)/ Coldest night time temperature (TNn), °C	18.0	17.3	17.2	17.5
Temperature (high)/ Warmest day time temperature (TXx), °C	38.5	39.2	35.7	35.5

[a] Source: Philippine Climate Extremes Report 2020

Exhibit 4-11: Typhoon Risk Map of the Philippines



Source: Joint Typhoon Warning Center (Typhoon Data 1945-2003) National Statistics Office (Population Density 2000) UNDP (Human Development Index 2000) NAMRIA (Base Map 1998)

Exhibit 4-12: Tropical Cyclone Tracks in the Province of Bataan (1948 to 2020)

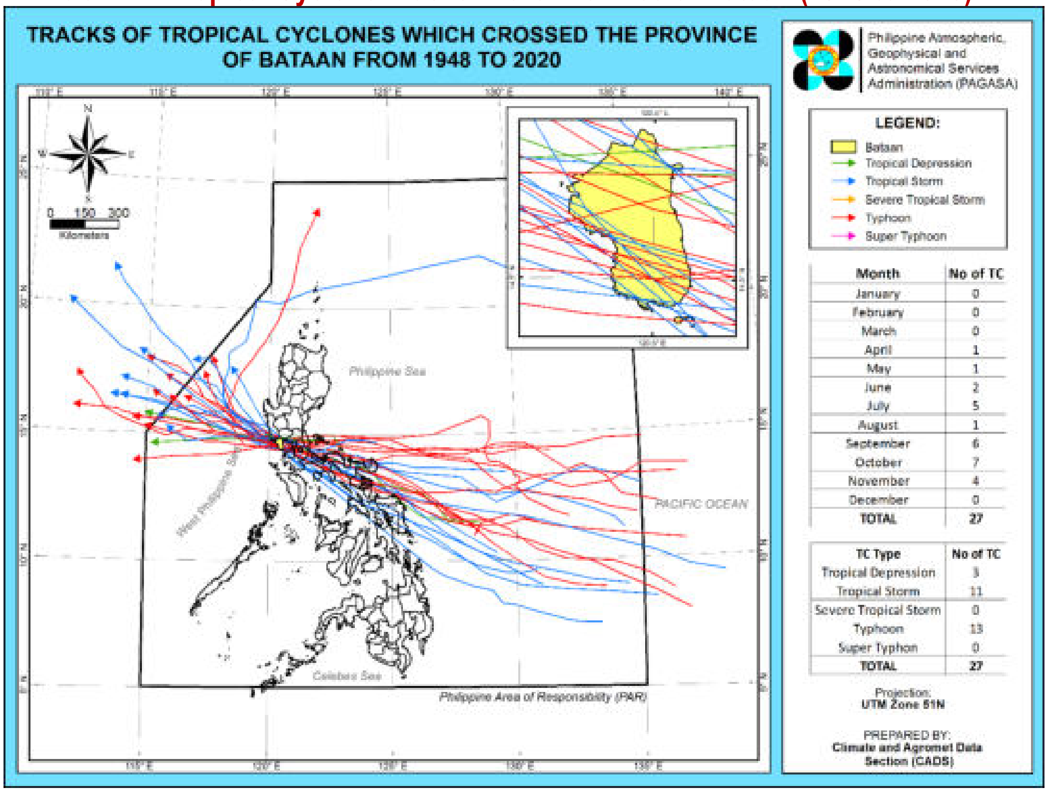


Exhibit 4-13. Tropical Cyclone Tracks in Cavite (1948 to 2020)

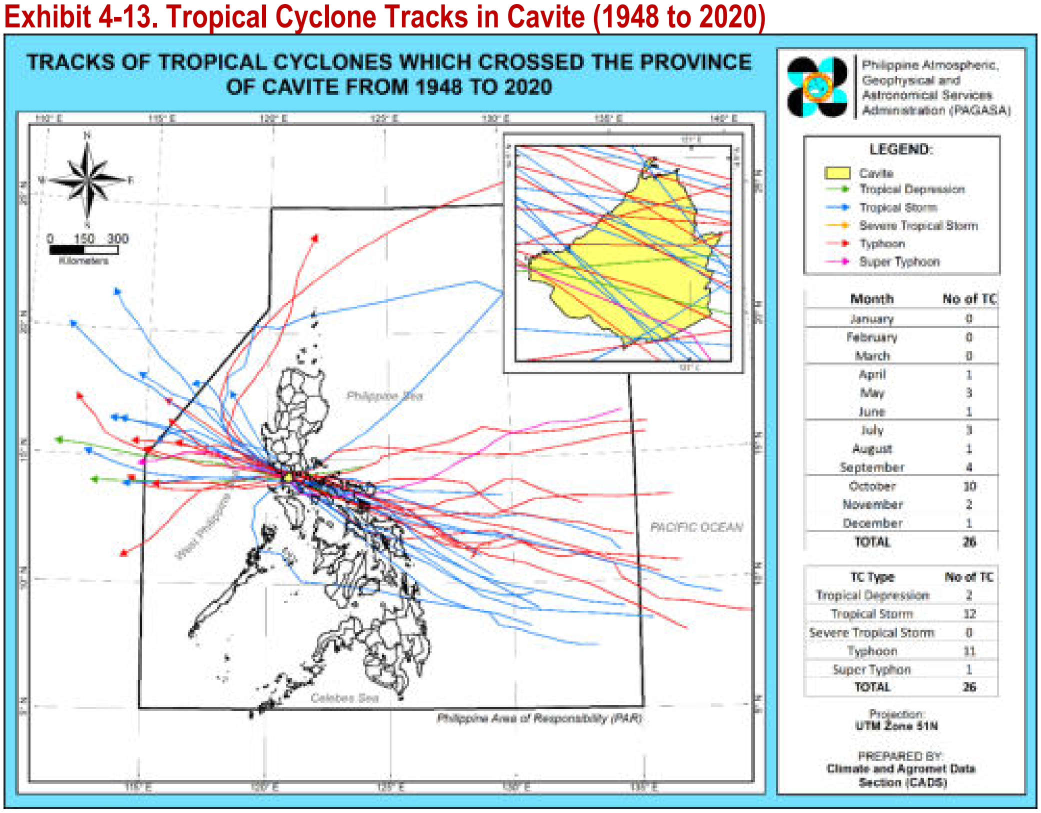
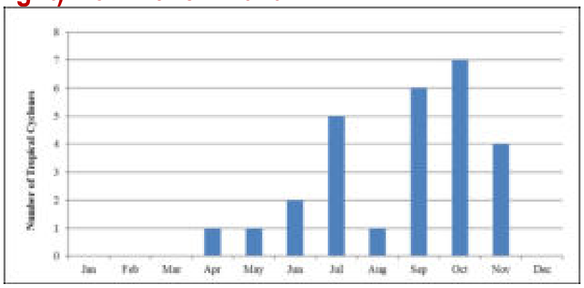


Exhibit 4-14: Monthly Distribution of Tropical Cyclones which Crossed Bataan (left) and Cavite (right) from 1948 – 2020



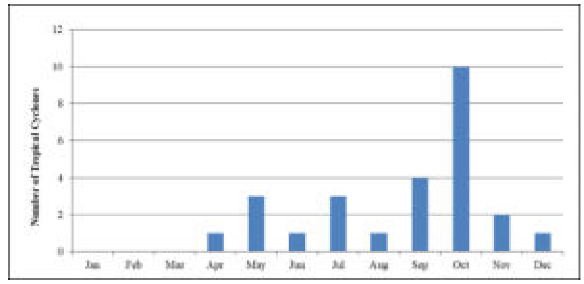
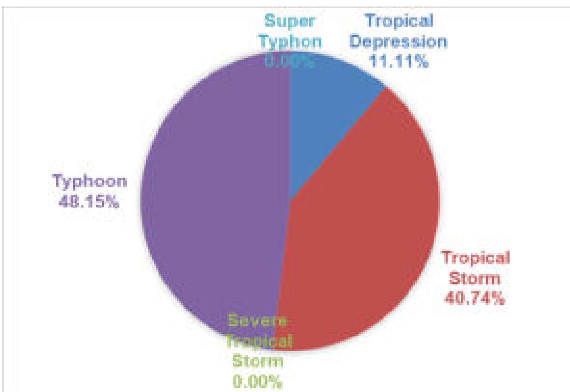
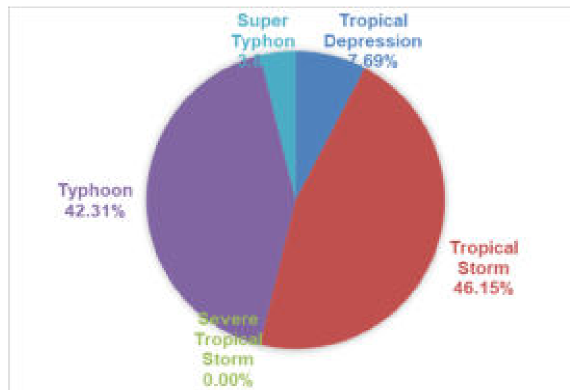


Exhibit 4-15: Breakdown of Tropical Cyclones which Crossed Bataan (left) and Cavite (right) from 1948 to 2020





4.2 Topography, Geomorphology, and Soils

4.2.1 Topography

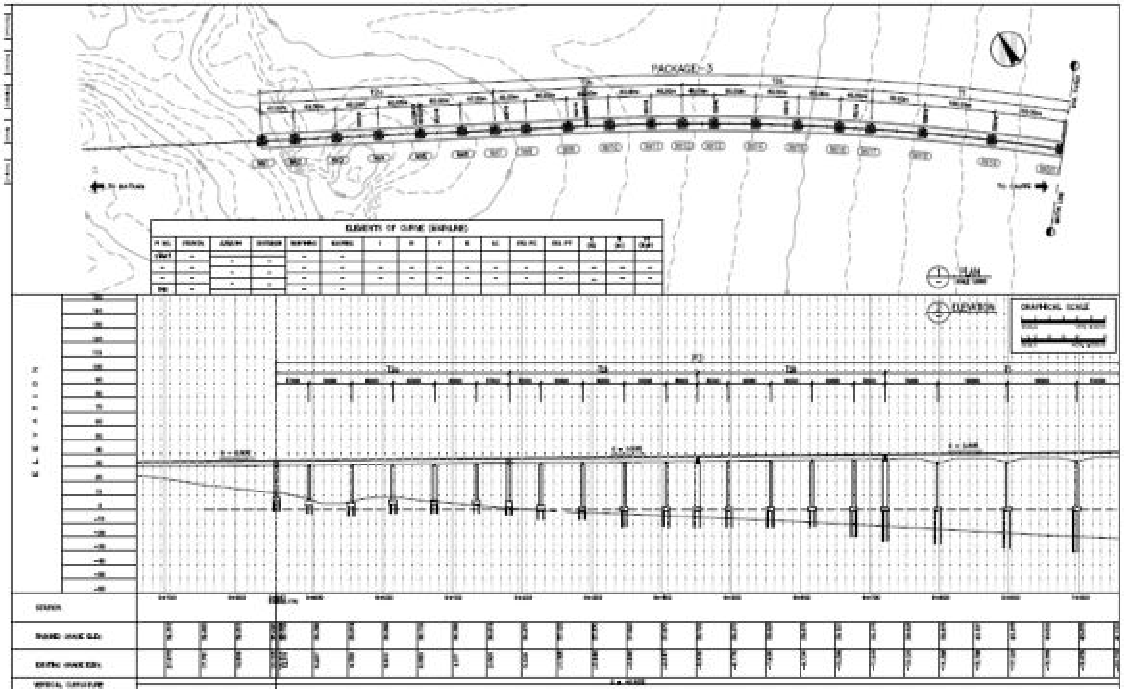
69. The project will link Bataan and Cavite through a 32.15-km bridge across Manila Bay. The bridge on the Bataan side will be landing on the Municipality of Mariveles, traversing the barangays of Alas-asin and Mt. View. On the Cavite side, the bridge will be landing on the Municipality of Naic, traversing barangays Timalan Concepcion and Timalan Balsahan. It should be pointed out that the alignment will not touch Corregidor Island but will pass through the southwest tip of the island.

70. Along the project alignment, the topography of the area is composed of hilly coasts of Bataan and Corregidor Island, alluvial plains in Cavite, flat to gently sloping bathymetry at the Southern Main Navigation Channel, and sloping bathymetry at the Northern Main Navigation Channel (Exhibits 4-16 - 4-18).

71. Based on the bathymetric profile, three levels of marine terraces can be observed from the main navigation channels (i.e., offshore) to the inland terrace. They are step-like landscape exhibits along with coastal areas and inland surface water bodies formed by coastal erosions and reflect the history of sea-level changes. "Level 1" is the offshore area with relatively flat and deep bathymetry

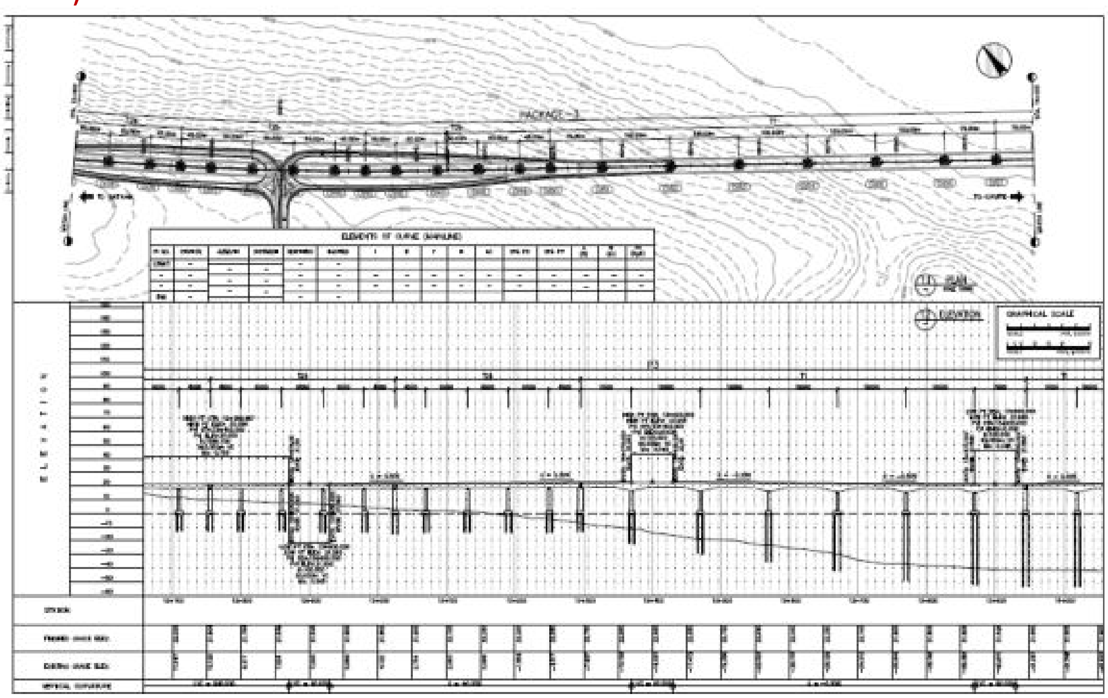
where main navigation channels situate. It is terminated by a change of slope at near shores reached by "Level 2." "Level 3" demarcates the coastlines of Bataan, Corregidor Island, and Cavite by coastal slopes where slopes steepen.

Exhibit 4-16: Topographic, Bathymetric and Marine Terraces at the BCIB Alignment (Bataan Side)



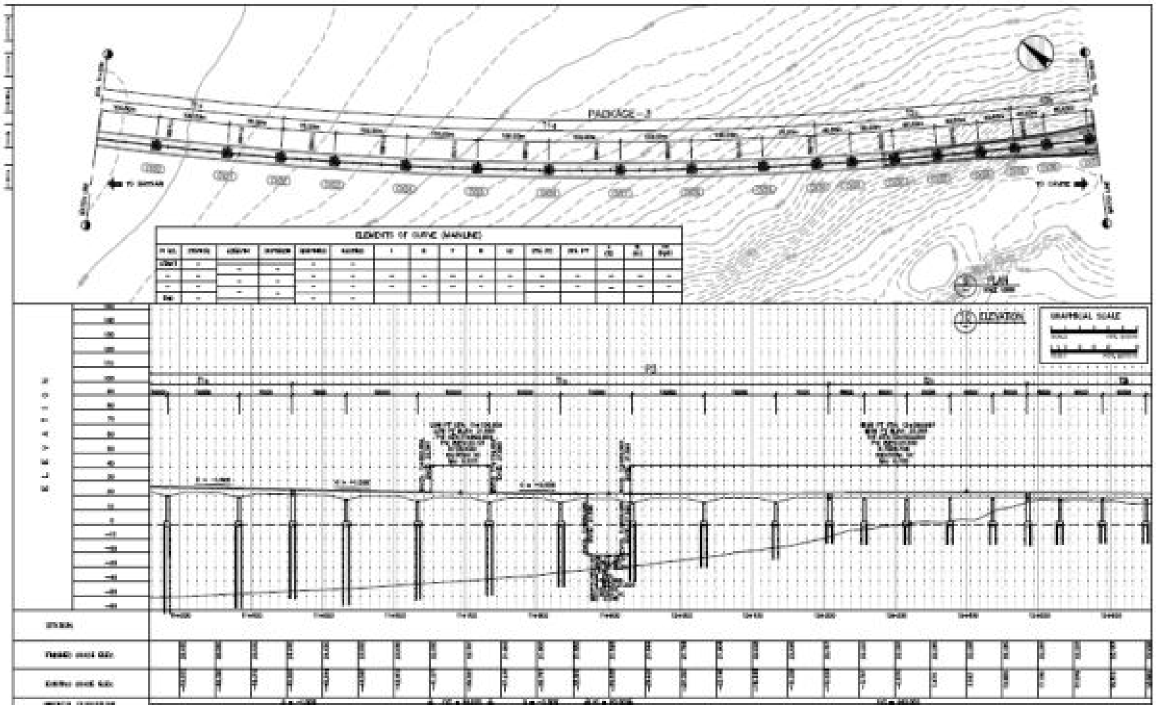
Source: Baseline Design Reports (P3 & P4), 07 January 2022.

Exhibit 4-17: Topographic, Bathymetric and Marine Terraces at the BCIB Alignment (Corregidor Island)



Source: Baseline Design Reports (P3 & P4), 07 January 2022.

Exhibit 4-18: Topographic, Bathymetric, and Marine Terraces at the BCIB Alignment (Cavite Side)



Source: Baseline Design Reports (P3 & P4), 07 January 2022.

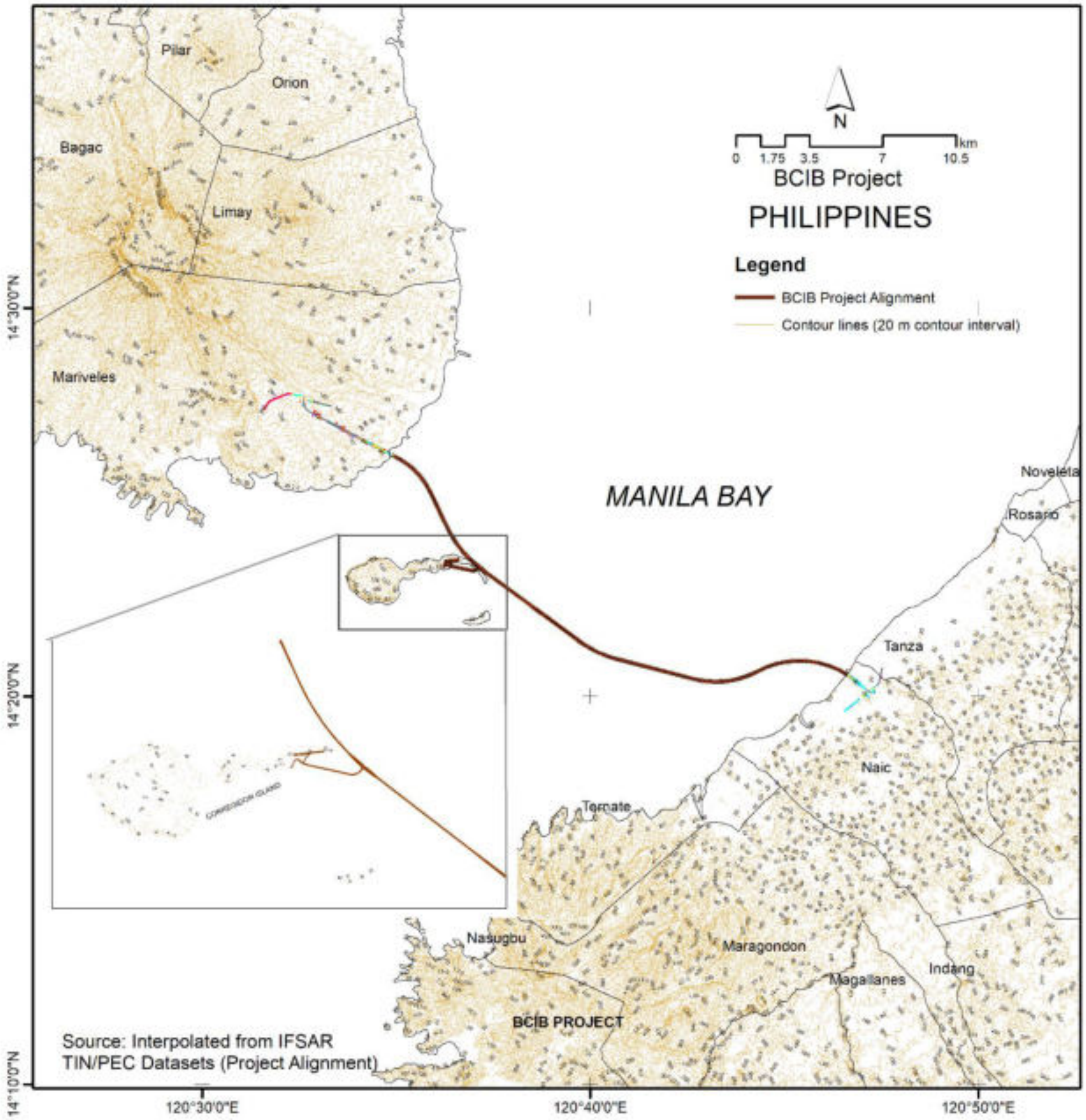
72. In the Bataan segment, the upland area's landform has been slightly modified by agricultural lands, pasture lands, small dwellings, and roads. The landing point forms narrow sandy beaches, rocky shores, high coastal slopes, and gently sloping coconut and grassland areas.

73. Bataan is characterized by a rocky, hilly, circular terrain of barren ground, brushlands, grasslands, and plantation forests formed by the Mariveles volcano. It flattens to gently sloping terraces punctuated by strips of steeply sloping terraces to form a series of rivers flowing toward the sea. The highest elevation is represented by the peak of Mt. Mariveles at approximately 1,400 m asl (Exhibit 4-19).

74. Cavite alignment contains alluvial plains toward the coast with a flat ground slope of less than 0.5% and low ground elevation, which steepens toward Mt. Maculot at the southeast. Mt. Maculot and the surrounded Taal Lake are formed by eruptions and flank collapses of the Taal Volcano. The flank of the Taal Volcano represents the highest elevation at approximately 600 m asl.

75. Corregidor Island is located south of Bataan, separated by the Northern Main Navigation Channel for about 4-6 km. The island is circular in shape, relatively small and with a generally flat terrain. The highest elevation is located near the island's center at approximately 173 m asl.

Exhibit 4-19: Topography of the Project Sites



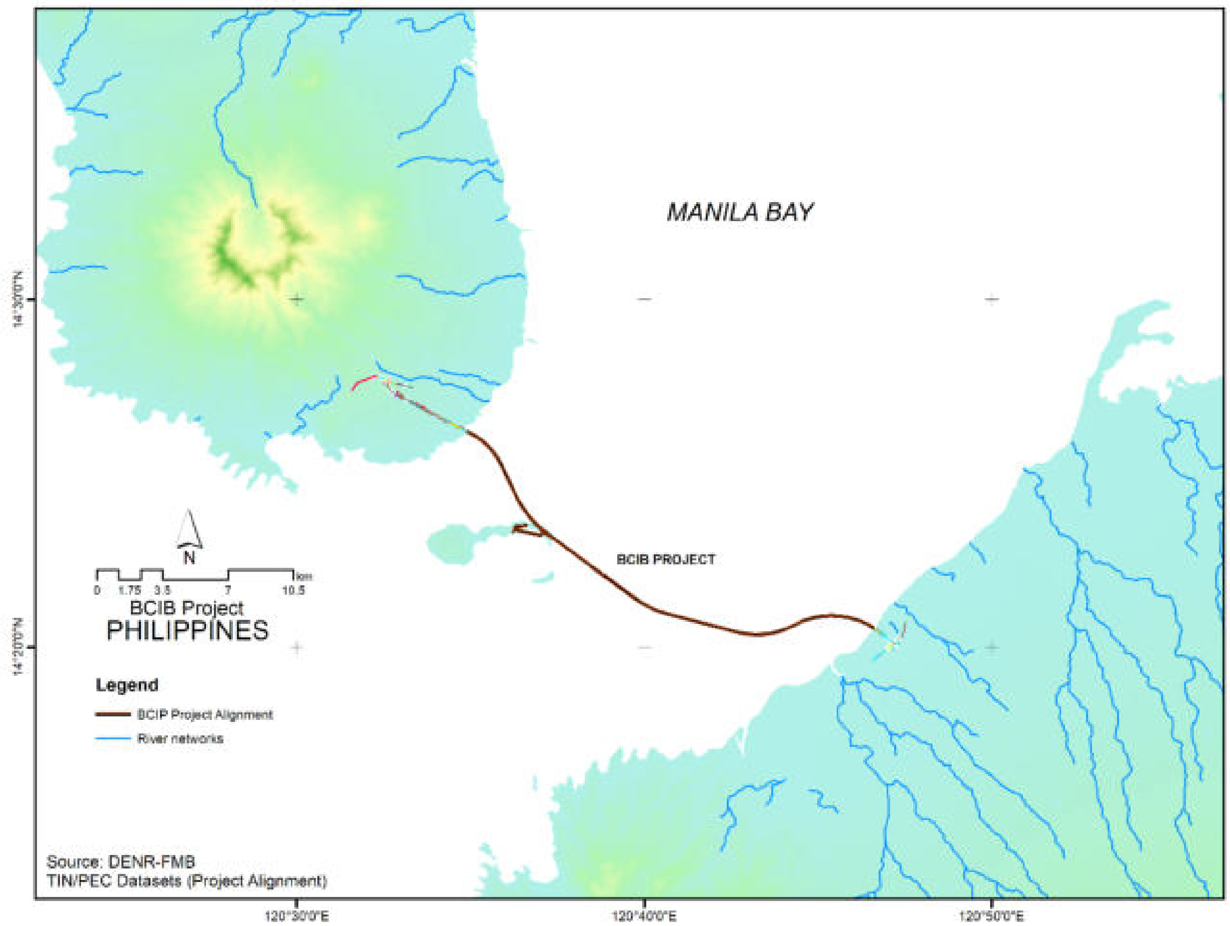
4.2.2 Geomorphology

76. As seen in Exhibit 4-20, the river networks in the project areas are positioned into a radial pattern. The waterway discharges into Manila Bay. The landing point in Bataan is located inside the Pangolisanin/Real River Basin, with a drainage area of 36.3 km^2. In comparison, the landing point and roadway in Cavite are along the Timalan and Labac River mainstream.

77. In the Bataan portion, the alignment is 5.4 km long, and its major structural components include the trumpet interchange that connects the BCIB with Roman Highway, Roman Interchange Bridge, the Alas-Asin reinforced concrete box culvert, Alas-Asin Overpass Bridge, Mt. View Overpass Bridge, Mt. View Waterway Bridge, and the Bataan land viaduct.

78. At the Mt. View waterway, a four-span bridge that crosses a wide and deep intermittent channel is proposed at Station 4+800. Based on the preliminary engineering design report, the vegetative cover consists mainly of patches of trees, drought-tolerant shrubs, and grassland along the waterway alignment. The Mt. View waterway is a shallow depression traversing a gently sloping to flat topography. The east-flowing intermittent channel has a small catchment, has no tributaries, and flow is generated only during the wet season.

Exhibit 4-20: River Systems Near the Project Alignment



79. The BCIB project conducted a frequency analysis to calculate probable floods based on a 100-year storm return period. Considering the impact of climate change, where it is projected, the Mt. View waterway will experience higher rainfall extremes in the future. The study added 10% of the calculated rainfall intensity following the provision of the DGCS (DPWH, 2015). Further, no flow was observed during the site visit, and added a base flow following the recommendation put forward in the design guideline.

80. The assessment found that the waterway has maintained its course and alignment for the past 35 years. It also found that a four-span bridge with a total length of 100 m can maintain the waterway regime and reduce adverse impacts considering its present morphology.

81. Further analysis results are available in Section 4.2 in the Updated Preliminary Design Report – Package 1 and 2. Under Package 2, it must be noted that there is no waterway crossed along the roadway alignment, and this was confirmed during the site visits.

4.2.3 Soils

4.2.3.1 North-western Portion of Project Alignment – Bataan

82. The Bureau of Soil and Water Management soil erosion map indicates that the project site has a moderate erosion rate (Exhibit 4-21). This erosion rate can be attributed to the topography and the presence of Antipolo Clay in Bataan areas. Accordingly, the soil belongs to Typic Dystropepts, which are formed from volcanic materials. They are extensively mapped on pyroclastic and volcanic complex hills. They are brownish and reddish in color, moderate deep to deep, well-drained, and clayey textured. Commonly occurring on pyroclastic and volcanic hills, these soils are mainly used for grasslands and secondary frost. However, soils with undulating slopes are sometimes cultivated to upland crops. Some portions are devoted to orchard mango and other tree crops.

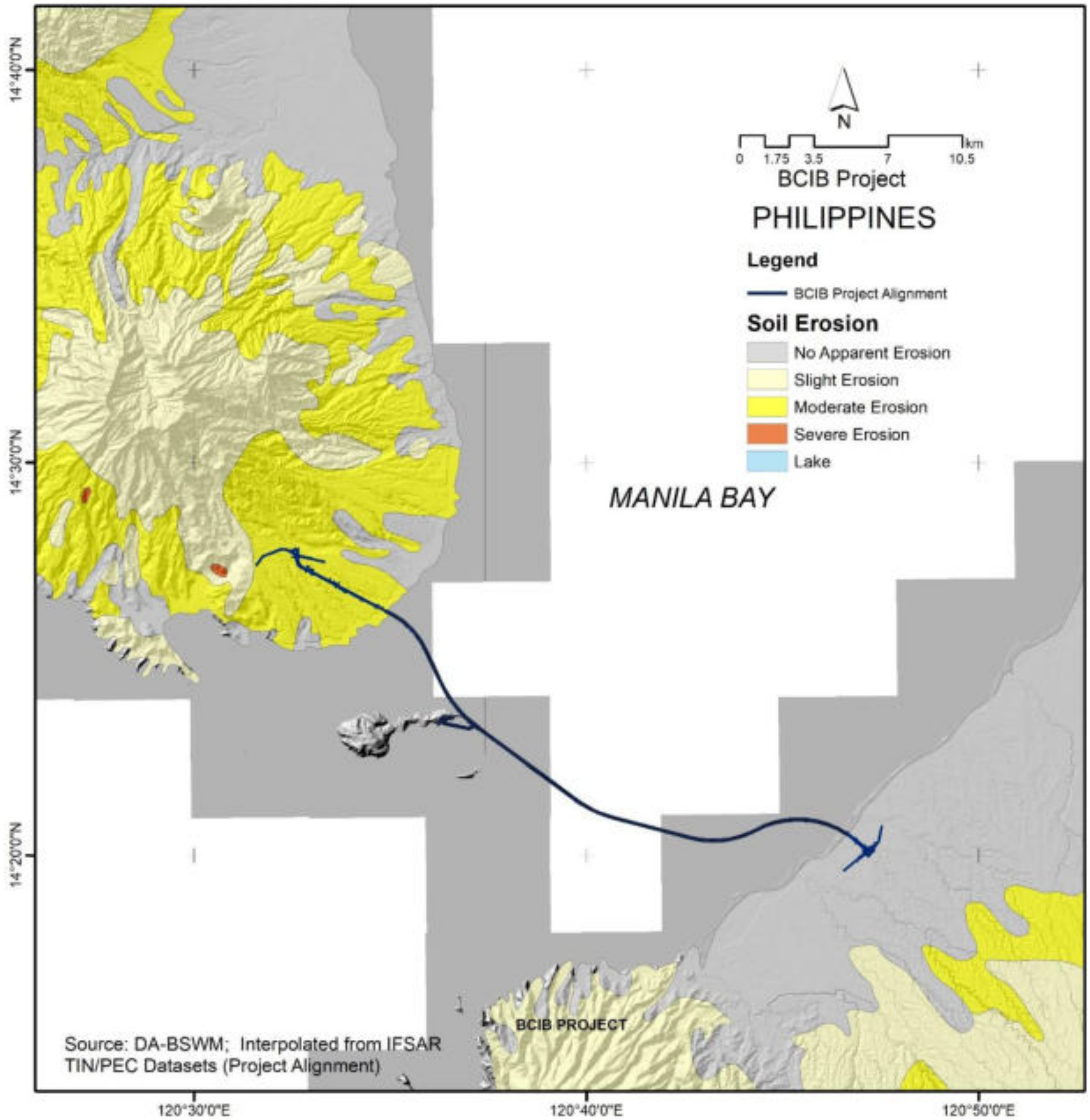
83. A confirmatory geotechnical study was conducted for the project during the detailed engineering design phase. Details are found in Chapter 5 of the Package 1 Baseline Engineering Design Report. The Bataan onshore is consistent for the length, with all boreholes encountering the relatively thick sublayers of the Antipolo Clay and the Bataan pyroclastic deposits at depth. The soil layers are generally described as stiff to very stiff, discolored clay, silt, and clayey/silty sand. The lithic tuff and the volcanic breccia are the underlying rock layers that comprise the Bataan pyroclastic deposits.

4.2.3.2 South-eastern Portion of Project Alignment – Cavite

84. The project site in Cavite has categorically no apparent soil erosion and signifies the presence of Guadalupe Clay. This soil series comprises dark clay with spherical tuffaceous concretions derived from Diliman Tuff (Carating et al., 2014). It is generally classified as fine, montmorillonitic, isohyperthermic Lepic Udic in lowland rice area or Lithic Trophorthents in undulating areas as Typic Ustropepts, which corresponds to shallow to moderately deep poorly drained dark brown to black clay.

85. During the detailed engineering design stage, the geotechnical conditions completed in October 2021 on the Cavite onshore were consistent for the length, with nearshore boreholes encountering the tidal sediments and the alluvial deposits towards the Antero Soriano partial clover interchange. The bedrocks are stratified lithic tuff layers, tuffaceous sandstone, sandstone, and conglomerate. Other details are found in Chapter 5 of the Package 2 Baseline Engineering Design Report.

Exhibit 4-21: Soil Erosion in the BCIB Project Alignment



4.3 Existing Road Conditions

4.3.1 Bataan Side

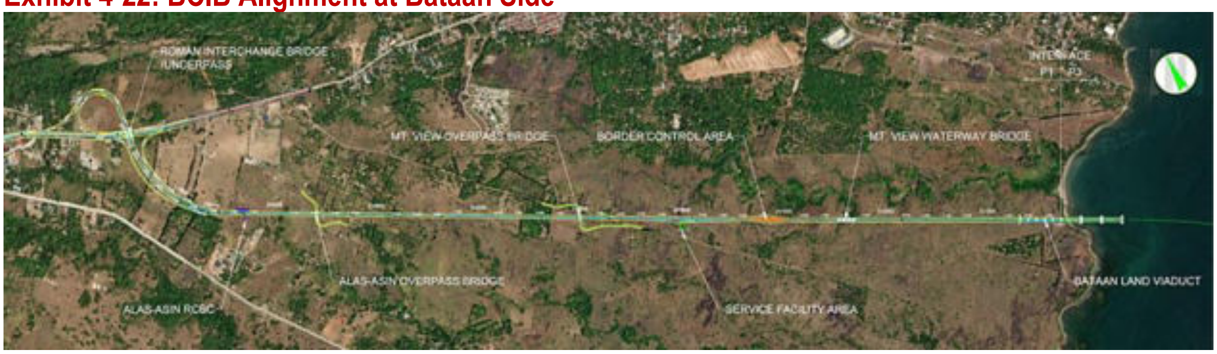
86. The existing Roman highway is a dual 2-lane PCCP road with a total carriageway width of 14.70 m and gravel shoulders on both sides. The right-of-way along this section is about 20 m. A combination of open earth and rectangular concrete channel for drainage are present along the roadway. Concrete poles carrying power and telecommunications cables are also present on both sides of the Roman Highway.

87. The alignment of BCIB connects with the existing 4-lane Roman Highway in Barangay Alas-asin, Mariveles, Bataan (Exhibit 4-22). Electric wooden poles are observed on the right side of the road at a typical spacing of 40 m.

88. Based on preliminary design findings, two (2) significant developments in the area can affect the project. First, there will be an expansion of the whole stretch of the Roman Highway from 2x2 lanes to 3x3 lanes in the future. Second, the plan is to have an international container port terminal in Barangay Baseco in Mariveles, of which the construction, development, and operation right at the mouth of the Manila Bay is meant to complement the already congested Manila Port Harbor. This port terminal will be located at a 180-ha. reclaimed land with a berth length of more than 6 km, 20 container berths, and 100 ha of container storage. The connection point of BCIB with the Roman Highway is well-positioned to service this port.

89. Meanwhile, climate change can directly impact environmental conditions and, therefore, change pavement performance. The energy and moisture balance of pavement can be disturbed by climate stressors, and the long-term pavement performance (rate of deterioration) will change as a consequence. The most common climate stressors include temperature, precipitation, and wind speed. Typically, pavement performance is most influenced by temperature and moisture, and the long-term impacts from the climate stressors can be significant.

Exhibit 4-22: BCIB Alignment at Bataan Side



Source: Revised Updated Preliminary Design Report – Package 2, 21 January 2022

90. The climate change assessment team conducted a conditional survey of existing roads to identify deterioration and failures due to weather events and to determine the potential impacts of climate change on the main roadway infrastructure that leads to the BCIB project. The survey considered a set of parameters, such as: i) investigation of damage caused by the recent typhoon, ii) existing damage to road from drainage issues, iii) existing damage to stream crossing structures, iv) stream crossing structures that may be under capacity when average annual precipitation and maximum daily rainfall increase, v) existing damage to drainage structures and bridge, vi) drainage structures that may be under capacity when average annual precipitation and maximum daily rainfall increase, vii) existing road damage from heat issues, viii) existing evidence of landslides and slope creep affecting or threatening to affect the road, ix) steep cross slopes, cut slopes, and embankments that may become unstable as precipitation/slope saturation increases, x) road segments that may be affected by flooding from storm surge and sea-level rise (possibly in combination with land subsidence), and xi) road segments that may be affected by coastal erosion. Exhibit 4-23 shows the stretch of the survey.

Exhibit 4-23: Stretch of the Conducted Conditional Road Survey

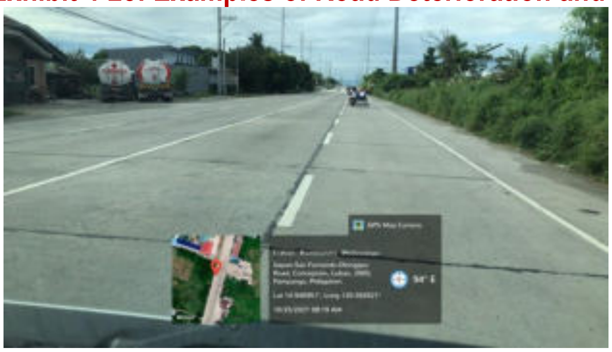
91. During the site visit, the assessment spotted some road deteriorations and failures on the stretch of Jose Abad Santos Avenue, Roman Expressway, Gov. JJ Linao Road, Junction Layac-Balanga Mariveles Port Road, and Bagac-Mariveles Road. Due to heavy vehicles and poor construction, longitudinal and traverse cracks can already be seen in the areas. A new pavement construction and the washed-out slope protection on the flood-prone portions are also noticed on the roadways. Due to the missing drainage system, the solid wheel guard and slope protection collapsed along Junction Layac-Balanga Mariveles Port Road. The assessment recommends immediate and emergency maintenance, partial re-pavement, a quick recovery, expanded pipe size, river section check, and installation of additional drainage facilities as adaptation measures on this road network. Other survey details are shown in Exhibit 4-24 and 4-25, and Appendix 1.

Exhibit 4-24: Results of the Conditional Road Survey in Bataan

Location/ KM	Road Condition	Cause of Damage	Recommended Adaptation Strategy
Jose Abad Santos Avenue (K0069+000 - K0126+000)			
K0069+300	Longitudinal crack	Heavy vehicle	Emergency maintenance
K0074+700	No problems with flooding in the past.		
K0083+250	Transverse crack	Poor construction	Partial re-pavement
K0083+800	No problems with flooding in the past.		
K0086+900	No problems with flooding in the past.		
K0087+300	No problems with flooding in the past.		

Location/ KM	Road Condition	Cause of Damage	Recommended Adaptation Strategy
Roman Expressway (K0100+000 – K0165+000)			
K0091+750	No problems with flooding in the past.		
K0093+100	-		
K0100+375	No problems with flooding in the past.		
K0100+400	No problems with flooding in the past.		
K1000+480	Transverse crack	Poor construction	Partial re-pavement
K0100+500	No problems with flooding in the past.		
K0104+400	-		
K0104+500	No problems with flooding in the past.		
K0104+550	-		
K0113+850	-		
K0120+300	Longitudinal crack	Heavy vehicle	Emergency maintenance
K0121+250	-		
K0121+330	New pavement construction		
K0124+142	Washed out slope protection	Flood prone area	Need a quick recovery
K0126+188	Washed out slope protection	Flood prone area	Need a quick recovery
K0127+550	Longitudinal crack	Heavy vehicle	Emergency maintenance
K0142+675	No problems with flooding in the past		
K0135+550	No problems with flooding in the past		
K0135+600	No problems with flooding in the past		
K0135+959	No problems with flooding in the past		
K0143+760	New pavement construction		
K0146+930	No problems with flooding in the past		
K0150+330	Longitudinal crack	Heavy vehicle	Emergency maintenance
K0158+300	-		
Gov. JJ Linao Road (K0126+000 to K0175+000)			
K0130+100	-		
K0132+088	No problems with flooding in the past		
K0133+350	No problems with flooding in the past		
K0135+645	New pavement construction (ongoing)		
K0136+350	Pipe crack	Insufficient drainage capacity	Expanded pipe size
K0137+013	No problems with flooding in the past		
K0151+829	Washed out slope protection	Flood prone area	Need a quick recovery
Junction. Layac-Balanga Mariveles Port Road (K0102+000 to K0142+000)			
K0124+500	Longitudinal crack	Heavy vehicle	Emergency maintenance
K0124+700	House flooding	Flood prone area	River section check
K0132+450	No problems with flooding in the past		
K0160+000	Collapsed solid wheel guard and slope protection	Drainage system missing	Installation of additional drainage facilities
Bagac-Mariveles Road (K0152+000 to K0195+000)			
K0193+780	Transverse crack	Poor construction	Partial re-pavement
K0186+100	No problems with flooding in the past		
K0180+100	No problems with flooding in the past		
K0174+100	New slope protection construction		
K0172+400	No problems with flooding in the past		
K0174+318	No problems with flooding in the past		
K0169+254	No problems with flooding in the past		
K0161+650	No problems with flooding in the past		
K0160+135	No problems with flooding in the past		

Exhibit 4-25: Examples of Road Deterioration and Failures in Bataan Roads


K0086+900 (Santa Cruz Bridge)


K0143+760


K0146+930 (Lucanin Bridge)


K0136+350


K0137+013 (Pantingan Bridge)


K0132+450 (Orion Bridge)

4.3.2 Cavite Side

92. The BCIB interchange connects to the existing 4-lane Antero Soriano Highway in Barangay Timalan, Naic, Cavite (Exhibit 4-26). The alignment passes along the ongoing construction of the Northdale Subdivision. The BCIB project crosses the populated Tramo road in Naic, Cavite. The road has a total width of 4 m with drainage channels on both sides.

93. Also, the road alignment traverses the Timalan-Balsahan road in Naic, Cavite, which runs through a populated area. The road has a total width of 7 m with 1 m shoulders on both sides. Concrete drainage channels are present on both sides of the road. Concrete electrical posts are also

located on one side of the road. It is estimated that about 20 houses will be affected directly within the project alignment.[18]

Exhibit 4-26: BCIB Alignment at Cavite Side

Source: Revised Updated Preliminary Design Report – Package 2, 07 February 2022.

94. On a site in Cavite, it was observed that the Kawit-Noveleta Highway to Juanito R. Remulla SR. Road has been experiencing road deteriorations and failures influenced by weather events. The most common road conditions are longitudinal cracks, new pavement constructions, box cracks, washed slope protection, and landslides at cut areas (Exhibit 4-27). Cracks typically change direction, but they appear longitudinally and extend continuously to many slabs. A few examples are shown in Exhibit 4-28, while the full documentation is found in Appendix 1.

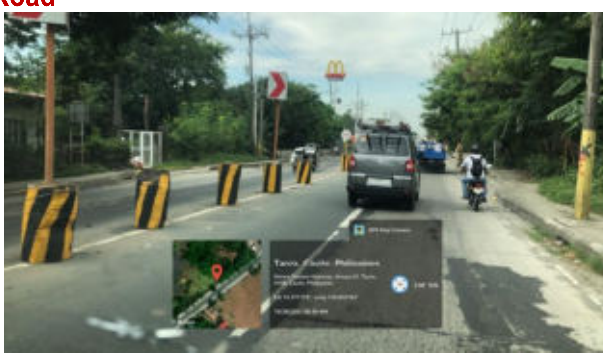
Exhibit 4-27: Results of the Conditional Road Survey in Cavite

Location/ KM	Road Condition	Cause of Damage	Recommended Adaptation Strategy
Manila-Cavite Expressway (K0007+500 to K0021+700); Kawit-Noveleta Div. Road (K0021+700 to K0025+500) Noveleta-Rosario Div. Road (K0025+500 to K0030+700); Noveleta-Naic Tagaytay Road (K0030+700 to K0048+000) Juanito R. Remulla SR. Road (K0048+000 to K0072+000)			
K0007+500	-	-	-
K0007+900	Waiting many vehicles	Increasing CO_2	Installing smart tolling
K0021+000	-	-	-
K0021+700	Waiting many vehicles	Increasing CO_2	Installing smart tolling
K0022+000	-	-	-
K0028+700	Longitudinal crack	Heavy vehicle	Emergency maintenance
K0036+925	New pavement construction		
K0039+525	New pavement construction		
K0043+600	Longitudinal crack	Heavy vehicle	Emergency maintenance

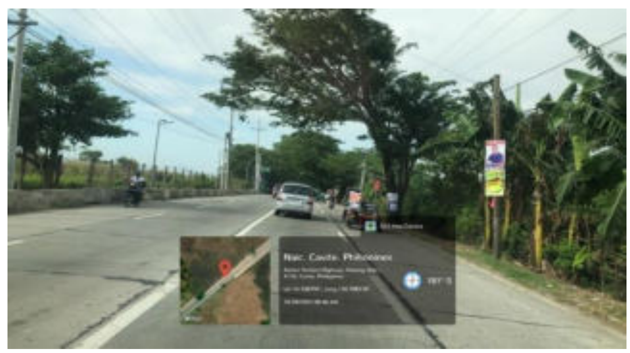
[18] Other details are described in the Preliminary Design Report – Package 2

Location/ KM	Road Condition	Cause of Damage	Recommended Adaptation Strategy
K0058+930	-	-	-
Nasugbu Road (K0067+000 to K0097+000); Juanito R. Remulla, Sr. Road (K0048+000 to K0072+000)			
K0070+000	Box crack	Insufficient drainage capacity	Expanded box size
K0069+400	Landslide at cut area	Drainage system missing	Installation of additional drainage facilities
K0068+600	Washed out slope protection	Flood prone area	Need a quick recovery
K0068+200	Landslide at cut area	Drainage system missing	Installation of additional drainage facilities
K0067+200	Washed out slope protection	Flood prone area	Need a quick recovery
K0067+000	Landslide at cut area	Drainage system missing	Installation of additional drainage facilities
K0069+219	No problems with flooding in the past		
K0057+783	No problems with flooding in the past		
K0056+157	No problems with flooding in the past		
K0069+190 (DPWH)	Landslide at cut area	Drainage system missing	Installation of additional drainage facilities
K0068+800 (DPWH)	Landslide at cut area	Drainage system missing	Installation of additional drainage facilities

Exhibit 4-28: Existing Road Conditions along the Kawit-Noveleta Highway to Juanito R. Remulla SR. Road



Noveleta-Naic-Tagaytay Road K0036+925



Noveleta-Naic-Tagaytay Road K0043+600

Nasugbu Road K0070+000 (Kaybiang Tunnel)

Nasugbu Road K00690+400

Nasugbu Road K0068+200

K0056+157 (Maragondon Bridge)

5. CLIMATE CHANGE AND RISK ASSESSMENT

95. This chapter describes the project's exposure to climate hazards and locations based on the current and future time frames. The future time frame is based on changes between the 1986–2005 average and a future average. This future average is most likely the early future (2020–2039), mid-future (2046–2065), and late future (2080–2099) average. Highlights of exposure and description of risks are summarized in the table below. Other details are discussed in the succeeding sections of this chapter.

Exhibit 5-1: Summary of Exposure to Climate Hazards at Project Locations

Risk/Hazard	Time Frame	Description of Risk/Hazard of the Project Locations
Extreme Temperature	Current	Baseline TXx observation (1986-2005) records 35.5 °C on the Bataan side and from 35.7 °C on the Cavite side. The number of hot days (TX90p) occurs 11.5% (42 days) of the year.
	Future	TXx projections diverge at an increasing rate up to 39 °C (late-future) on the Bataan and Cavite sides. TX90p will increase by at least 21% (76 days) in the early future, and as much as 79% (288 days) in the late future, essentially making every day of the year a hot day.
Extreme Rainfall	Current	Based on PAGASA Extreme Projection (2020) using ensemble median, maximum 1-day rainfall totals (Rx1day) are 133 mm (Bataan) and 116 mm (Cavite). Using KNMI Climate Change Atlas for CMIP5 extremes ensemble under RCP8.5, the observed values of Rx1day is 315 mm for the Bataan side and 260 mm for the Cavite project site.
	Future	Based on PAGASA Extreme Projection (2020) using ensemble median, Rx1day under RCP4.5 can get as much as 8.2 mm additional rainfall in the mid- and late future. The RCP8.5 scenario projects an increasing Rx1day from approximately 0.5 mm in the early future to around 8.4 mm in the mid-future. Comparing with the KNMI Climate Change Atlas for CMIP5 extremes ensemble under RCP8.5, the trend of Rx1day is increasing, which indicates the need to look

Risk/Hazard	Time Frame	Description of Risk/Hazard of the Project Locations
		closely at the hydraulic structure designs based on a specific return period. The design values of Rx1day for the future climate must be 409 mm for the Bataan side and 338 mm for the Cavite area considering the climate change factor of 30% and 25 year return period.
Flooding	Current	Under Package 1, the landing point between Station 5+800 and Station 5+900 is considered at high risk to coastal flooding due to seawater intrusion during the high tide. Under Package 2, between Station 31+600 and Station 32+500 and between Station 33+100 and Station 33+200 roadways, and from Station 0+000 to Station 0+501.782, and Station 0+000 to Station 0+700 interchange areas are highly susceptible to flooding.
	Future	Under Package 1, the landing point between Station 5+800 and Station 5+900 is considered at high risk to coastal flooding due to seawater intrusion during the high tide. Under Package 2, between Station 31+600 and Station 32+500 and between Station 33+100 and Station 33+200 roadways, and from Station 0+000 to Station 0+501.782, and Station 0+000 to Station 0+700 interchange areas are highly susceptible to flooding.
Sea Level Rise	Current	Sea level in the project locations has increased by roughly 0.2 m over the past three (3) decades as per records at Manila Harbor Tidal station.
	Future	Under Package 3 & 4 and Package 5 & 6, annual sea level changes in the project locations are expected to increase by 0.6 to 1.1m, and 0.8 to 1.6m in 2100 and 2130, respectively plus a 1.0 m storm surge.
Storm Surge	Current	Slight incidents of storm surge occurred in the areas in the past.
	Future	Incidents of storm surge and tall waves are expected to increase, a 1.0-meter maximum water level increase in Manila Bay, given a 10% increase over historical typhoons.
Strong Winds	Current	The latest and strongest typhoon to have struck the project areas was Typhoon Rolly in November 2020 with maximum winds of 220 kph. The project locations have been exposed to 27 tropical cyclone winds in the past seven decades. The months of September and October record a high number of tropical cyclones that traverse the project location. Using Global Wind Atlas, Bataan and Cavite sections have mean wind speeds ranging from 6.61 - 7.05 m/s and from 6.60 to 7.37 m/s, respectively, while the Corregidor Island portion is exposed at rate ranging from 6.96 to 7.19 m/s. The mean wind at the Sangley Weather Station is 5.91 m/s, or about 1.2 times less than on Bataan alignment.
	Future	A study on Design Tropical Cyclone Wind Speed when Considering Climate Change indicated that wind speed during tropical cyclones could increase by 1.2-1.4 times the historical record.
Heat Waves	Current	The project areas have been experiencing warmer temperatures, with an average monthly maximum of 31.3 °C and the warmest day temperature of 35.7 °C. The current median probability of a heat wave is around 2%. Heat waves might increase due to projected increases in temperature.

Risk/Hazard	Time Frame	Description of Risk/Hazard of the Project Locations
Landslide	Current	In the Bataan end alignment, the susceptibility to landslide is high at the interchange section. At the Cavite segment, the interchange and roadway alignment are running through a gentle to flat alluvial plain at the shoreline and the susceptibility to landslide is negligible.

5.1 Temperature Extremes

96. Based on PAGASA (2020) projection, the temperature extreme indices show spatial variability in the baseline; but projected changes indicate almost spatially uniform warming trends, with the magnitude and duration of warming increasing in the future. The change in daily temperature range is particularly interesting as it indicates a slight cooling and greater spatial variability in the future. However, the magnitude of change is relatively small over Bataan and Cavite project areas.

97. The summary of the temperature extremes over project areas is presented in Exhibit 5-2.

Exhibit 5-2: Temperature Extreme Indices (in °C) of the Project Areas

Scenario	Period	Bataan			Cavite		
		TXm	TXx	TX90p	TXm	TXx	TX90p
Baseline Value	1986-2005	31.3	35.5	11.5	31 .0	35.7	11 .5
Moderate Emission (RCP 4.5)	Early (2020-2039)	31 .8 (0.5)	36.3 (0.6)	23.6 (12.1)	31 .6 (0.6)	36.0 (0.5)	25.5 (14.0)
	Mid (2046-2065)	32.5 (1.2)	37.0 (1 .3)	49.3 (37.8)	32.2 (1 .2)	36.7 (1 .2)	53.2 (41.7)
	Late (2080-2099)	32.8 (1.5)	37.3 (1.6)	60.9 (49.4)	32.5 (1 .5)	37.0 (1 .5)	64.1 (52.6)
High Emission (RCP 8.5)	Early (2020-2039)	32.0 (0.7)	36.6 (0.9)	31.7 (20.2)	31 .8 (0.8)	36.3 (0.8)	33.4 (21.9)
	Mid (2046-2065)	32.9 (1.6)	37.4 (1.7)	60.6 (49.3)	32.6 (1.6)	37.2 (1 .7)	65.1 (53.6)
	Late (2080-2099)	34.5 (3.2)	39.3 (3.6)	90.6 (79.1)	342 (3.2)	39.1 (3.6)	91.4 (79.9)

Source: DOST-PAGASA, Manila Observatory and Ateneo de Manila University (2021). Philippine Climate Extremes Report 2020: Observed and Projected Climate Extremes in the Philippines to Support Informed Decisions on Climate Change Adaptation and Risk Management. Philippine Atmospheric, Geophysical and Astronomical Services Administration, Quezon City, Philippines. p.77&p.84.

5.1.1 Average Daytime Temperature (TXm)

98. TXm refers to the average of daytime temperatures.

99. Historical data shows that the average daytime temperature over project areas ranges from 31.0°C to 31.3°C. This is projected to increase in both RCP scenarios. In the RCP4.5 scenario, TXm is expected to increase by as much as 0.6°C in the early future and 1.5°C in the late future; in the RCP8.5 scenario, it is expected to increase by as much as 3.2°C in the late future.

5.1.2 Warmest Daytime Temperature (TXx)

100. TXx refers to the temperature on the hottest day of the year.

101. Baseline observations show that the hottest daytime temperature in the project areas ranges from 35.5 °C to 35.7 °C. It is also projected to increase in the future, by as much as 1.6 °C in the late future for the RCP4.5 scenario and by as much as 3.6 °C in the RCP8.5 scenario.

5.1.3 Fraction of Hot Days (TX90p)

102. TX90p tracks the number of hot days when the maximum temperature exceeds the 90^{th} percentile threshold.

103. Historically, the number of hot days occurs 11.5% (42 days) of the year. This is projected to increase significantly in the future, with projections indicating an increase of at least 21% (76 days) in the early future, and as much as 79% (288 days) in the late future, essentially making every day of the year a hot day.

5.2 Rainfall Extremes

104. Based on PAGASA (2020) projection, the precipitation extreme indices show distinct patterns of spatial variability in the baseline data, especially for the magnitude and frequency indices. The projected changes indicate a general drying trend but also the occurrence of extreme rainfall events in the area. Prolonged wet events tend to decrease, but prolonged dry events also show localized decreases, indicating possibilities of increased frequency of wet events in the future which would interrupt the long-duration dry events.

105. The summary of rainfall extremes of the project areas (observed and projected annual climate extremes) is presented in Exhibit 5-3.

Exhibit 5-3: Rainfall Extremes (in mm) of the Project Areas

Scenario	Period	Bataan			Cavite		
		Rx1day	P99	R99p	Rx1day	P99	R99p
Baseline Value	1986-2005	133.2	115.3	206.5	116.4	87.1	162
Moderate Emission (RCP 4.5)	Early (2020-2039)	128.9 (-4.3)	113.4 (-1.9)	181.0 (-25.5)	118.0 (1 .6)	89.1 (2.0)	169.9 (7.9)
	Mid (2046-2065)	135.9 (2.7)	11 5.2 (-0.1)	215.7 (9.2)	121.0 (4.6)	96.5 (9.4)	202.2 (40.2)
	Late (2080-2099)	136.7 (3.5)	112.1 (-3.2)	203.6 (-2.9)	124.6 (8.2)	94.9 (7.8)	184.4 (22.4)
High Emission (RCP 8.5)	Early (2020-2039)	137.7 (4.5)	113.6 (-1.7)	189.3 (-17.2)	116.9 (0.5)	87.3 (0.2)	151 .5 (-10.5)
	Mid (2046-2065)	141.6 (8.4)	114.1 (-1.2)	227.4 (20.9)	124.6 (8.2)	95.4 (8.3)	190.0 (28.0)
	Late (2080-2099)	132.9 (-0.3)	102.7 (-12.6)	169.2 (-37.3)	122.9 (6.5)	92.3 (5.2)	183.8 (21.8)

Source: DOST-PAGASA, Manila Observatory and Ateneo de Manila University (2021). Philippine Climate Extremes Report 2020: Observed and Projected Climate Extremes in the Philippines to Support Informed Decisions on Climate Change Adaptation and Risk Management. Philippine Atmospheric, Geophysical and Astronomical Services Administration, Quezon City, Philippines. p.77&p.84.

5.2.1 Maximum 1-day Rainfall Total (Rx1day)

106. Rx1day describes the maximum amount of rain that can fall in one day. Such extreme rainfall is typically associated with local thunderstorms or large-scale systems such as monsoons or tropical cyclones and may induce flash floods or landslides. It is useful variable as an engineering design criterion in sizing hydraulic structures.

107. Baseline observations show that the project areas experience a maximum 1-day rainfall total of up to 133 mm. For RCP4.5, the project areas can get as much as 8.2 mm additional rainfall in the mid- and late future. In the RCP8.5 scenario, the project areas are projected to have an increasing Rx1day as time progresses, from approximately 0.5 mm in the early future to around 8.4 mm in the mid-future. A possible decrease will likely occur in Bataan (-0.3 mm) and increase in Cavite (6.5 mm) in the late future.

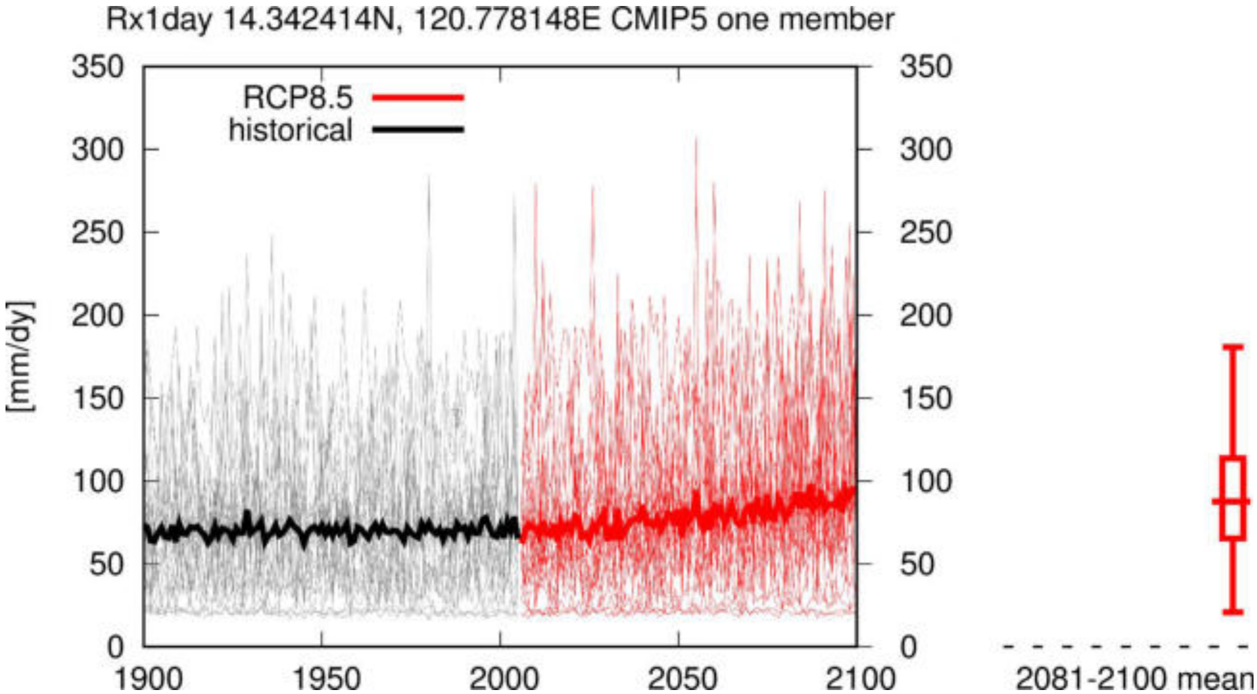
108. It is worthy to note that the use of projected average climate extremes published by PAGASA provides a good set of data to describe the general trajectories of rainfall but not to assess the adequacy of engineering designs that are generally based on climate extremes. Again, the extreme climate projections are fairly in agreement until the early future (2020-2039) scenario, and ensemble medians as criteria to test engineering design parameters may be acceptable. After that, the climate change model projections diverge at a fluctuating rate, and therefore, the use of median values discounts the extremes.

109. Exhibits 5-4 and 5-5 show the RCP8.5 CMIP5 extreme ensemble using the KNMI explorer. The box plots on the right side demonstrate the underestimation of the extreme projections using the ensemble median which was used in the PAGASA projection. The top whisker represents the 95th percentile, and the bottom is the 5th percentile. The middle line is the median (50th percentile), representing climate extremes in Exhibit 5-5. Following the 1-day maximum historic data, the observed design values of Rx1day must be 315 mm for the Bataan side and 260 mm for the Cavite project site.

110. The trend of Rx1day is increasing, which indicates the need to look closely at the hydraulic structure designs based on a specific return period. The non-stationarity of Rx1day raises the possibility that the DPWH design return periods must be adjusted. The design values were calculated for the baseline (1986-2005) and future periods (2016-2035). Exhibits 5-6 and 5-7 present the extreme Rx1day values for a 25-year return period. The bcc-csm1-1 climate model indicated the highest Rx1day values during the baseline and future periods at Bataan and Cavite sides.

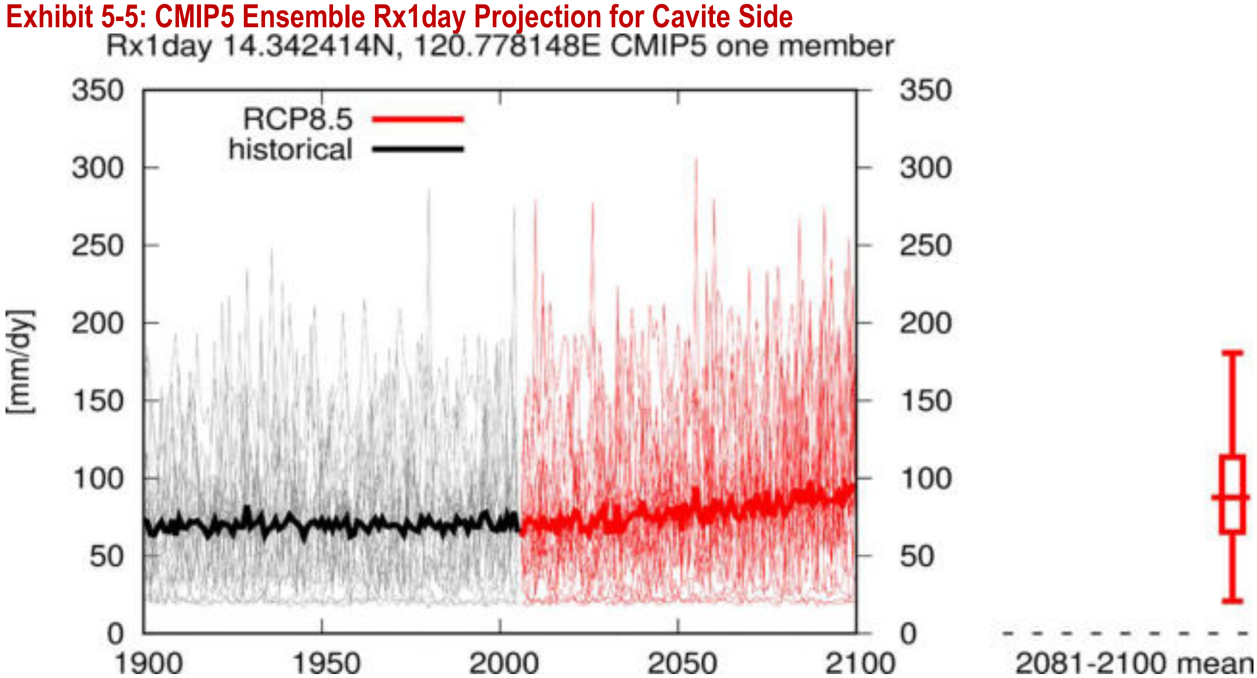
111. Exhibit 5-8 shows a probability curve and the percentage increase in Rx1day with a 25-year return period. It was extracted to determine the required percentile from the climate model ensemble. The plot supports the need to adjust the Rx1day design criteria by 30% to handle 97.5% of the projected rainfall intensity extremes. As a result, the design values of Rx1day for the future climate must be 409 mm for the Bataan side and 338 mm for the Cavite area. This information helps assess all hydraulic structures designed based on a 25-year return period and the need to recommend upward adjustments.

Exhibit 5-4: CMIP5 Ensemble Rx1day Projection for Bataan Side



Source: KNMI Climate Explorer

Exhibit 5-5: CMIP5 Ensemble Rx1day Projection for Cavite Side



Source: KNMI Climate Explorer

Exhibit 5-6: Estimates of Rx1day with 25-Year Return Period at Bataan Side

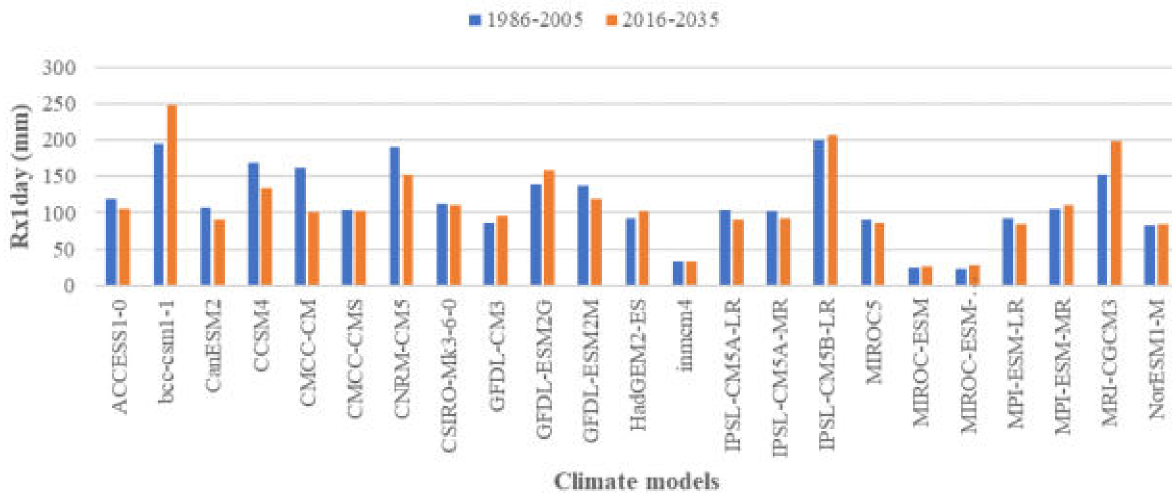
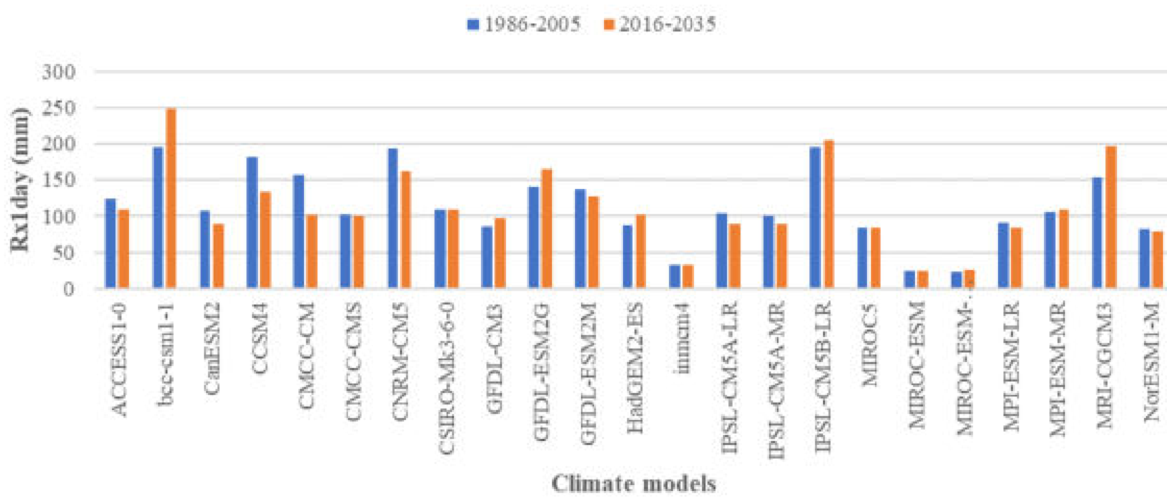


Exhibit 5-7: Estimates of Rx1day with 25-Year Return Period at Cavite Side

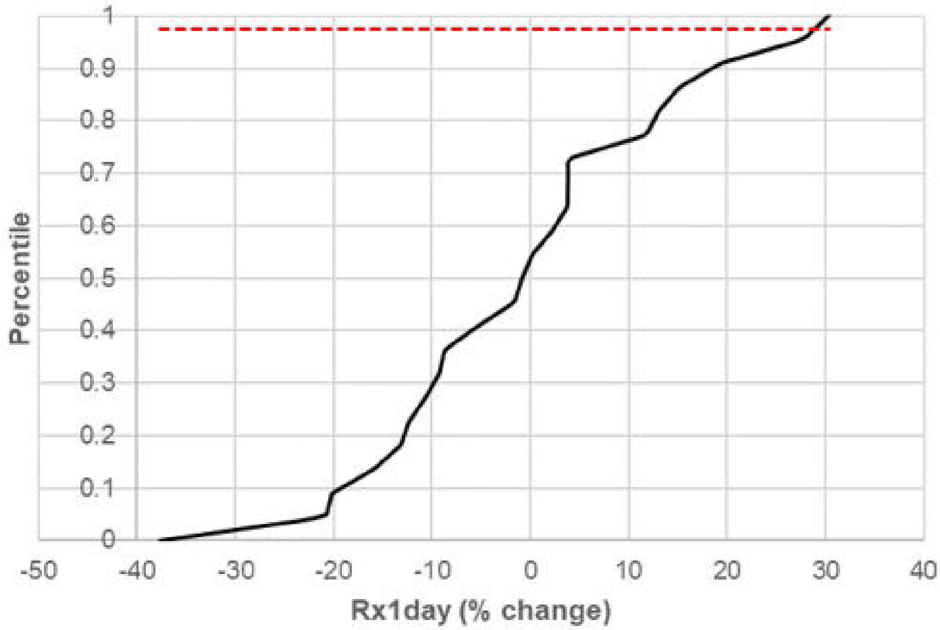


5.2.2 Rainfall on Extremely Wet Days (P99)

112. P99 indicates the amount of rainfall "extremely wet" days, defined as those exceeding 99th percentile threshold.

113. Historically, the distribution of rainfall on extremely wet days is similar to P95 with maxima reaching up to 115 mm/day and minima at around 87 mm/day. In both scenarios, the P99 is projected to increase by as much as 9 mm/day in the early future to late future in Cavite. It decreases from approximately 12 mm/day in the late future over Bataan areas; and in Cavite the decrease can be in the late future. The changes are projected to become slight in the early future and mid-future.

Exhibit 5-8: Probability Curve Showing the Percentile from CMIP5 and the Percentage Increase in Rx1day with a 25 Year Return Period



5.2.3 Total Rainfall Extremely Wet Days (R99p)

114. R99p describes the total amount of rain that falls on "extremely wet" days when rainfall exceeds the 99th percentile. Similar to R95p, it is related to the rainfall events that occur during the wet season as well as during tropical cyclone events.

115. Historically, R99p can reach up to 206 mm and was concentrated over Bataan area. In the future, wet conditions are projected with maximum increase of up to 40 mm in Cavite area. Meanwhile, dry trends of up to 37 mm are projected over project areas in the late future RCP8.5 scenario.

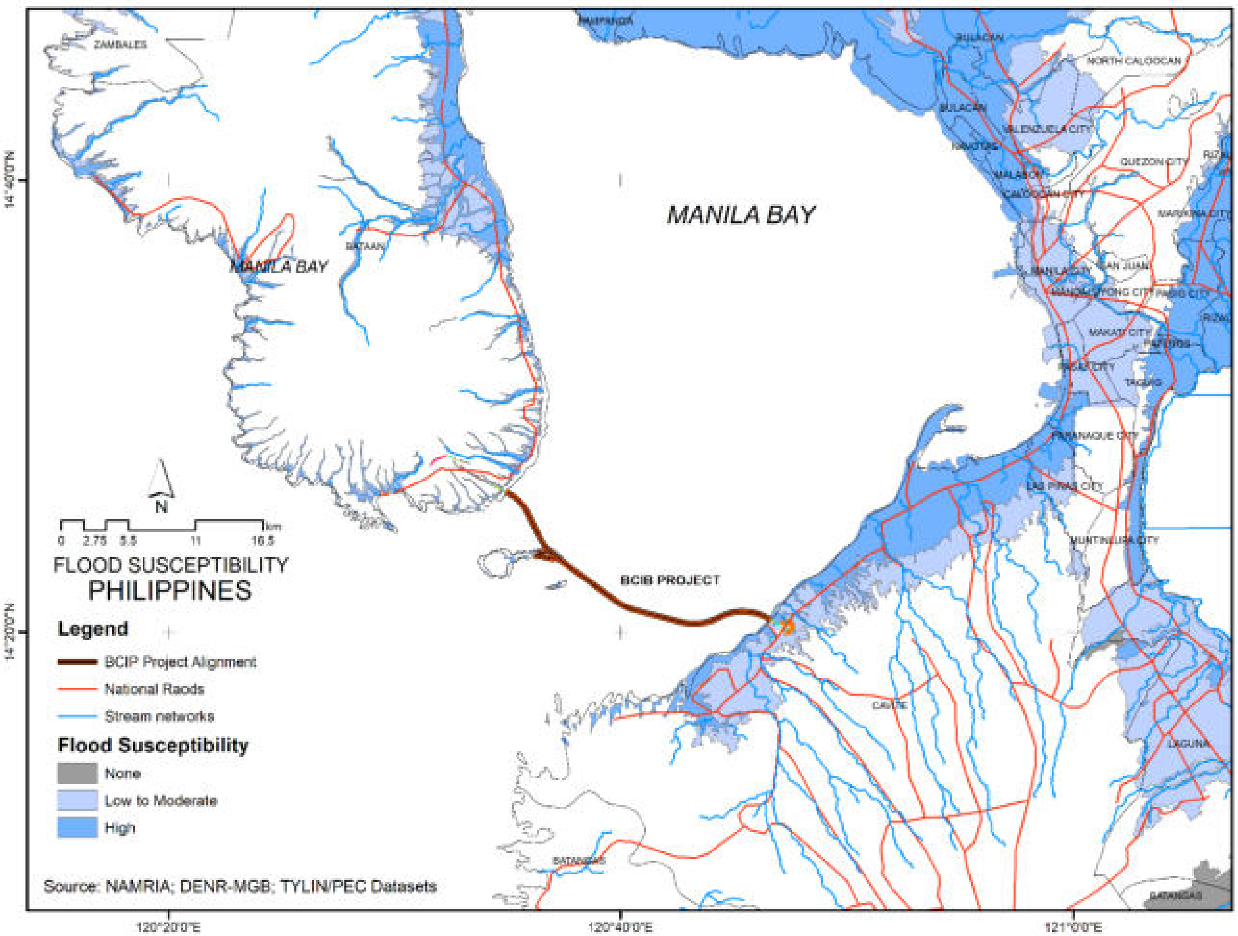
5.3 Flooding

116. Based on MGB's combined flood and landslide susceptibility map for Bataan and Cavite, the project alignment along the coast of Cavite is categorically low to moderately and highly susceptible to flooding (Exhibit 5-9).

117. The project will not likely affect the surface drainages within the Bataan and Cavite coastal areas. However, some sections along the project alignment in the Cavite areas have been experiencing flooding. The flooding is mainly due to the insufficient drainage canals that drain storm waters into the river and the coastal regions. This is further aggravated by the area being very close to the water line and forming a depressed low-elevation catchment surrounded by slightly elevated highway areas and residential lots.

118. Based on the rainfall projection, changes in the maximum 1-day rainfall total are expected to vary temporally with wetter trends of about 140 mm during the mid-future (2046-2065) in both scenarios over the project areas. It will likely be drier conditions during the late future under RCP8.5 of up to 28 mm over the Bataan portion. The assessment predicts that there will probably be flooding downstream, considering primarily its topographic location. A portion of the Labac River Basin appears highly susceptible to flooding. Vulnerable areas are most evident in the eastern part, including the municipality of Naic, downstream and urban areas. However, there would be an improvement in flooding susceptibility in the late future under two scenarios due to a projected significant decline in rainfall amounts and possible long dry spells.

Exhibit 5-9: Flood Susceptibility of the Project Location



119. The BCIB interchanges and viaducts component are being designed at an elevation above the projected water level. The project will not be blocking water flows and impeding water drainages. Installation of pipes, box culverts, and side ditches follows the provision of the DPWH-DO No. 40 series of 2012, on the guidelines on required drainage works along the approach roads. Flood and stormwater will run off into drainage canals and nearby creeks.

120. Under Package 1, the south-eastern portion of Bataan exhibits a radial drainage pattern since it is located on the flanks of Mt. Mariveles. The landing point in Bataan is part of the Pangolisanin/ Real River Basin, with a drainage area of 36.3 km^2. It is observed that the Mt. View Waterway Bridge location is considered low to very low susceptible to flooding due to its alignment across the gully, although it is intermittent. The rest of the project alignment will likely not be exposed to any flooding because of the high elevation and the drainage patterns near the project areas. The stream networks of the Santolan-Bulok River and Pangolisanin-Real River along the project alignment are radial patterns, which means all river systems directly flow to the seas. However, the landing point between Station 5+800 and Station 5+900 is considered to be at high risk to coastal flooding due to seawater intrusion during high tides.

121. Under Package 2, flooding in the Cavite segments is primarily due to inundation from sea and stormwater during extreme events. The landing point in Cavite is part of the Labac River Basin, which has a drainage area of 94.5 km^2.

122. In Cavite, the Provincial Government already undertook surface water and groundwater assessment through the Cavite Integrated Water Resource Management Master Plan in 2012. The evaluation was made to estimate the stream discharge of major river basins that originate in the southern mountainous part of the province and flow northerly, traversing the various municipalities and emptying into Manila Bay. The four (4) gauged rivers are the Maragondon River in Maragondon, the Panaysayan River in General Trias, the Balsahan River in Naic, and the Ilang-ilang River in Imus City. The flow of a river varies in response to available precipitation, topographic features, soil conditions, land cover, hydro-geologic characteristics, and channel geometry. Changes in land use, drainage patterns, stream geometry, and groundwater levels also produce variations in streamflow. In Naic, for instance, the Balsahan River monthly discharge records ranged from 0.07 cm to 17.89 cm with a peak discharge during July.

123. During the field site visit, the team held interviews with the head of the Municipal Disaster Risk Reduction and Management Office (MDRRMO), barangay captain and its administrator, and local community residents to confirm the exposure and susceptibility of the project areas to flooding (Exhibit 5-10 and Appendix 2). While on-site, the project team confirmed that areas in the Cavite segment already experienced moderate flooding in 2014, 2019, and 2020. In 2014, flooding was associated with extreme rainfalls brought about by typhoon Glenda that caused almost a meter inundation of the entire low-lying areas of the municipality of Naic. This event happened again in 2019 and 2020 due to typhoons *Tisoy* and *Rolly*. Poor drainage systems mainly caused the flooding in the municipality.

124. Participating stakeholders in the consultations were also aware of the project location and alignment and confirmed that the project areas are susceptible to flooding. Interchange areas between Station 33+100 and Station 33+200 roadways, and from Station 0+000 to Station 0+501.782 and Station 0+000 to Station 0+700 are highly vulnerable to flooding. It must be noted that the project alignment is 500 m away from the main tributary of the Labac and Timalan Rivers.

Exhibit 5-10: Conducted Interviews to Validate Project Areas Exposure and Susceptibility to Flooding

Interview with Mr. Alvin Binondo and Engr. Marcelo Serrano of the Municipal Disaster Risk and Management Officer, Mariveles, Bataan on 25 October 2021.

Interview with Brgy. Chairman Leoncio Lungcay (represented by his Brgy. Administrator), Mt. View, Mariveles, Bataan on 26 October 2021

Interview with Mr. Jesly Gonzales, the Municipal Disaster Risk and Management Officer of Naic, Cavite on 28 October 2021.

Interview with Brgy. Chairwoman Marissa Pabiton, Timalaya Conception, Naic, Cavite on 28 October 2021.

Interview with Mr. Sitoy Doculan, a Bantay Dagat in Barangay Mt. View, Mariveles, Bataan on 26 October 2021

Interview with Mr. Nick Salvador, a Bantay Dagat and Tanod of Barangay Timalaya Conception, Naic, Cavite on 28 October 2021.

5.4 Mean Sea Level

5.4.1 Global Sea Level Rise

125. The observed global sea-level rise rate for the 20th century has been reported in various literature to be about 1.7 mm/yr (Church et al., 2013; Kahana et al., 2016; Oppenheimer et al., 2019; Wang et al., 2021). Recent estimates from the IPCC AR5 assessment indicate that it is very *likely* (probability > 90%) that this rate has increased in the last part of the century, between 1993 and 2015, to 2.8–3.6 mm/yr, and that the total sea-level rise for 1901–2010 was 1.9 mm (Church et al., 2013; Kahana et al., 2016; Oppenheimer et al., 2019).

126. Based on the report of Oppenheimer et al. (2019), future rise in global mean sea level (GMSL) caused by thermal expansion, melting of glaciers and ice sheets and land water storage changes, is strongly dependent on which RCP emission scenario is followed. The sea level rise (SLR) at the end of the century is projected to be faster under all scenarios, including those compatible with achieving the long-term temperature goal set out in the Paris Agreement. GMSL will rise between 0.43 m (0.29–0.59 m, *likely* range; RCP2.6) and 0.84 m (0.61–1.10 m, *likely* range; RCP8.5) by 2100 (*medium confidence*) relative to 1986–2005 (Exhibit 5-11).

127. Beyond 2100, sea level will continue to rise for centuries and will remain elevated for thousands of years (*high confidence*). Only a few modelling studies are available for SLR beyond 2100. However, all studies agree that the difference in GMSL between RCP2.6 and RCP8.5 increases substantially on multi-centennial and millennial time scales. On a millennial time scale, this difference is about 10 meters in some model simulations, whereas it is only several decimeters at the end of 21st century. The larger the emissions the larger the risks associated with SLR as already assessed in SR1.5. Under RCP8.5 the few available studies indicate a likely range of 2.3 – 5.4 m in 2300. With strong mitigation efforts (RCP2.6), SLR will be kept to a *likely* range of 0.6 – 1.1 m. Regardless, ambitious and sustained adaptation efforts are needed to reduce risks.

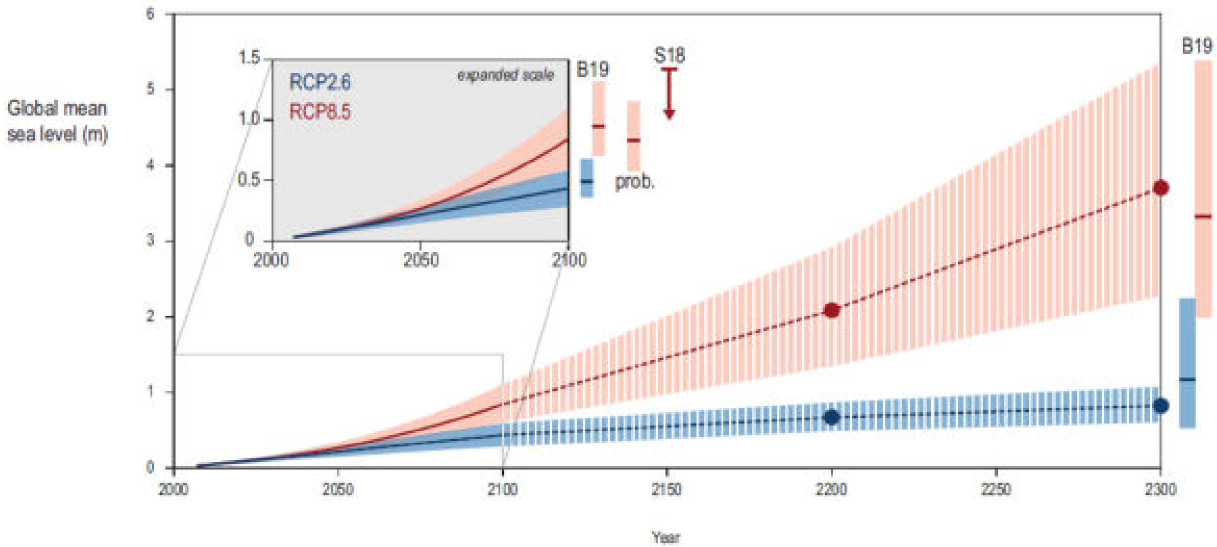
128. The global and regional mean sea levels will change due to climate change. Coupled climate models are used to make projections of the climate changes and the associated SLR. Results from the CMIP5 model archive used for AR5 provide information on expected changes in the oceans and the evolution of climate, glaciers, and ice sheets. The new estimates from CMIP6 are not yet available (at the time of preparing this report) and will be part of the discussion in the IPCC 6th Assessment Report (AR6).

129. Projections of sea-level rise are larger than in the AR4, primarily because of improved modeling of land-ice contributions. For the period 2081–2100, compared to 1986–2005, global mean sea level rise is likely (*medium confidence*) to be in the 5 to 95% range of projections from process-based models, which give 0.53 m (0.36 to 0.71 m) for RCP4.5, and 0.74 m (0.52 to 0.98 m) for RCP8.5. For RCP8.5, the global mean sea level rise rate in 2100 is 11.2 mm/yr (7.5 to 15.7 mm/yr).

5.4.2 Sea-Level in the Philippines

130. Exhibit 5-14 shows satellite observations for 1993–2015 of the Tropical Western Pacific region, to the east of the Philippines, experiencing sea level rise at a rate of 5–7 mm/yr, which is more than thrice the global average. The most considerable rate of 4.5–5 mm per year is observed in the east of the islands of Leyte and Samar, and Mindanao, south of Zamboanga, and along the southwestern coasts of the Central and Western Visayas. However, Kahana et al. (2016) reported that the satellite record is relatively short, and the regional patterns and rates do not necessarily represent the entire 20th century. It might be caused by the timing and magnitude of shorter natural modes of variability such as El Nino Southern Oscillation (ENSO) and the Pacific Decadal Oscillation.

Exhibit 5-11: Projected Sea Level Rise Until 2300



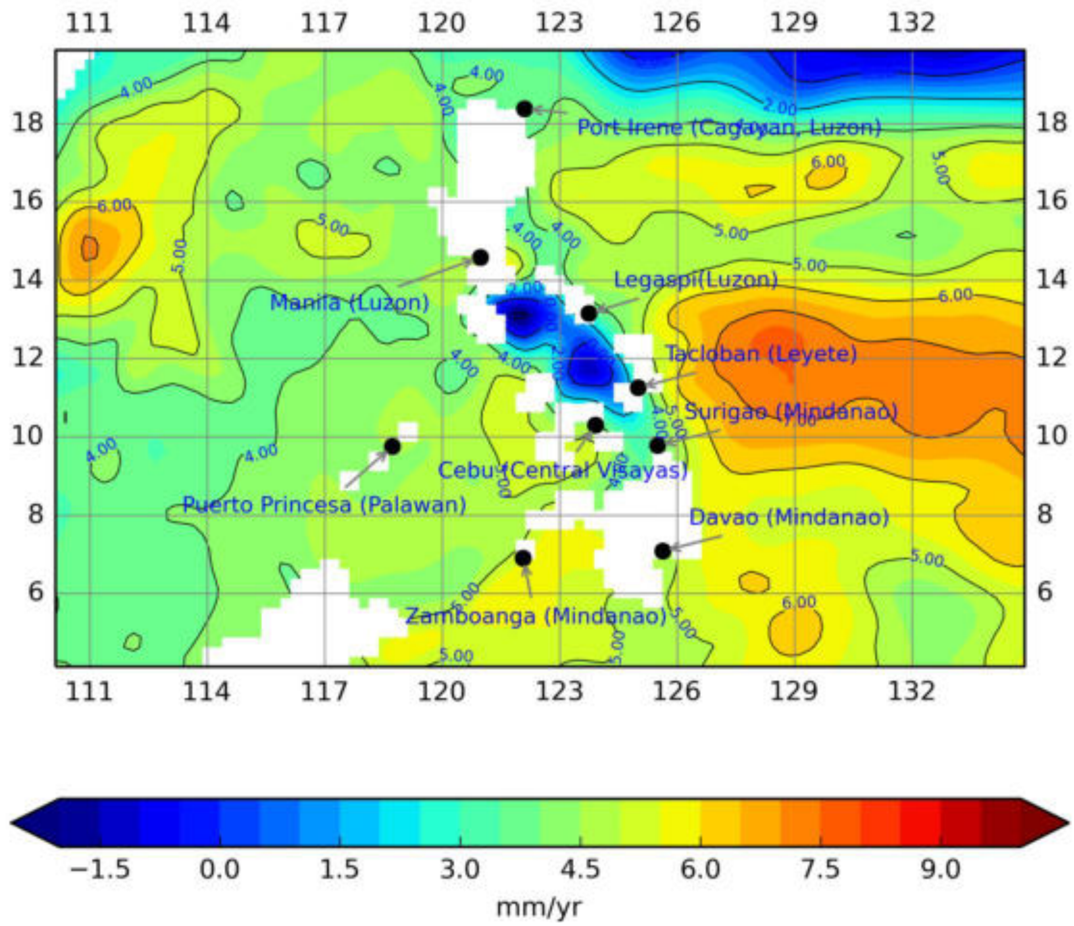
Source: Chapter 4: Sea Level Rise and Implications for Low-Lying Islands, Coasts and Communities. p.327.
Note: The inset shows an assessment of the likely range of the projections for RCP2.6 and RCP8.5 up to 2100 (medium confidence). Projections for longer time scales are highly uncertain but a range is provided (low confidence). For context, results are shown from other estimation approaches in 2100 and 2300. The two sets of two bars labelled B19 are from an expert elicitation for the Antarctic component (Bamber et al., 2019), and reflect the likely range for a 2 ºC and 5 ºC temperature warming (low confidence). The bar labelled "prob." indicates the likely range of a set of probabilistic projections. The arrow indicated by S18 shows the result of an extensive sensitivity experiment with a numerical model for the Antarctic Ice Sheet (AIS) combined, like the results from B19 and "prob.", with results from Church et al. (2013) for the other components of SLR. S18 also shows the likely range.

131. The time series of the projected sea level change (SLC) under RCP4.5 and RCP8.5 are presented in Exhibit 5-12. The solid line represents the central (50th percentile, median) estimate. The dotted line of uncertainty covers the likely (10% and 90%) rather than the full range of possible future sea-level changes. This implies that there is still a probability of ~40% that sea level will rise or decline beyond these range.

132. The World Bank projection for the Philippines reveals a slightly lower than global average sea-level rise in the 21st century.[19] In the near term, both the medium–low GHG concentration scenario (RCP4.5) and the high-end scenario (RCP8.5) lead to similar increases in sea level. However, the high-end scenario adds approximately 0.20 m to the projected mean sea level with 0.63 m sea-level change by the end of the 21st century (Exhibit 5-13).

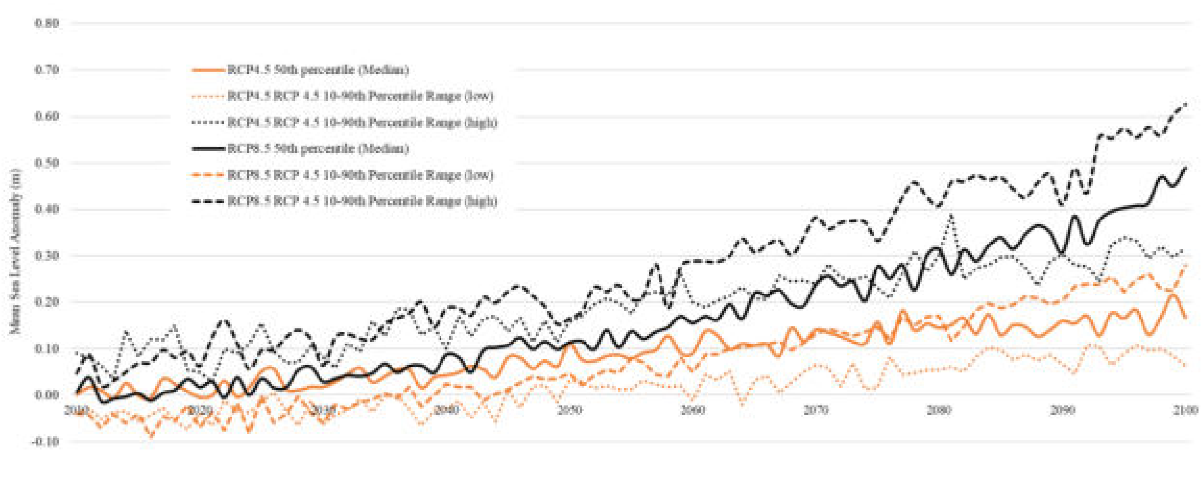
[19] Based on sea level change projection from the climate change knowledge portal.

Exhibit 5-12: Sea Level Changes in the Philippines Region from 1993 to 2015 Produced from the AVISO Satellite Observations



Source: Kahana R, Abdon R, Daron J and Scannell C. 2016. Projections of Mean Sea Level Change for the Philippines. p.9.

Exhibit 5-13: Change Anomaly of the Mean Sea Level in the Philippines



Note: Interpolated based on the Philippines' Climate Change Knowledge Portal dataset.

5.4.3 Mean Sea Level at a Site

133. Following the methods adopted by the US Army Corps of Engineers,[20] a local historical rate of sea-level change is used as the estimate. The past rate is extrapolated over the (economic or service) life of the infrastructure project and added to the datum. This must be regarded as a lower bound because future contributions from ice melt, thermal expansion, and changes in the Earth's gravity field are expected to be greater in a warmer world than before.

134. The estimate of the mean sea level at a site only considers the lower bound mean sea-level change because of insufficient information on the upper sea level rise, surge, wave, high tide, and tidal regime. The assessment derived a linear extrapolation of the trend of mean sea-level from the historical tide records and adjusted to a revised local reference level by the Permanent Service for Mean Sea Level (Exhibits 5-14 and 5-15).

135. Manila harbor is considered the nearest available tide-gauge at a site about 40 km away from Cavite and Bataan navigation bridges and marine viaduct projects. The sea-level datum for Manila Harbor in the year 2000 was 7,450 mm. The observed rate of sea-level change at the site is +8.286 mm/year over the available period of record. This yields a sea-level estimate of 8,150 mm by 2100, after rounding up to the nearest 50 mm. It must be noted that local storm surge, tide, and wave effects are not included.

136. The Manila tide-gauge record shows a massive change in the early 1960s. Values published in various literature since the 1960s reached 26 mm/yr (Perez et al.,1999; Rodolfo and Siringan, 2006), but it was reported to be heavily influenced by groundwater extraction and land subsidence (Church et al., 2013; Amiruddin et al., 2015). The observed sea-level rise shows that the above-average sea-level rise experienced in Manila Bay in recent decades (between 1960 and 2019) is estimated to be at 16.35 mm/yr, about ten times the global average. Groundwater extraction has been reported as the leading cause of cumulative subsidence of over 1.0 m since the early 1990s in the Manila Bay area (due to urban use) and the neighboring Pampanga delta (due to agricultural use) (Rodolfo and Siringan, 2006).

137. For their part, Kahana et al. (2016) made projections of mean sea level change for the Philippines. This study was part of a DFID-funded project focusing on building resilience to the country's tropical cyclones and climate extremes. It aimed to provide a range of predictions for regional changes in the mean sea level through the 21st century. Estimates are based on the projections for future changes to the GMSL from the IPCC AR5 (Church et al., 2013a), combined with the effects of the oceanic, atmospheric, and land processes operating in the Philippines region.

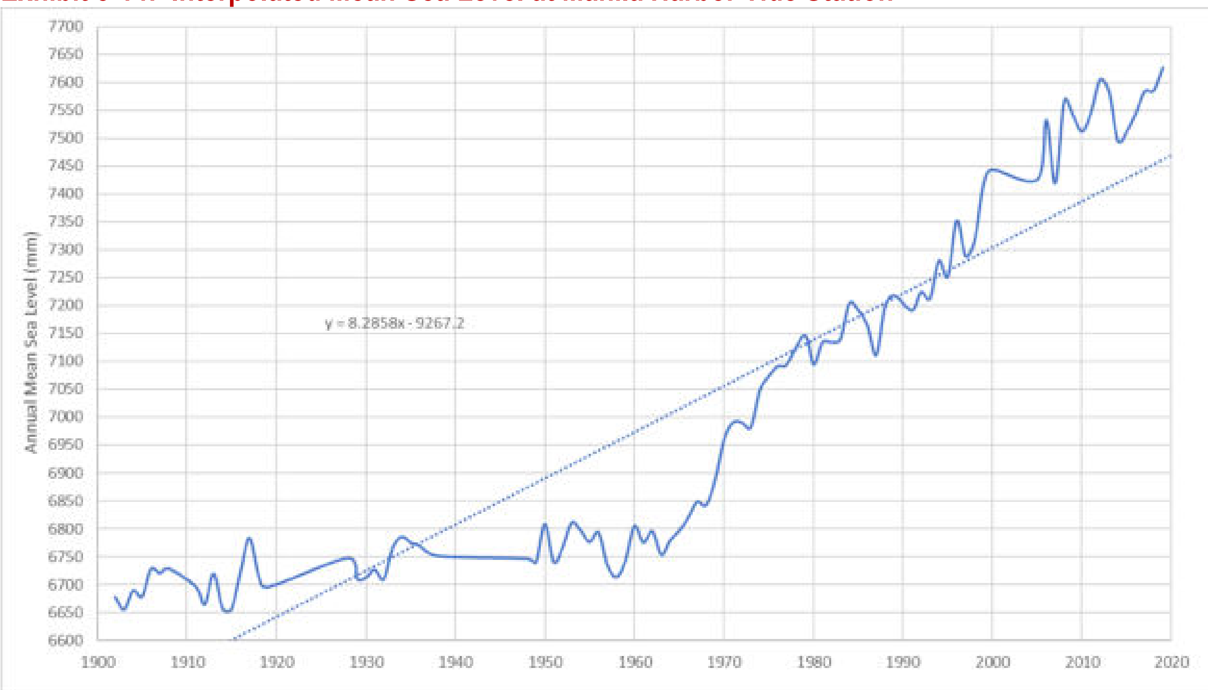
138. The project estimated future regional sea level changes for the Philippines by using projections for the GMSL changes from the IPCC AR5 and combining them with non-uniform regional patterns of sea level change around the country. It is projected to be almost twice the magnitude of corresponding global levels at the end of the 21st century. The Special Report on the Ocean and Cryosphere projection that the sea level rise is likely in the range of 0.61 to 1.10 m and 0.8 to 1.6 m in 2100 and 2130, respectively. The time series of the projected SLC under RCP4.5

[20] As cited in ADB 2020 Manual on Climate Change Adjustments for Detailed Engineering Design of Roads using examples from Viet Nam. pp. 11-17.

and RCP8.5 are presented in Exhibit 5-16 (global mean) and Exhibit 5-17 (manila mean). The solid line represents the central (50th percentile, or median) estimate, and the shaded range of uncertainty covers the likely (66-100%) rather than the full range of possible future sea level changes.

139. Exhibit 5-18 shows the potential inundation coverage considering the projected sea-level rise combined with a storm surge and high tide wave in the project areas.

Exhibit 5-14: Interpolated Mean Sea Level at Manila Harbor Tide Station



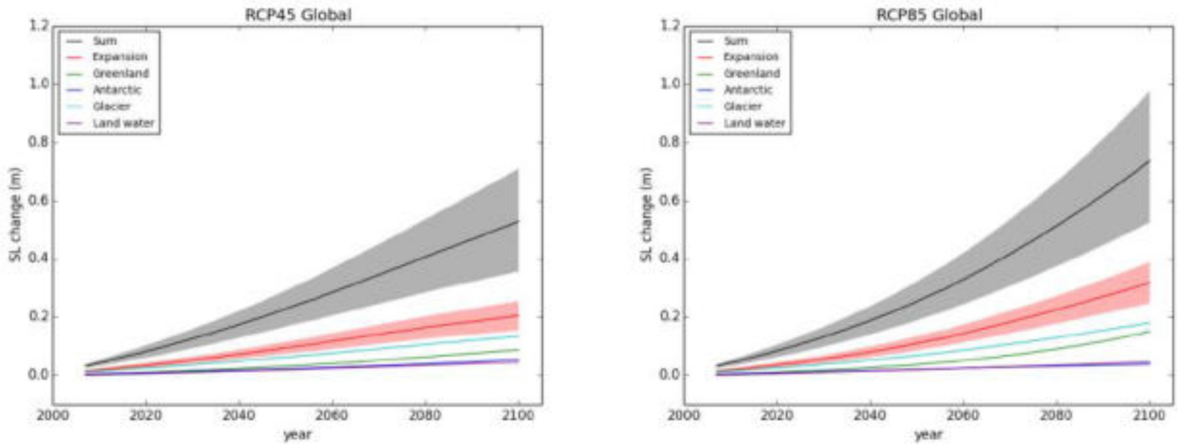
Source: Consultant's formulation

Exhibit 5-15: Projected Mean Sea Level Change (m) at Manila Harbor Tide Station

Scenario	Projected Sea Level Rise (m)			
	2021-2040	2041-2060	2061-2080	2081 -2100
Linear projection (median)	0.11	0.27	0.44	0.60
Lowest	0.03	0.19	0.36	0.53
Highest	0.19	0.35	0.52	0.68

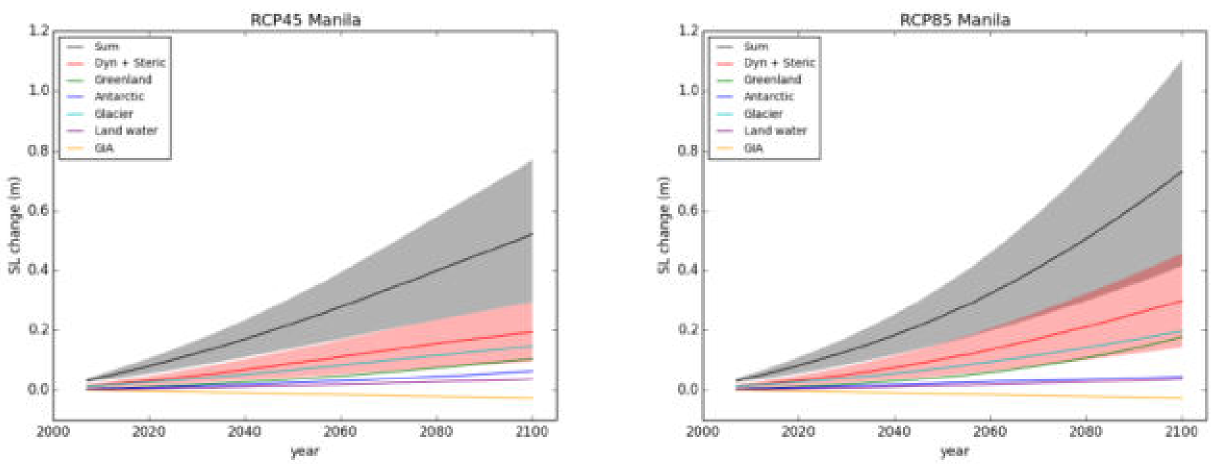
Source: https://www.psmsl.org/data/obtaining/map.html; Consultant's formulation

Exhibit 5-16: Time Series of the Global Mean Sea Level Change Projections Under RCP 4.5 and RCP8.5



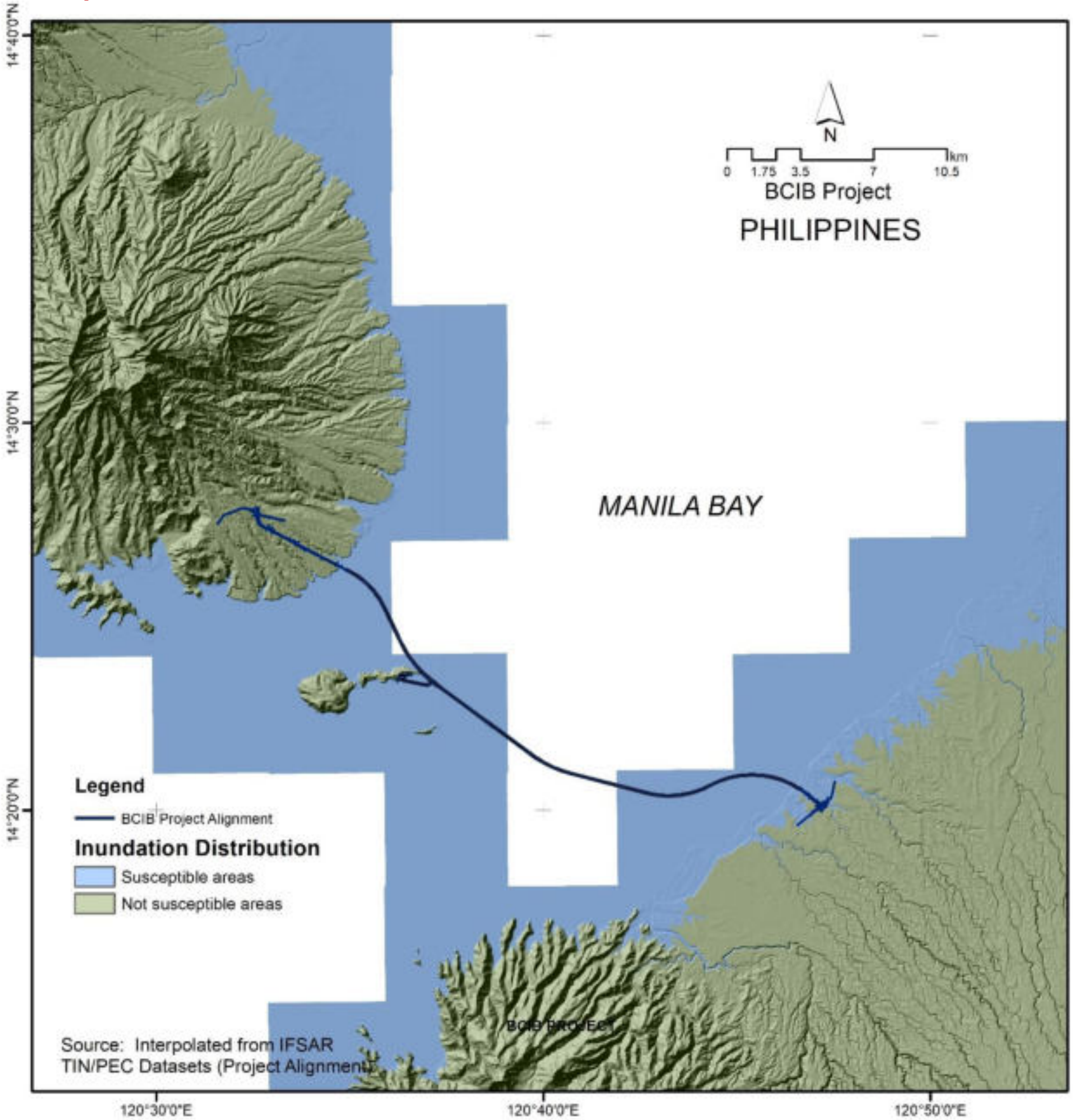
Source: Projections of mean sea level change for the Philippines, p.23.
Note: The solid line represents the central estimate, shaded area represents the uncertainty of the likely range.

Exhibit 5-17: Time Series of the Mean Sea Level Change for Manila



Source: Projections of mean sea level change for the Philippines, p.24.
Note: The solid line represents the central estimate, shaded area represents the uncertainty of the likely range.

Exhibit 5-18: Inundation Distribution Considering Sea Level Rise, Storm Surge, and High Tide Wave of the Project Areas



5.5 Storm Surge

140. The Department of Science and Technology (DOST), together with the Philippine Institute of Volcanology (PHIVOLCS), has published a map showing tsunami-prone areas in the country (Exhibit 5-19). As seen on the map, the coastal areas of Manila Bay, including Bataan and Cavite, are prone to "trench-related" local tsunami, which means that seismic activity in the Manila Trench can trigger a tsunami along the coastal areas.

141. The passage of strong typhoons also generates storm surges along the coastal areas of the archipelago.[21] Project NOAH (Nationwide Operational Assessment of Hazards) in partnership with DOST through PAGASA, PHIVOLCS, and the DOST-Advanced Science and Technology Institute (ASTI), the UP National Institute of Geological Sciences, and the UP College of Engineering has embarked on Coastal Hazards and Storm Surge Assessment and Mitigation (CHASSAM). Along with other vital components of the project, the aim is to generate wave surge, wave refraction, and coastal circulation models to understand and recommend solutions for coastal erosion. NOAH maintains an online publication of storm surge maps along with other hazard maps.[22]

142. It can be seen from the image below that the coastal areas of Brgy. Timalan Concepcion are the only and potentially susceptible to storm surge events. Much of the sensitive areas can be dispersed on the main tributaries of the Labac River, which is about 500 m away from the Cavite interchange roadway alignment. Other adjacent areas along the alignment are susceptible to the storm surge, including Bataan project sites.

Exhibit 5-19: Susceptibility to Storm Surge of the Project Sites, Bataan (left) and Cavite (right)

Susceptibility of the project site in Barangay Mt. View, Mariveles, Bataan

Susceptibility of the project site in Barangay Timalan Concepcion, Naic, Cavite

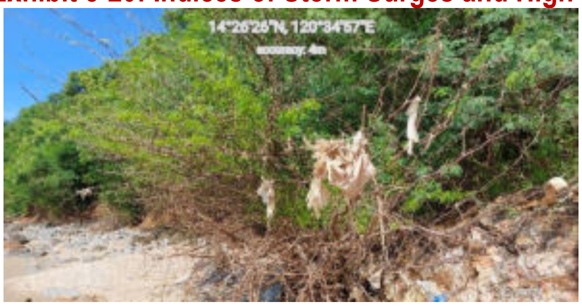
143. Motu et al. (2010) reported the maximum simulated tidal deviation caused by storm surges in Manila Bay. The model typhoon was the historic typhoon that caused the most considerable rise above general sea level. The study found that typhoons with the lowest pressures or strongest winds do not always yield the highest storm surge. After choosing the model typhoon, it’s at-sea winds and barometric pressure field were calculated, then used to estimate the storm surge. In addition, the study calculated an intensified storm surge case (the model typhoon with 10% lower central pressure). The study found that the maximum calculated surge based on a typhoon that hit the islands in November 1957 was a 0.91-meter water level increase. The study estimated a 1.0-meter maximum water level increase in Manila Bay, given a 10% increase over historical typhoons.

21 A storm surge is a tsunami-like phenomenon of rising water resulting from typhoons (storms).

22 https://noah.up.edu.ph/know-your-hazards/storm-surge

144. During the site visit, the study team observed different signs and indices of storm surge because of typhoons (Exhibit 5-20). Local communities, barangay officials, and MDRRMO staff of both municipalities also confirmed the slight incidences of storm surges in the areas.

Exhibit 5-20: Indices of Storm Surges and High Waves Occurrence in the Project Areas



Height indices of the storm surge

Collapse of the community boat landing areas due to high waves during the onset of typhoons

Exposed roots due to high tidal waves during typhoons Tisoy and Rolly occurred in 2019and 2020, repectively along Brgy. Timalaya Conception, Naic, Cavite

Affected beach offshore areas during the storm surge

5.6 Strong Winds

145. The project areas are categorically *medium* to *high risk* in typhoon occurrences. Again, Bataan and Cavite are hit by one (1) typhoon per year. Typhoon *Jolina* (with international name *Conson*) with sustained winds of more than 120 km/h was the latest to hit the project areas on 08 September 2021.

146. In 2019, Typhoon *Kammuri* hit Central Luzon with maximum sustained winds of 150 kph and gustiness of up to 185 kph causing moderate wind damage to Bataan province and other provinces of Region 3. Another noted tropical storm, typhoon *Rammasun*, hit the country in 2014 with peak winds at 120 kph and gustiness of 165 kph, caused widespread flooding due to heavy downpours.

147. For the last 70 years, PAGASA recorded an annual average of 20 tropical cyclones in the PAR, with nine of these passing through Philippine landmasses. PAGASA also tracked 27 tropical cyclones that crossed Bataan while 26 tropical cyclones crossed the Province of Cavite. These tropical cyclones traversed the project location during the months of September to October. The latest typhoon's effect is evident in a photo below of coconut trees along coastal areas on the Cavite side (Exhibit 5-21).

148. Although the estimates are uncertain, the maximum wind speed of future tropical cyclones is generally expected to increase. Similarly, the intensity of future storms is generally expected to increase, although the details of these changes are highly uncertain. The frequency of future severe storms is even more uncertain. Some scientists predict that their intensity may increase with climate change (Knutson et al., 2010; Emanuel 2013). Moreover, regardless of any increase in intensity or frequency, their effects would likely be exacerbated by the Philippines' rapidly growing population, particularly along the coast, and by localized environmental degradation (Holden and Marshall, 2018).

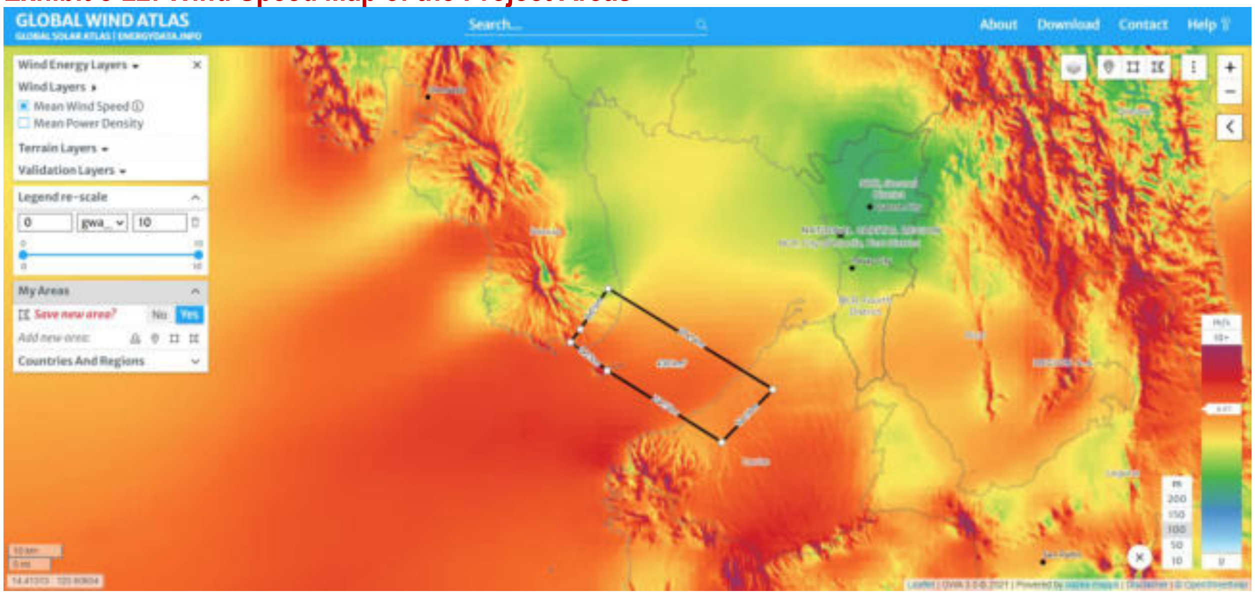
Exhibit 5-21: Indication of Typhoon Rolly Damage in 2020 at the Cavite Project Site

149. Exhibit 5-22 shows the project area and mean wind speed map. Seasonally, the Mariveles and Nasugbu mountain ranges create a funnel that constricts the wind from the West Philippine Sea towards Corregidor Island. Bataan and Cavite sections have mean wind speeds ranging from 6.61 to 7.05 m/s and from 6.60 to 7.37 m/s, respectively, while the Corregidor Island portion is exposed at rates ranging from 6.96 to 7.19 m/s. In contrast, the mean wind at the Sangley Weather Station is 5.91 m/s, or about 1.2 times less than on the Bataan alignment. For instance, based on the orographic effect and a simple ratio and proportion, the wind speed in Bataan could reach 231 kph considering the historically recorded peak wind speed of 194 kph in Sangley Point Station.[23] A study on Design Tropical Cyclone Wind Speed when considering Climate Change indicated that wind speed during tropical cyclones increases by 1.2-1.4 times the historical record.[24] These could increase the wind speed in Bataan section to well over 300 kph. Other details are presented in Exhibit 5-23.

[23] 54 mps or 194.4 kph is the extreme wind speed event recorded on 13 July 2010

[24] Xu H et al. (2020). Design Tropical Cyclone Wind Speed when Considering Climate Change. https://ascelibrary.org/doi/pdf/10.1061/%28ASCE%29ST.1943-541X.0002585.

Exhibit 5-22: Wind Speed Map of the Project Areas



Source: https://globalwindatlas.info/

Exhibit 5-23: Estimated Peak Wind Speed with Climate Change Consideration

Alignment Section	Mean Wind Speed Range (m/s)[a]	Estimated Wind Speed (kph)[b]	With Climate Change Consideration[c]
Bataan	6.61 – 7.05	231	300
Corregidor	6.96 – 7.19	236	307
Cavite	6.60 – 7.37	242	315

[a] Values are taken from global wind atlas with an altitude of 100 m.

[b] A simple ratio and proportion considering the historically recorded peak wind speed of 194 kph in Sangley Point Station

[c] Tropical cyclones increase by 1.3 times the historical record considering climate change as per study on Design Tropical Cyclone Wind Speed.

5.7 Landslide

150. Landslide is essentially described as the downward movement of a relatively dry mass of earth and rock. It is a process where soil particles are detached, transported, and deposited from one place to another. It is usually triggered by excessive rainfall or the occurrence of an earthquake strong enough to cause instability in the underlying rock layer.

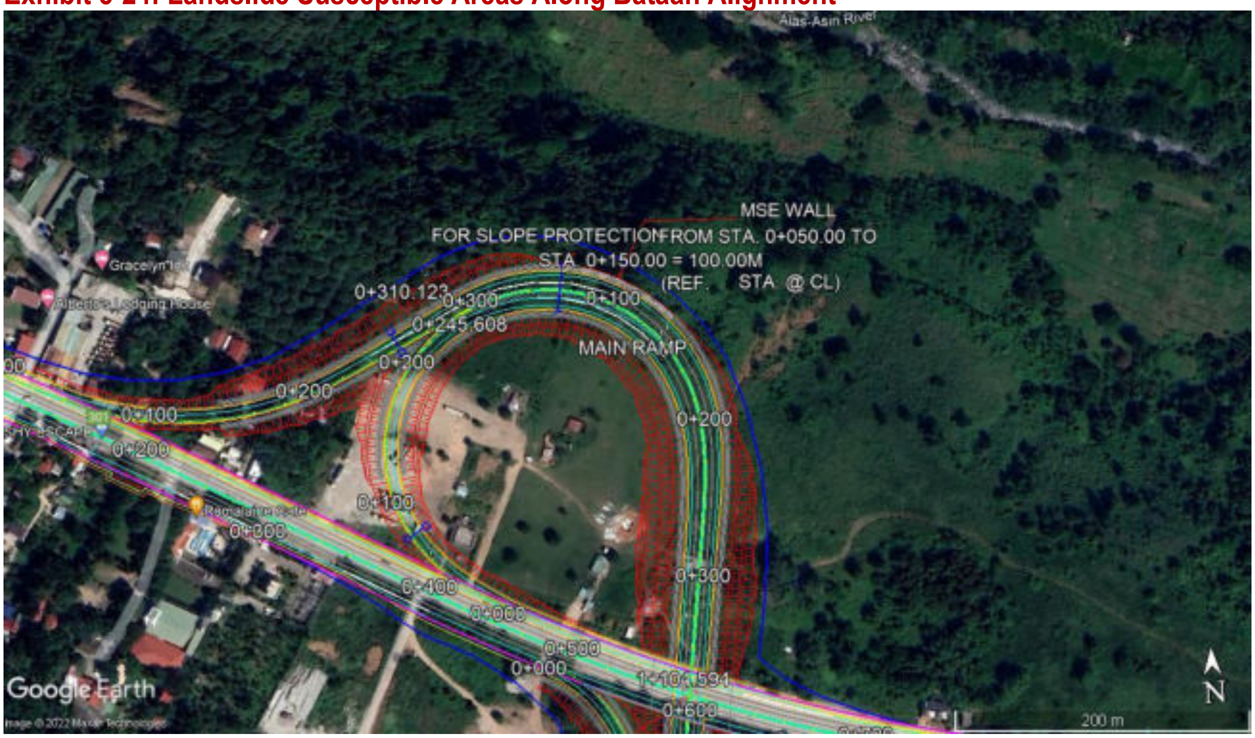
151. The DENR-MGB (undated) issued a landslide susceptibility map for both provinces. At the Cavite segment, the interchange and roadway alignment runs through a gentle to flat alluvial plain at the shoreline, and the landslide susceptibility is negligible. Consequently, it is expected that the hazards from mass movements will not significantly affect the project structures onshore in the future.

152. The BCIB project is within a gently sloping interfluve terrain at the coastal area of the Bataan end alignment with generally low landslide susceptibility although the project alignment located between Station 0+050 and Station 0+150 is highly susceptible to landslide (Exhibit 5-24).

153. The maximum 1-day total (Rx1day) describes the maximum amount of rain that can fall in one day. This extreme rainfall is typically associated with local thunderstorms or large-scale systems, such as monsoons or tropical cyclones, and may induce flash floods or landslides. Based on the rainfall projection in Bataan, changes in the Rx1day are expected to vary temporally with wetter trends during the mid-future (2046 – 2065). In the RCP8.5 scenario, the project areas are projected to have an increasing Rx1day as time progresses, to around 300 mm in the mid-future.

154. Increased Rx1day rainfall and higher intensities will likely reduce soil stability. This applies to natural slopes and man-made structures, such as road embankments and cuttings. Consequently, the frequency of slope failures affecting the road system is believed to increase in such stations (between 0+050 and 0+150), where more intense rainfall is expected. It means that the area requires slope protection and climate change considerations in making protective measures.

Exhibit 5-24: Landslide Susceptible Areas Along Bataan Alignment



5.8 Heatwaves

155. The project areas (Bataan and Cavite) have been experiencing warmer temperatures, with the warmest daytime temperature of about 39 °C. The current median probability of a heatwave (a period of 3 or more days where the daily temperature is above the long-term 95th percentile of daily mean temperature) is around 2%. This low value reflects the relatively stable temperature regime. Under two (2) emission pathways projections, the probability of experiencing a heatwave increases dramatically by up to 76% under the RCP8.5 pathway in 2081–2100. However, this

indicator is somewhat distorted by the definition of a heatwave. Usually, climate change continually pushes temperatures away from the baseline (1986–2005), meaning a long-term change is captured as a heatwave. Another lens to measure heatwave potential is through the annual maximum of daily maximum temperatures.

6. GREENHOUSE GAS EMISSIONS REDUCTION

156. The transportation sector is a major contributor to GHG emissions, considering energy and fuel consumption as the main factors in the analysis. Transport accounts for around one-fifth of global carbon dioxide (CO_2) emissions.[25] Carbon dioxide comprises most of the transport GHG emissions. Thus, the implementation of the BCIB project will certainly increase GHG emission through the consumption of fossil fuel during construction and operation phases.

157. A quantitative GHG assessment was performed to estimate the potential GHG emissions of the project through the methodology of the Inter-governmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories and ADB Guidelines for Estimating GHG Emissions of ADB Projects (Additional Guidance for Transport Projects).[26] The guidelines provide suggested methodologies in calculating GHG emissions in different transport subsectors.

158. With the above guidelines, the framework of the Greenhouse Gas Protocol classifies emissions as *direct* GHG emissions and *indirect* GHG emissions. Under this definition, the majority of GHG emissions for the transport sector are Scope 3 indirect GHG emissions, since they primarily arise from the use of energy by vehicles whose movements occur on or due to the infrastructure. This generally comes in the form of the consumption of gasoline, diesel, and other forms of fossil fuels. Therefore, Scope 3 emissions are the primary consideration for the project. Emissions that relate to the construction of the transport infrastructure are considered direct GHG emissions and included in the analysis.

[25] Ritchie H. 2020. URL https://ourworldindata.org/co2-emissions-from-transport
[26] ADB. 2016. *Guidelines for estimating greenhouse gas emissions of Asian Development Bank projects additional guidance for transport projects*. Manila, Philippines. 21p.

6.1 CO_2 Emissions During Construction

159. The concept and approach of estimating GHG emissions attributed to the project are shown in the table below.

Exhibit 6-1: Estimation of GHG Emissions during Construction Phase

Emission Source	Approach	Variable
Emissions from the carriage of construction plant equipment to site	For each plant type: carbon emissions = distance traveled by plant type x relevant emissions factor (kg CO_2/km)	Number and type of plant equipment, distance traveled (km)
Emissions from the carriage of bulk construction materials to site	For each bulk material: carbon emissions = total volume of material (tonnes) x % carried by road x distance from point of manufacture to site (km) x relevant emissions factor (kg CO_2/km)	Volume of each bulk material (tonnes), % carried by mode of transport (road), distance from point of manufacture to site (km)
Emissions from the carriage of excavated material from site	Carbon emissions = total volume of excavated material (tonnes) x % carried by road, rail x distance traveled to landfill site(s) (km) x relevant emissions factor (kg CO_2/km)	Volume of excavated material (tonnes), distance to landfill site(s) (km), % carried by mode of transport (road)
Emissions from construction personnel travel to and from the site	Mode of transport characteristics (i.e., private transport or public transport)	Mode of transport specification and/or efficiency
Emissions from the manufacture (cradle to gate) of bulk construction materials (embedded carbon) for each type of track feature (i.e., viaducts, tunnels, stations); bulk construction materials include concrete, steel, aluminum, copper, and aggregate	Carbon emissions = tonnes of steel x relevant emissions factor (kg CO_2/ton) Carbon emissions = tonnes of concrete x relevant emissions factor (kg CO_2/ton) Carbon emissions = tonnes of ballast (aggregate) x relevant emissions factor (kg CO_2/ton)	Tonnes of steel Quantity (tonnes) and grade (% of cement) of concrete used Quantity (tonnes) of aggregate required
Emissions from materials	Quantity (m^3) x Density (kg/m^3) x EF	
Emissions from equipment	Fuel Consumption Rate x Quantity x Duration (hr) x EF	Duration (hours)
Emissions from transportation	Mass (kg transported) x Distance (km) x EF	

Note: Emission factor of GHG in consideration, based on the default EF by type of fuel (kg fuel/gal). Based on the Emission Factors for Greenhouse Gas Inventories for mobile combustion of CO_2 for diesel fuel, 2.70 kg CO_2/liter (10.15 kg CO2/gal) is used. 1L = 0.26417 gallon

160. The GHG emissions attributed to the project during the construction stage are assessed as direct GHG emissions and indirect GHG emissions. The direct sources of CO_2 emissions during the BCIB project construction phase include on-site use of oil or electricity in construction machinery, vehicles, and power generators. The transport of construction materials to the project sites also contributes to CO_2 emissions. The indirect emissions are attributed to the embodied

carbon in construction materials and fuels used on-site. CO_2 emissions are released during the production of construction materials. The production process includes extraction, transportation, processing, and distribution. These emissions are indirect emissions as they are not released at the project sites but elsewhere.

161. In particular, the assessment has considered four (4) types of emission sources: i) GHG emissions that occur in *producing* the main materials, ii) GHG emissions that occur in *transporting* the main materials, iii) direct emissions due to combustion of fossil fuels that are used at road and bridge construction sites using different types of construction machinery and vehicles, iv) GHG emissions from the buildings, vehicles, and other road facilities, and v) removal of vegetation.

162. The first type is based on the fuel consumption that occurs in producing main materials. Again, these emissions are indirect emissions as they are not released at the construction site but elsewhere. The assessment provided quantities of steel, cement, fine aggregate, coarse aggregate asphalt which are determined during the feasibility study and DED stage. Exhibit 6-2 gives the quantity of materials to be used in producing main materials and the estimated CO_2 emissions during construction. The BCIB does specify the use of low carbon concrete that will use low emissions ingredients to for a reduction of 45,301 tCO_2e over the project construction.

163. The second type of GHG emissions are from fuel consumption that arises from transporting main materials. GHG emissions associated with the use of materials, equipment, and their transportation during the construction phase were estimated in the project. An average of 100 km is assumed transport distance from point of manufacture to the project site. Exhibit 6-3 summarizes the number of different materials used per kilometer during the construction stage.

Exhibit 6-2: Estimated CO_2 Emissions Generated from Main Materials Used for the BCIB Project

Material [a]	Quantity (ton)	Emission Factor ($kgCO_2$/ton)[b]	CO_2 Emissions (tonnes/CO_2)
Steel	303,896	1.460	444
Cement	440,543	0.762	336
Fine aggregate	1,071,486	0.002	2
Coarse aggregate	1,398,493	0.004	6
Asphalt	149,420	0.066	10
Fly Ash	124,108	0.240	30
Total	**3,487,946**		**828**

[a] Based on the estimated material delivery quantities for the project.

[b] ADB. 2016. *Guidelines for estimating greenhouse gas emissions of Asian Development Bank projects additional guidance for transport projects*. Manila, Philippines. p.20.

Exhibit 6-3: Estimated CO_2 Emissions Generated from Transporting Main Materials for the BCIB Project

Material	Vehicle	Transport Distance (km)	Volume of Materials (tons)	Emission Factor ($kgCO_2$)	CO2 Emission (tonnes)
Steel	Heavy Truck 49T	100	303,896	1.460	44,369
Cement	Heavy Truck 49T	100	440,543	0.762	33,569
Fine aggregate	Medium Truck 18T	100	1,071,486	0.002	214
Coarse aggregate	Medium Truck 18T	100	1,398,493	0.004	559
Asphalt	Medium Truck 18T	100	149,420	0.066	986
Fly Ash		100	124,108	0.240	2,979
Total					**82,677**

Note: 100 km is assumed transport distance based on the similar project in Korea (11.65 km Bridge to Incheon International Airport Mega Project).

164. The third type is fuel and electricity consumption from the use of heavy equipment and different types of construction machinery, generators, vehicles, and batching plants used at the construction sites.[27] Exhibit 6-4 summarizes the CO_2 emissions according to the amount of oil or electricity consumption per equipment and other machinery specifications used on the marine viaduct, navigational bridge, interchanges and viaducts on land, and approach ramps construction.

Exhibit 6-4: Estimated CO_2 Emissions Generated from Heavy Equipment, Generators, and Other Machineries

Device Name	Fuel Consumption Rate (l/hr)	Fuel Consumption Rate (kWh)	Quantity*Duration	GHG Emissions (Tonnes CO2e)
400 Amp Welding Machine (kWh)		453	538,096	106,035
500 Amp Welding Machine (kWh)		562	95,680	23,384
Alimak Elevators		1,404	24,336	14,868
80 kW Generator	12.00		193,648	6,274
CAT 374 Excavator	34.10		5,616	517
CAT 325 Excavator	18.90		71,552	3,651
CAT D7 Dozer	10.00		11,232	303
CCS9 Compactor/Roller	8.00		11,232	243
CAT 938 Wheel Loader	10.00		5,616	152
CAT 986K Rubber Tire Loader	10.00		79,456	2,145
CAT 14 Motor Grader	10.00		8,424	227
10-Ton 4WD Forklift	8.00		76,960	1,662
2-Ton Flatbed Trucks	2.90		59,488	466
1/2-Ton Pickup Trucks	2.00		317,200	1,713
S-30 Derrick Crane	10.00		6,240	168
Lifting Frame w/ Hoists	10.00		16,640	449
3,000-Ton Crane	400.00		17,472	18,870
2,000-Ton Crane	300.00		21,008	17,016
4100 Series 3 Ringer Crane	400.00		8,320	8,986
300-500 Ton Derrick Crane	10.00		97,552	2,634
300 Ton Crawler Crane	50.00		138,112	18,645
200 Ton Crawler Crane	25.00		36,712	2,478
160-Ton Rubber Tire Crane	25.00		8,320	562
60-Ton Rubber Tire Crane	12.00		58,032	1,880
45-Ton Rubber Tire Crane	12.00		8,320	270
Small Boom Truck (Neckbreaker)	15.90		8,320	357
375 kW Generator + CAT C9 Engine	50.00		97,552	13,170
2 Drum Aux. Hoist on Crane for Pile Driving	10.00		195,104	5,268
3-Drum 20,000 Lb Winch for Spuds	10.00		105,872	2,859
IHC Hydraulic Pile Hammer	10.00		36,608	988

[27] Equipment and diesel consumptions are based on the completed 11.65 km Bridge to Incheon International Airport Mega Project from 2005 to 2009 in the Republic of Korea.

Device Name	Fuel Consumption Rate (l/hr)	Fuel Consumption Rate (kWh)	Quantity*Duration	GHG Emissions (Tonnes CO2e)
Powerpack for IHC Hydraulic Pile Hammer	10.00		36,608	988
APE 400 Vibratory Hammer	10.00		86,216	2,328
Powerpack for APE 400 Vibratory Hammer	10.00		86,216	2,328
D46 Pile Hammer	19.10		8,944	461
185 CFM Air Compressor	13.00		235,456	8,265
750 CFM Air Compressor	13.00		44,928	1,577
Hoisting Gear 120 kW Generator	10.00		73,008	1,971
36 kW Portable Generator	7.00		278,096	5,256
10 kW Portable Generator	5.00		98,384	1,328
47 ft Crew Boats (28-Person)	10.00		94,848	2,561
38 ft Mechanic Boats	50.00		71,552	9,660
Survey Boats	50.00		71,552	9,660
Superintendent Boats	50.00		71,552	9,660
900 HP Tugboats	50.00		94,848	12,804
1200 HP Tugboats	50.00		35,776	4,830
1400 HP Tugboats	50.00		35,776	4,830
3-Axle Trucks	29.00		67,392	5,277
6 kW Light Plants	4.20		271,024	3,073
Schwing Concrete Pump	7.60		80,912	1,660
100-Ton Straddle Lift	10.00		122,304	3,302
Steam Generator	38.00		84,240	8,643
Air Tugger for Cart System	10.00		112,320	3,033
FSLM Overhead Gantry	10.00		21,008	567
FSLM Transporter	10.00		18,928	511
Slip Form Paving Machine	10.00		2,496	67
Ready Mix Truck	3.90		39,936	421
Bidwell for Overlay	10.00		2,496	67
Total				**361,368**

Note:

- Fuel consumption rates are based on the available equipment specifications and information taken from the 11.65 km Bridge to Incheon International Airport Mega Project from 2005 to 2009 in the Republic of Korea. The project comprised a cable-stayed bridge (1.48 km), an approach bridge (1.78 km), and a viaduct (8.40 km).
- Operating hours computation is based on the equipment quantity multiplied by the duration of working hours per day. Eight (8) hours are considered the working duration of all equipment during weekdays. The quantity of equipment is taken from the project document on BCIB Equipment Study (Equipment and Deliveries).
- Emission Factor = 2.70 kgCO_2 (Diesel); 0.435 kgCO_2 (Electricity)

165. The fourth type is on-site CO_2 emission on oil and electricity consumption from buildings, business and road management vehicles, and road facilities (i.e., streetlamps, closed-circuit televisions (CCTVs), cameras and variable message signs (VMSs)). Exhibit 6-5 summarizes the oil and electricity consumption from buildings, business and road management vehicles, and road facilities. For this type, the project contributes an annual estimate of 370 tonnes of CO_2e during its construction period.

166. The fifth is the carbon sequestration potential lost. The bridge and road project requires clearance of vegetation that may lead to a certain amount of carbon sequestration potential being lost. However, the project proponent and its constructors will replace new trees to compensate for the tree lost, making up for the potential sequestration losses for trees cut during construction. The

assessment does not include the CO_2 sequestration potential lost due to the removal of vegetation in the carbon footprint accounting of the BCIB project, where the replacement of new seedlings will compensate for this loss.[28] A total of 1,454 trees (1,120 trees in Bataan and 334 trees in Cavite) with a diameter of more than or equal to 15 cm at breast height will be affected during construction. The replacement of 145,000 seedlings is required in compliance with the DENR Memorandum Order No. 2012 – 02.

Exhibit 6-5: Estimated CO_2 Emissions Based on Oil Consumption from Buildings, Business and Road Management Vehicles, and Road Facilities

Oil Type	Unit	Building	Business Vehicles	Road Management Vehicles	Road Facilities	Annual Consumption	Emission Factor ($kgCO_2$)	CO2 Emission (tonnes)
LPG	liter	196				196	1.50[a]	0.3
Diesel	liter	1,000	10,000	100,000		111,000	2.70[a]	299.7
Gasoline	liter		10,000			10,000	2.32[a]	23.2
Electricity	kw	10,000			100,000	110,000	0.44[b]	47.9
Total								**371.0**

[a] ADB. 2016. *Guidelines for estimating greenhouse gas emissions of Asian Development Bank projects additional guidance for transport projects*. Manila, Philippines. p.17.

[b] National Electricity Emission Factor (Philippines) kg CO_2/kWh = 0.4350061

167. Based on GHG emissions estimation, the total quantum of fuel and electricity to be consumed for marine viaduct, navigational bridge, interchanges and viaducts on land, and approach ramps construction was converted to equivalent CO_2 emissions using the Philippine-specific emission factors. Similarly, the embodied CO_2 in construction materials and/or fuels used was estimated using specific values. The CO_2 estimation results for the construction phase of the BCIB project is found in Exhibit 6-6. Given these, the construction of the project releases 89,049 tons of CO_2 (tCO_2) annually. Based on ADB's threshold of 100,000 tCO_2/year, the project's construction is an insignificant source of emissions.[29] Throughout the 5-year construction period, about 445,200 tCO_2 are attributed to the BCIB project.

Exhibit 6-6: Estimated CO_2 Emissions for the Entire Construction Phase

GHG Emissions	CO_2 Emission (ton)
1) GHG emission in producing the main materials	828
2) GHG emission in transporting the main materials	82,677
3) GHG emission for various equipment, machinery, and vehicle	361,368
4) GHG emission for buildings, vehicles, and road facilities	371
5) Carbon sequestration	0
Total	**445,244**
Construction period	5
Average GHG emission	**89,049**

28 The permittee shall replace the tree to be cut with one hundred (100) seedlings of indigenous species in compliance with the DENR Memorandum order No. 2012 - 02 dated November 5, 2012 re: "*Uniform Replacement for Cut and Relocated Trees*" to be turned-over to the local DENR office concerned in support to the National Greening Program (NGP) and climate change initiatives of the Government.

29 ADB. 2009. Safeguard Policy Statement. https://www.adb.org/sites/default/files/institutional-document/32056/safeguard-policy-statement-june2009.pdf.

6.2 CO_2 Emissions During Operation

6.2.1 GHG Emissions from Buildings, Lights, Service Vehicles, and Road Facilities

168. To estimate GHG emissions from buildings, lights, service vehicles, and road facilities, the oil or fuel consumption rates and the given emission factor were considered in the project. The outbuildings are applying the Philippine Green Building Codes. The pavement will be pervious. The drainage will be captured for landscaping. The buildings will include solar panels, and the building materials will be sustainably sourced.

169. For streetlights, the number of lamps to be installed, as well as their wattage, type, and the operation period are required inputs. Streetlamps in the project are assumed to operate on the average of 11 hr/day. The electricity emission factor was 0.43501 $kgCO_2e/kWh$.

170. Exhibit 6-7 and 6-8 summarize the absolute contributions of building facilities, lightings, service vehicles, and road facilities to GHG emissions at the operational phase. The GHG emissions assessment during the operation of the BCIB project is estimated at about 5,000 tCO_2e/yr.

Exhibit 6-7: CO_2 Emissions from Buildings, Service Vehicles, and Road Facilities

Mode	Oil Type			
	LPG (li)	Diesel (li)	Gasoline (li)	Electricity (kW)
Building				
Bridge Monitoring and Maintenance Compound (BMMC)	200	1,000		50,000
Weighbridge Station and Grounds (WGS facilities)	40	200		400
Business vehicles (e.g., shuttles)		10,000	10,000	
Road management vehicles		100,000		
Estimated Annual Consumption	240	111,200	10,000	50,400
Emission Factor ($kgCO_2$)	1.50	2.70	2.32	0.43501
Calculated CO_2 Emission (ton/yr)	0.4	300.2	23.2	21.9
Total CO2e				**345.7**

Assumptions: 400 kWh electricity consumption in each station per month, which is equal to 400 kW in a year.
100,000 kWh electricity consumption per month for the BMMC facilities, which is equivalent to 50,000 kW per year.

Exhibit 6-8: CO_2 Emissions from Street Lightings

Lighting	Wattage (kW)	Quantity	Duration (hr/yr)	EF (kgCO2e/kWh)	Calculated CO_2e Emission (ton/yr)
Street lighting (P1 and P2 only)	3.3	680	4015	0.4350	3,919
Cable lightning	2.2	130	4015	0.4350	500
Pylon lighting	2.2	50	4015	0.4350	192
Total CO_2e					**4,611**

Note: The project emissions of the street lighting are not included in the computation because of using the latest solar technology.

171. While the Project does result in new GHG emissions for lighting and buildings, the Project incorporates GHG emission minimization measures, such as energy efficient lighting and Green Building Design. The estimated used High Pressure Sodium (HPS) for the highway lighting, and Metal Halide (MH) as the basis of comparison which is in used throughout the Philippines. The proposed system is all based on energy efficient LED lighting. The calculation is based on '(Number of fixtures)*(Watts/fixture)*(12 hrs/day(1))*(365 days/year)*(0.592 tCO_2e/MW-hr) = (# tCO_2e/year) and results reduce GHG emissions of approximately 1,152 tCO_2e per year. Green building design will include solar panels, extra insulation, rain infiltration process, energy efficient lighting and windows for both he BMMC and the proposed Tourist Facility which is estimated to reduce GHG emissions as compared with normal building standards by 283 tCO_2e per year.

6.2.2 GHG Emissions on the BCIB Project Transport Network

172. For this GHG emission assessment, the structure of the ADB GHG emissions estimation formula was considered (ADB, 2016):

$$Total\ Transport\ Emissions = Activity\ (vkm) \times ModalStucture \times Intensity\ \left(\frac{l}{pkm}\right) \times Fuel\ Carbon\ Content\ \left(\frac{g}{l}\right)$$

173. The transport fuels used in vehicles during the project operation contribute to direct and indirect CO_2 emissions on account of fuel combustion in vehicle engines and embodied carbon in fuels, respectively. The cumulative GHG emissions are attributable to the increasing number of vehicles on the road, the number of kilometers traveled by each vehicle, the fuel consumed for each kilometer traveled, and the carbon content of the different fuels used.

174. Traffic volume is an important component in the GHG estimation of vehicle movements. The forecasted volume (2030 and 2050) in terms of Annual Average Daily Traffic was considered in the economic appraisal report. On the opening year of the project in 2030, around 17,500 vehicles along the eastbound direction and 17,200 vehicles along the westbound direction are expected to use the BCIP. In the year 2050, traffic is expected to increase to about 28,900 vehicles and 29,300 vehicles for the eastbound direction and westbound direction, respectively.

175. Exhibit 6-9 presents the volume of traffic by each vehicle class for forecast years 2030 and 2050 with BCIB in place. The main significant factor in the decrease in vehicle kilometers is the shorter distance due to the BCIB. Along the considered network, total truck and bus trips will benefit due to the regional travel characteristics of these modes doing longer trips than other modes.

Exhibit 6-9: Traffic Projection Volume in 2030 and 2050

Year	Direction	MC	Car	PUJ	Bus	Truck	Total
2030	BCIB Eastbound	8,900	6,233	-	666	1,762	17,561
	BCIB Westbound	8,788	6,341	-	768	1,370	17,261
2050	BCIB Eastbound	12,654	12,671	-	1,293	2,312	28,930

BCIB Westbound	12,654	13,113	-	1,293	2,312	29,372

Source: Bataan-Cavite Interlink Bridge Project: Updated Traffic Projection (2023)

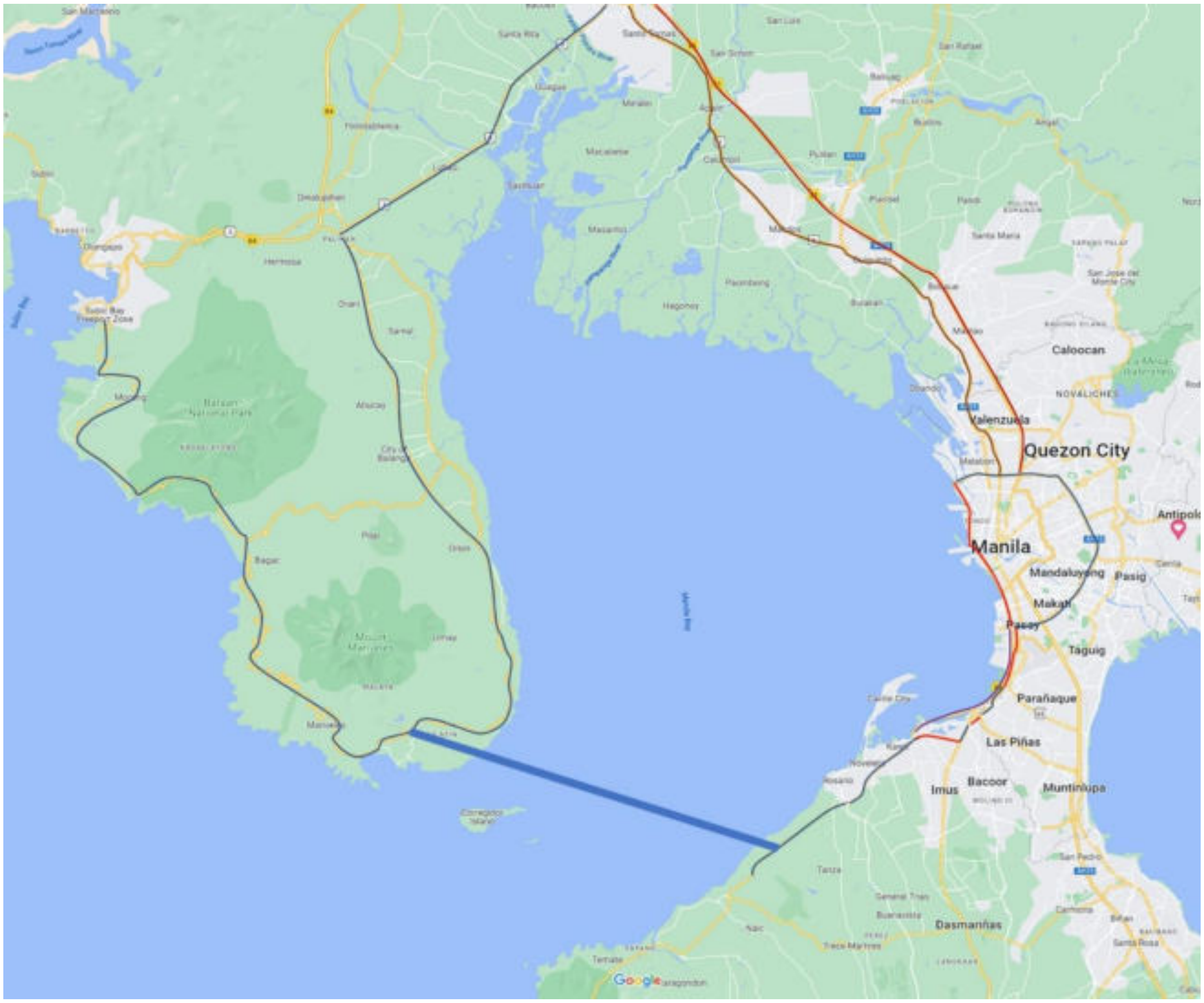
176. A transport model was set up and validated to assess the traffic impact of the BCIB scheme.[30] The origin-destination matrices outputs were used to inform the economic appraisal. Two (2) forecast years were modeled: 2030 and 2050. The analysis forecast overall traffic volume would increase up to 10 million vehicle trips between 2030 and 2050.

177. The assessment and computation are based on the travel activity that relies on the trip distance data, considering the BCIB transport route with travel sectors shown in Exhibit 6-10. The traffic projections cover the entire traffic analysis zones of Luzon. Internal zones were aggregated to emphasize the sectors (finer zones combined to produce the larger sectors 1 to 11) between the regions of Pampanga in the north up and Bicol in the south.

178. Currently, there are almost 2,000 vehicle trips per day between Bataan and Cavite. With the BCIB in place, vehicle trips are forecasted to be around 34,000 in 2030.

Exhibit 6-10: National Capitol Region Travel Zones

[30] ARUP and DPWH (2020). B2 Highway Alignment and Traffic Study Report for Bataan – Cavite Interlink Bridge (BCIB) Project



Sources: Updated traffic projection report (2023)

179. Net changes in GHG emissions due to changed traffic flows are estimated in 2030 and 2050, representing the commencement year of the BCIB project and 20 years during the project implementation.

180. Following the basic structure of the ADB GHG emissions estimation formula (as described in Para 171) to calculate the gross GHG emissions, the modal structure, the intensity (fuel consumption), and the fuel carbon content were applied to the total network vehicle kilometers (vkm) for *with* and *without* BCIB scenario. Again, the modal structure was determined by estimating the percent (%) share of petrol and diesel vehicles by mode. Intensity referred to liters of petrol/diesel used per kilometer and was included for each mode considered in this analysis. The mobile combustion emission factor was determined for both petrol and diesel with kg CO_2/liter of 2.32 and 2.70, respectively. Others details of the GHG emissions impact assumptions are presented in Exhibit 6-11.

Exhibit 6-11: GHG Emission Impacts Assumptions

Modes	Modal Structure [a]		Intensity [b,c] (l/km)
	% Diesel	% Petro Gas	
Car	10	90	0.08
Bus	80	20	0.28
Truck	90	10	0.30
Motorcycle	0	100	0.02
Jeepney	100	0	0.18

[a] http://www.neda.gov.ph/wp-content/uploads/2015/03/FR-MAIN-TEXT.-12149605_01.pdf. p. 2-25

[b] Clean Air Asia. 2012. Air pollution and GHG emissions indicators for road transport and electricity sectors – guidelines for development, measurement, and use. p 131. *https://cleanairasia.org/wp-content/uploads/portal/files/documents/Guidelines_for_AP_and_GHG_Indicators_2012_Edition.pdf.*

[c] Assumed 18 liters/100km is equivalent to 5.65 liters/km. https://businessmirror.com.ph/2018/05/05/political-will-drives-puv-modernization/

181. The contribution to GHG emissions by the operation phase is summarized in Exhibit 6-12. The absolute GHG emissions from vehicular movements are about 30,000 tCO_2e without project scenario and 9,100 tCO_2e with project scenario in 2030. The estimated emissions are about 148,100 tCO_2e (without project) and 45,100 tCO_2e (with project) in 2050. The highest contribution of emissions would be associated with trucks in the opening year, followed by buses CO_2 emissions. By 2050, truck emissions and bus emissions will increase significantly compared to the opening year. The assessment of GHG emissions also found an increasing trend for motorcycles and private cars movements. Results indicated that the project's operation could be an insignificant source of emissions (average of 34,700 tCO_2/year) compared to GHG emissions without BCIB.

Exhibit 6-12: CO_2 Emissions (in ton/yr) from the Vehicular Movement in 2030 and 2050 With Project and Without Project Scenario

Mode	2030		2050	
	Without Project	With Project	Without Project	With Project
Motorcycle	476	145	2,044	623
Car	1,529	466	9,405	2,867
Jeepney	-	-	-	-
Bus	12,567	3,831	67,989	20,723
Truck	15,522	4,731	68,748	20,955
Total	**30,094**	**9,173**	**148,186**	**45,168**

Note: Computed based on traffic demand forecast for the BCIB project.

6.2.3 GHG Emissions Reduction

182. Road projects like the BCIB project can reduce congestion which can assist in reducing emissions. The net change in emissions on the account of the BCIB project was identified and valued, which was done through a *with* and *without* project comparison.

183. Exhibit 6-13 shows that the BCIB project in place will decrease GHG emissions with an annual average of 79,182 tCO_2 during the appraisal period. Results also indicated GHG reductions of about 20,900 tCO_2 in the opening year and about 1.6 million tCO_2 during the entire appraisal period (2030-2050).

184. GHG emissions reduction are mainly from trucks and buses as presented in Exhibit 6-14.

185. Additional elements to further encourage transition from petroleum fuels to low/ no emission vehicles includes encouraging both Baranguays to find parcels where electric vehicle charging stations can be added. This would be incorporated in a long-term program to reduce GHG in conjunction with improving the regional transportation system and not funded as part of the BCIB, but tangentially associated.

Exhibit 6-13: Net GHG Emissions (tCO_2e) Impacts

Estimation Scenario	2030	2050	Average	Entire Appraisal Period (2030 - 2050)
Without project (A)	30,094	148,186	113,899	2,391,888
With project (B)	9,173	45,168	34,717	729,056
Net emissions (B-A)	**-20,921**	**-103,018**	**-79,182**	**-1,662,832**

Exhibit 6-14: Reduction in GHG Emissions (in tCO_2e)

Year	Motorcycle	Car	Jeepney	Bus	Truck	Total
2030	**331**	**1,063**	**-**	**8,737**	**10,791**	**20,921**
2031	1,011	3,305	-	26,991	32,997	64,304
2032	1,029	3,426	-	27,796	33,635	65,885
2033	1,048	3,551	-	28,625	34,286	67,510
2034	1,067	3,681	-	29,479	34,952	69,178
2035	1,086	3,816	-	30,359	35,631	70,891
2036	1,106	3,955	-	31,265	36,326	72,651
2037	1,126	4,100	-	32,199	37,035	74,459
2038	1,146	4,249	-	33,162	37,760	76,317
2039	1,167	4,405	-	34,153	38,500	78,225
2040	1,188	4,566	-	35,175	39,257	80,185
2041	1,209	4,733	-	36,228	40,030	82,199
2042	1,231	4,906	-	37,312	40,820	84,269
2043	1,253	5,085	-	38,430	41,627	86,395
2044	1,276	5,271	-	39,581	42,451	88,580
2045	1,299	5,464	-	40,768	43,294	90,825
2046	1,322	5,664	-	41,991	44,155	93,132
2047	1,346	5,871	-	43,251	45,035	95,503
2048	1,371	6,085	-	44,549	45,935	97,940
2049	1,395	6,308	-	45,887	46,854	100,444
2050	**1,421**	**6,538**	**-**	**47,266**	**47,794**	**103,018**
Total	**24,427**	**96,040**	**-**	**733,202**	**809,163**	**1,662,832**
Average	**1,163**	**4,573**	**-**	**34,914**	**38,532**	**79,182**

186. While the Project does result in new GHG emissions, the Project incorporates GHG emission reduction measures, such as energy efficient lighting and Green Building Design. The estimated used High Pressure Sodium (HPS) for the highway lighting, and Metal Halide (MH) as the basis of comparison which is in used throughout the Philippines. The proposed system is all based on energy efficient LED lighting. The calculation is based on '(Number of

fixtures)*(Watts/fixture)*(12 hrs/day(1))*(365 days/year)*(0.592 tCO_2e/MW-hr) = (# tCO_2e/year) and results reduce GHG emissions of approximately 1,152 tCO_2e per year.

187. It must be noted that the monetization of changes in net emissions was accounted for in the Updated Economic Analysis Report of this project. The global social cost of carbon of $40.40 per ton of CO_2 cited in the ADB guidance was applied for this project.[31] The real growth rate of 2% per annum was also applied to allow for the potential of increasing marginal damage of global warming over time. The change in net emissions multiplied by the social cost of carbon represents the GHG emission impact. As a result, the project's economic impact due to change in transport emissions was accounted for at PhP 4,716 million (non-discounted) and PhP 4,716 million (discounted) GHG emissions impact.[32]

7. CLIMATE RISK MANAGEMENT RESPONSE WITHIN THE PROJECT

188. This chapter describes the climate risk management response within the project considering the particular risk profile. A Climate Risk and Adaptation Assessment is prepared to help assess climate change impacts of BCIB project and prescribe adaptation options as part of its detailed design. The detailed BCIB design is robust able to withstand extreme weather events. Certain sections and facilities that would be exposed to risk have been reviewed and design considerations have been incorporated and will be implemented during the construction and operation phases. Design considerations and adaptation measures that address or counter climate change and associated risk on the project's physical infrastructure and assets as currently designed are summarized below.

7.1 Impacts of Climate Change on the Project

7.1.1 Potential Impacts

189. Identified potential climate change impacts, risks, and the standards and design criteria being applied to address this risk are in Exhibit 7-1.

Exhibit 7-1: Climate Change Impacts, Risks, Impacts on the Project and Engineering Design Considerations

Potential Climate Change[a]	Description of Risks	Impacts on the Project[a, b]	Design Standards and Parameters
Increases in very hot days and heat waves	TXx as much as 1.6 °C in the late future for the RCP4.5 scenario and by as much as 3.6°C in the RCP8.5 scenario.	Higher temperatures and extreme heat can cause bridges to be stressed by thermal expansion and movement and lead to premature deterioration of the structure.	Pavement design standards are following codes and guidelines: i) 1993 AASHTO Guide for Design of Pavement Structures, and ii) 2013 Volume II Standard

[31] Asian Development Bank. Guidelines for the economic analysis of projects.
[32] IPIF1 BCIB Economic Model Final Report

Potential Climate Change[a]	Description of Risks	Impacts on the Project[a, b]	Design Standards and Parameters
	TXx projections diverge at an increasing rate from 35.5 °C (historical) to 39.3 °C (late-future) on the Bataan side and from 35.7 °C (historical) to 39.1 °C (late-future) on the Cavite side. TX90p is with projections indicating an increase of at least 21% (76 days) in the early future, and as much as 79% (288 days) in the late future, essentially making every day of the year a hot day.	Thermal expansion of bridge expansion joints and paved surfaces. Corrosion of steel reinforcements in concrete structures due to increase in surface salt levels.	Specifications for Highways, Bridges and Airports DPWH D.O. No. 22 series of 2011 - Minimum Pavement Thickness and width of National Roads.
Sea level rise and storm surges	Increase annual sea level changes in the project locations by 0.6 to 1.1m, and 0.8 to 1.6m in 2100 and 2130, respectively. Increase storm surge by a 1.0-meter maximum water level increase in Manila Bay, given a 10% increase over historical typhoons	Damage to highways, roads, and bridges due to flooding, inundation in coastal areas, and coastal erosion, Damage to infrastructure from land subsidence, More frequent flooding of low-lying infrastructure, Erosion of road base and bridge supports, Reduced clearance under bridges, Decreased expected lifetime of highways exposed to storm surges, Placement of precast segments may disturb seabed sediments which may have accumulated heavy metal content.	The navigation clearance studies were based on the Harbor Approach Channel Design Guidelines calculation method (PIANC 121-2014). Based on Internal Memo 001 – Design Life of BCIB Bridges, the BCIB project considered a 1.2 m (2130) sea level rise to design bridges to adapt to the operation and safety of critical infrastructure elements. SLR's Effects on Structural Design of Bridges: SLR may not only increase the Mean High Tide (MHT) but also extend or broaden the stream channels. The structural elements shall be designed for the following forces both with and without considering 1.2 m of SLR as well as other applicable loads. i) Vessel collision force, ii) Water load including: static pressure, stream pressure and wave force. **Vessel collision force** was applied considering both current conditions and conditions with most conservative projection of 1.6 meter of SLR. **Wave Parameters** The hydrodynamic modeling has been run under two scenarios: (i) existing sea level, and (ii) assuming a +1.2 m SLR.
Increase in intense precipitation events	Following the 1-day maximum historic data, the observed design values of Rx1day must be 315 mm for the Bataan side and 260 mm for the Cavite project site. Under CMIP5 RCP8.5 scenario, a 30% climate change factor is	Damage to bridge and drainage systems due to flooding, Increase the scouring rate of piers and bridge foundations, and build-up of sediments,	Calculated rainfall intensity following the provision of Table 9-3 of the DGCS (DPWH, 2015) Hydraulic design of all the drainage structures including the bridges is the flow generated from 1:100 years storm return period.

Potential Climate Change[a]	Description of Risks	Impacts on the Project[a, b]	Design Standards and Parameters
	computed to handle 97.5% of the projected rainfall intensity extremes. The design values of Rx1day for the future climate must be 409 mm for the Bataan side and 338 mm for the Cavite area.	Damage to road infrastructure due to landslides in the Bataan side, Overloading of drainage systems in Bataan and Cavite project alignments, Deterioration of structural integrity of roads and bridges due to increasing soil moisture levels. Landslide and soil erosion: extreme rainfall may also affect soil saturation which can cause landslides along with the sloping areas of the project site.	Rainfall intensities will be increased by 10% to reflect potential climate change per DCGS Vol 3, Section 9.2.4.1.
Increase of storm intensity and wind speed	Have been exposed to 27 tropical cyclone winds in the past seven (7) decades. As per the strongest typhoon occurred in November 2019, maximum sustained winds of 150 kph and gustiness of up to 185 kph. Bataan and Cavite sections have mean wind speeds ranging from 6.61 - 7.05 m/s and from 6.60 to 7.37 m/s, respectively, while the Corregidor Island portion is exposed at rate ranging from 6.96 to 7.19 m/s. The wind speed in Bataan could reach 231 kph considering the historically recorded peak wind speed of 194 kph in Sangley Point Station. Climate change wind speed during tropical cyclones could increase by 1.2 to 1.4 times the historical record, which means the wind speed in Bataan to well over 300 kph.	Expected to cause flooding or increase in the sea's surface water level (sea rise) in the project areas. Damage to road infrastructure and increased probability of infrastructure failures, Increased threat to the stability of bridge decks, and Increased damage to signs, lighting fixtures, and supports.	Design storm frequencies used in the project were recommended values shown in Table 5-3 of the DPWH DGCS 2015, Volume 4. *Wind load:* Wind design criteria: 1700 year wind standard– industry standard for cable bridges. A directional, and topographical factors of 1 were used in absence of any recommendations from Site Specific Climatology and Wind Study. Skew wind loads were calculated as per Article 3.8.1.2.3a of AASHTO LRFD Bridge Design Specification 8th Edition (2017). Vertical wind loads were determined based on published literature or findings from wind tunnel testing. Additional climate change factor of 1.05 was applied to Strength Design of the bridges in consideration of future climate change effects on wind.

[a] ADB. 2014. *Climate proofing ADB investment in the transport sector: initial experience*. p.9.
[b] IPIF1-BCIB-Environmental Impact Assessment Report Issue 3.
[c] T.Y. Lin International / Pyunghwa Engineering Consultants. 2021. *Bataan-Cavite Interlink Bridge Project. Package 1,2,3,4,5 &6: Baseline Engineering Design.* January 2022

7.1.1.1 Increases in Very Hot Days and Heat Waves

190. Baseline observations show that the hottest daytime temperature in the project areas is 35.6 °C. The temperature at project sites is projected to increase by as much as 1.6 °C in the late future for the RCP4.5 scenario and by as much as 3.8 °C in the RCP8.5 scenario. Since temperatures on

the warmest days are projected to increase at similar rates, the temperature range for bridge design is considered to determine the right course of action.

191. Potential climate impacts and risks of higher temperatures and extreme heat can cause bridges to be stressed by thermal expansion and movement and lead to premature deterioration of the structure. Increased temperatures can damage pavements that protect the bridge decks and the expansion joints of bridges. In addition, corrosion of steel reinforcements in concrete structures due to increase in surface salt levels is likely to happen.

192. The project design team reviewed the trends for average annual maximum and average yearly minimum temperature for the region from 1901 to the present and is utilizing a more extensive thermal range to account for the anticipated increase in temperature. This leads to more significant movements for bearing and expansion joints and higher stress on the fixed piers; however, these demands do not control the design as the movements and stresses from other loading are more strenuous. Therefore, no cost impact is anticipated due to increased thermal loading.

193. In terms of pavements, these are climate-sensitive infrastructure, where the climate can impact their deterioration rate, subsequent maintenance, and life-cycle costs. Various studies have supported the view that temperature is the most influential for flexible pavement performance compared to other climatic factors. For instance, Qiao et al. (2020) made a comprehensive review of flexible pavements and climate change implications. The study found that high temperature is the greatest climate concern as flexible pavements are highly sensitive to high temperature, and the impacts can accumulate over the complete service life.

194. Pavement design needs to consider changes in high temperatures to adapt to future climates. Qiao et al. (2020) further described that asphalt binder upgrading to adapt to greater temperatures can be applicable. Underwood et al. (2017) and Wistuba and Walther (2013) explained the upgrading binder grade or increasing layer thickness in pavement design may be desirable in areas with increasing extreme temperatures. In addition, Dave et al. (2013) described where gaps between daily/monthly/seasonal high and low-temperature increases, the choice of binder needs to be able to cover all extremes.

195. The BCIB Project will be exposed to a higher temperature in the future. The applied pavement design is a Polymer Modified Stone Mastic Asphalt (PSMA), which is stronger and more durable than Conventional Mixtures Asphalt (CMA) (Exhibit 7-2). The PSMA's Performance Grade is PG76-22, a material that can maintain durability for seven (7) days at the maximum design temperature of 76 °C and the minimum design temperature of -22 °C. Also, the PSMA secured more than three (3) times the pavement life of Conventional Mixtures Asphalt by applying grain size of the wearing surface asphalt. Exhibit 7-3 presents an investigation of the pavement temperatures during a heat wave in Korea.

Exhibit 7-2: Comparison of Materials of Conventional Mixtures Asphalt and Polymer Modified Stone Mastic Asphalt

DIV	CMA	PSMA
Concept	Normal Performance Grade + Grain size of Conventional	High Performance Grade + Grain size of SMA

Schematic Diagram		
Performance Grade [a]	PG64-22	PG76-22 PG82-22
Grain size range (Coarse aggregate: fine aggregate)	Grain size of Conventional (50: 50)	Grain size of SMA (75: 25)
Cost [b] (US$)	**24,714,000**	**35,305,000**

[a] Performance Grade: it is unified standard applied to both general and modified asphalt since 1997 in the USA. (ASTM D 637 9-99, KS F 2389).

[b] PSMA construction cost refers to the construction cost performed by ARUP in 2019. Pakage3~6: Wearing Surface Asphalt (WSA).

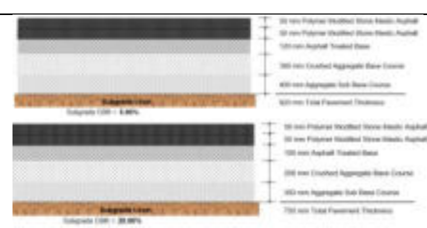
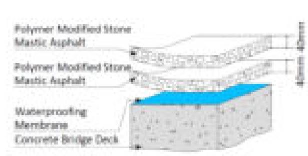
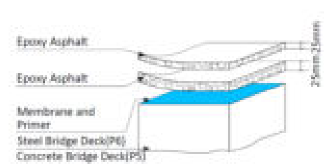
Exhibit 7-3: Investigation of the Pavement Temperature During Heat Wave in Korea

Pavement Types/ Temperature	At-grade Roads Flexible Pavement	At-grade Roads Concrete Pavement	Steel Bridge Flexible Pavement
Average Surface Temperature (° C)	51.4	44.6	51.7
Average Temperature (° C)	34.1	34.2	35.1

Source: https://www.joongang.co.kr/article/23543932

196. Under Package 1 and 2 (at-grade road), the project will use paving materials that are more resistant to expansion in extreme heat conditions. The flexible pavement type is considered due to environmental and weather exposure, traffic loading, and constructability. As the surface course, the flexible pavement of a 920 mm (P1) and 750 mm (P2) polymer-modified stone mastic asphalt is required to enhance the dynamic shear modulus against permanent deformation. Exhibit 7-4 shows the design considerations of the pavement type in different packages of the project.

Exhibit 7-4: Design Consideration of the Pavement Type

Design Considerations	Pakage1 & 2	Package 3 & 4 Concrete Bridge Deck	Package 5 Concrete Bridge Deck	Package 6 Steel Bridge Deck
BCIB Project Component	At-grade Roads	Land / Marine Viaducts	North Channel Bridge	South Channel Bridge
Pavement Type (Thickness)	Flexible Pavement (P1: 920 mm; P2: 750 mm)	Flexible Pavement (80 mm)	Flexible Pavement (50 mm)	
Pavement Structure				

Pavement Performance period	10-year	10-year	10-year

197. At the Land and Marine Viaducts (Package 3 and 4), a flexible pavement is considered with an 80 mm of polymer modified stone mastic asphalt. Concrete bridge deck is designed in the project that has many benefits, which include the ability to resist high temperatures. The concrete can withstand extreme hot climatic condition, and generally has the advantages of being durable and having a long service life.[33]

198. In Package 6 (South Channel Bridge) and Package 5 (North Channel Bridge), a flexible pavement is also taken into consideration with a 50 mm epoxy asphalt cement.

199. The BCIB pavement structure is designed in accordance with the AASHTO 1993 Guide for Design of Pavement Structures. The design parameters used in the pavement includes pavement performance period, roadbed and subgrade soil properties, projected traffic loads, design serviceability and material properties for pavement structure design. Pavement structures are analyzed for the 20-year and 10-year performance periods. The structural design of the pavement is based on fatigue loads. Fatigue loading is taken as the cumulative number of passes of an Equivalent Standard Axle Load (ESAL) of 8,300 kg (18 kip) per axle, to which the pavement structure will be subjected throughout its design life. The structural design of a pavement is expressed in terms of the Present Serviceability Index (PSI), which is obtained from measurements of distress and roughness. PSI values of 2.0 and 1.7 are considered in the rigid (Portland cement concrete) pavement, and flexible (asphalt) pavement, respectively. Also, reliability factor is introduced in the design to account for chance variations in both traffic prediction and to provide a predetermined level of assurance that pavement sections will survive the period for which it is designed. Based on analyses, the project considered 80-99 level of reliability as per AASHTO Guide recommendation.

7.1.1.2 Sea Level Rise and Storm Surges

200. The sea level of the BCIB project on the marine portion is expected to rise by as much as 0.70 meters in 2100 based on Manila Bay tidal gauge station extrapolation and about 0.61 to 1.10 m (2100) and 0.8 to 1.6 m (2130) range under RCP8.5 scenario. Storm surge is also likely to increase with a 1.0-meter maximum water level increase in Manila Bay, given a 10% increase over historical typhoons.

201. Following the SROCC projection (of AR5) that the sea level rise is likely to be in the range of 0.80 to 1.60 m by 2130, the BCIB Project proposes that the design should consider accommodating a sea level rise of 1.20 m in 2130. This recommendation is based on the global sea level rise experience demonstrating that the Asian-Pacific International engineering community (based on Cadangan Project Jambatan Temburong in Brunei and Hongkong) comfortably relies on the medium confidence line which indicates a central estimate of a 1.2 m sea level change in Manilla Bay by 2130. The BCIB design team considered a 1.2 m rise by 2130 during its project engineering design. Also, the BCIB design team (TYLI, PEC, DCCD) found that

[33] A Guide for USAID Project Managers BRIDGES.

current the BCIB Project design already accommodates the most conservative projection of 1.6 m (and greater – see para. 201 below) by 2130 (Internal Memo 001 – Sea Level Rise of BCIB Bridges, 2022). A copy of the BCIB Internal Memo 001 – Sea Level Rise of BCIB Bridges is found in Appendix 3.

202. The anticipated impacts and risks on the projects include the following: i) damage to highways, roads, and bridges due to flooding, inundation in coastal areas, and coastal erosion, ii) damage to infrastructure from land subsidence, iii) more frequent flooding of low-lying infrastructure, iv) erosion of road base and bridge supports, v) reduced clearance under bridges, vi) decreased expected lifetime of bridges exposed to storm surges, and vii) placement of precast segments may disturb seabed sediments which may have accumulated heavy metal content.

SLR's effects on structural design of marine and navigational bridges

203. The sea level rise and its impacts and risks are part of the bridge design considerations. The navigation clearance studies were based on the Harbor Approach Channel Design Guidelines calculation method (PIANC 121-2014). Also, the project design structures adopted the Philippine Coast Guard-approved navigational clearance for the BCIB.

204. The BCIB project appears that it can accommodate greater than 1.6 m sea level rise in 2130. The approved navigational clearance for North Channel is 380 m in width, and 40.5 m high above mean sea level (msl) (Exhibit 7-5). The Northern Main Navigation Channel is amended to 300 m width and 40.5 m high above msl.[34] The required minimum vertical clearance was calculated as 39.77 m assuming an increase in sea level rise from 1.0 m to 1.6 m based on Ship Maneuvering Simulation conducted for the North Channel. Results revealed that the value is below the 40.5 m vertical clearance, and thus there is no need to increase the clearance envelope. Other details are presented in Exhibit 7-6.

205. The Southern Main Navigation Channel is designed to be 650 m in width and 72.3 m high above msl (Exhibit 7-7). The required minimum vertical clearance was computed as 65.04 m considering an increase in sea level rise of 1.6 m. The value is below the 72.3 m vertical clearance. Hence, there is no need to increase the clearance envelope for the SCB.

206. In addition, the passage is necessary near the Cavite shoreline for smaller vessels such as Philippine Coastguard patrol vessels and ferries. The Cavite shoreline also includes marine facilities, like the International Maritime & Offshore Safety Training Centre, Cavite Gateway Terminal, and various beach resorts. Hence, a smaller "Nearshore Navigation Channel" is provided for this vessel traffic. The Nearshore Navigation Channel is designed as 140 m wide and 23.1 m high above msl.

[34] Amended during the DED, and the clearance was referenced in the ARUP report "Working Paper No.5-1 Navigation Clearance Study Report for Feasibility Study for BCIB Project".

Exhibit 7-5: North Channel Bridge General Arrangement - Elevation

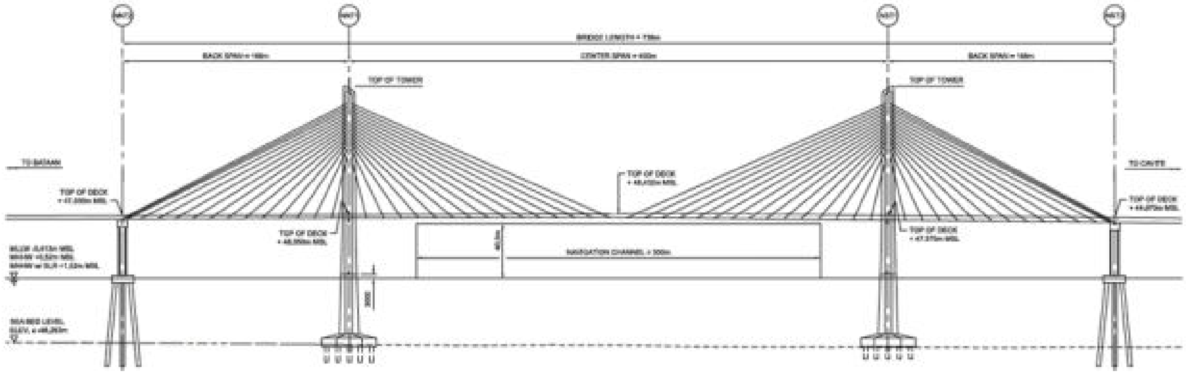
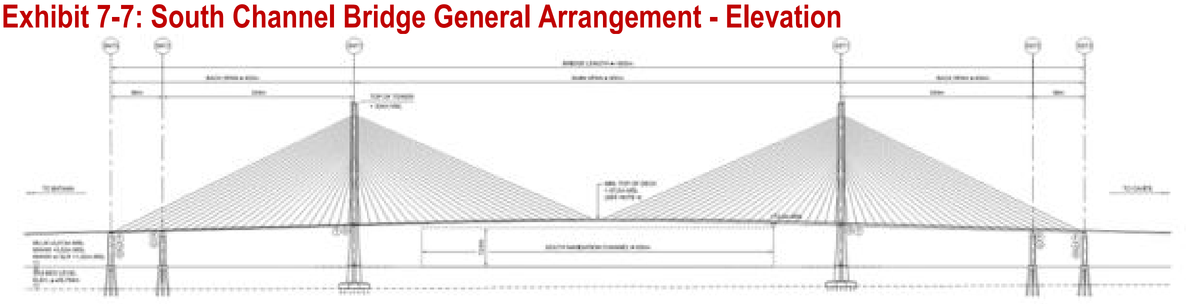


Exhibit 7-6: BCIB Minimum Clearance Considerations

Considerations	North Channel Bridge	South Channel Bridge
Air draft (m)	32	60
Tidal level from the mean sea level	1.1	1.1
Sea level rise (m)	1.6	1.6
Vertical dynamic motion (m)	4.97	2.24
Minimum clearance (m)	**39.77**	**65.04**

Exhibit 7-7: South Channel Bridge General Arrangement - Elevation



207. The marine viaduct vertical profile varies between EL 87.600 Sta 17+645.000 at the South Cable Bridge high point to EL 21.446 Sta 12+874.197 at the Corregidor Island Turnaround intersection. The design accommodates commercial vessel air draft with 72.3 m vertical navigation clearance at the South Cable Bridge. The low deck at the Corregidor Island Turnaround facility does not provide recreational air draft, however it is designed to clear a compounded effect of high tide, sea level rise, storm surge and typhoon-generated tidal waves.

208. Exhibit 7-8 shows the typhoon-generated maximum wave heights simulation in the vicinity of the Corregidor Turnaround facility, which varies spatially along with the project. West Consultants performed the oceanic wave study in June 2022, considering the vertical datum elevations and the maximum astrometric tide elevation at the Corregidor Island Gauge. Based on the Lapidez report (2015), the study also assessed the predicted maximum storm surge between 1 and 3 meters. These surge values come from simulations that evaluated a storm with the intensity of Super Typhoon *Haiyan* following storm tracks for typhoons observed from 1948 through 2013.

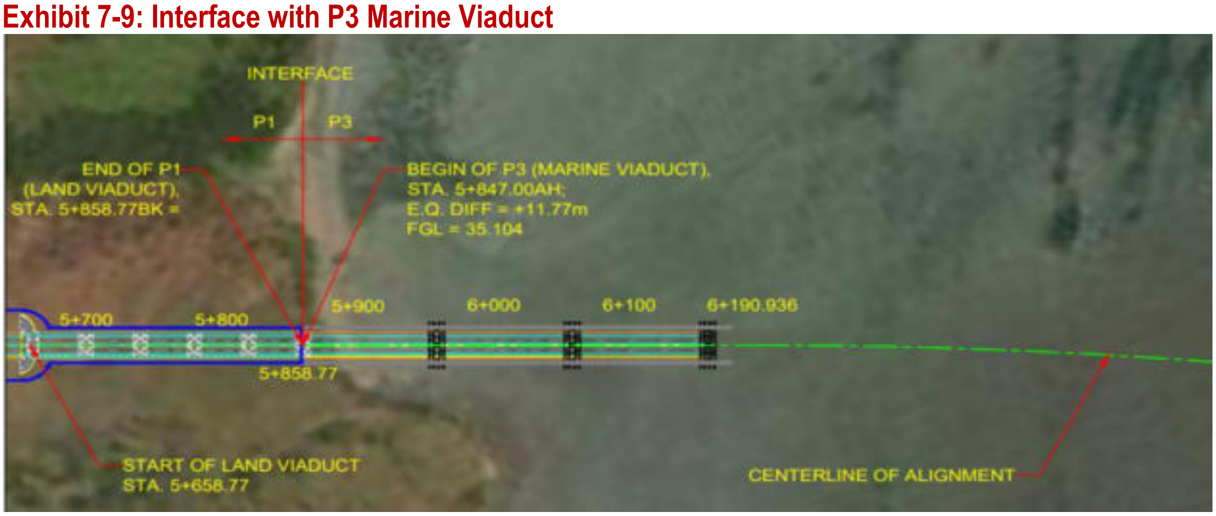
Exhibit 7-8: Typhoon-Generated Maximum Wave Heights Simulation in the Vicinity of the Corregidor Island Turnaround Facility

Pier	H max (m)	Pier	H max (m)
CV35	7.6	CV43	7.6
CV36	7.6	CV44	7.6
CV37	7.6	CV45	7.7
CV38	7.6	CV46	7.7
CV39	7.6	CV47	7.7
CV40	7.6	CV48	7.7
CV41	7.6	CV49	7.7
CV42	7.6	CV50	7.7

209. Likewise, the project engineering team confirmed that the current design can remain the same even when using the conservative projection of a 1.6 m sea level rise for 2130. The freeboard allows all ship sizes to pass easily, given a large surge in tidal movements and sea level rise. Therefore, no additional design is necessary to accommodate the sea level rise projection.

210. In land viaduct and interchange components, the Bataan land viaduct (Package 1) begins at Sta. 5+658.77 and ends at Sta. 5+858.77 and connects with the marine viaduct at the shoreline. The substructure is a 2-column pier bent type supported on pilecap and multiple rows of bored pile substructure. The terrain ground condition has a steep slope from abutment towards the shoreline, and column heights vary from 8 m to 17 m high (Exhibit 7-9 & 7-10). Under Package 2, the Cavite Land Viaduct starts at Sta 31+840 and ends at Sta 31+900. The substructure is a 2-column pier bent type supported on pilecap and multiple rows of bored pile substructure. The terrain ground condition is flat, and the shoreline and column heights vary from 6 m to 7 m high (Exhibit 7-11 & 7-12). The two (2) land viaducts locations and pavement surface are resilient to the sea level rise and storm surge influence with the preferred designs.

Exhibit 7-9: Interface with P3 Marine Viaduct



Vessel collision force

211. Vessel collision force has been applied considering both current conditions and conditions with 1.2 m of SLR and 1 m surge. It is noted that bridge elements that currently do not have vessel collision risk may have such risk with 1.6 m of SLR.

Exhibit 7-10: Road Section at the Bataan Land Viaduct

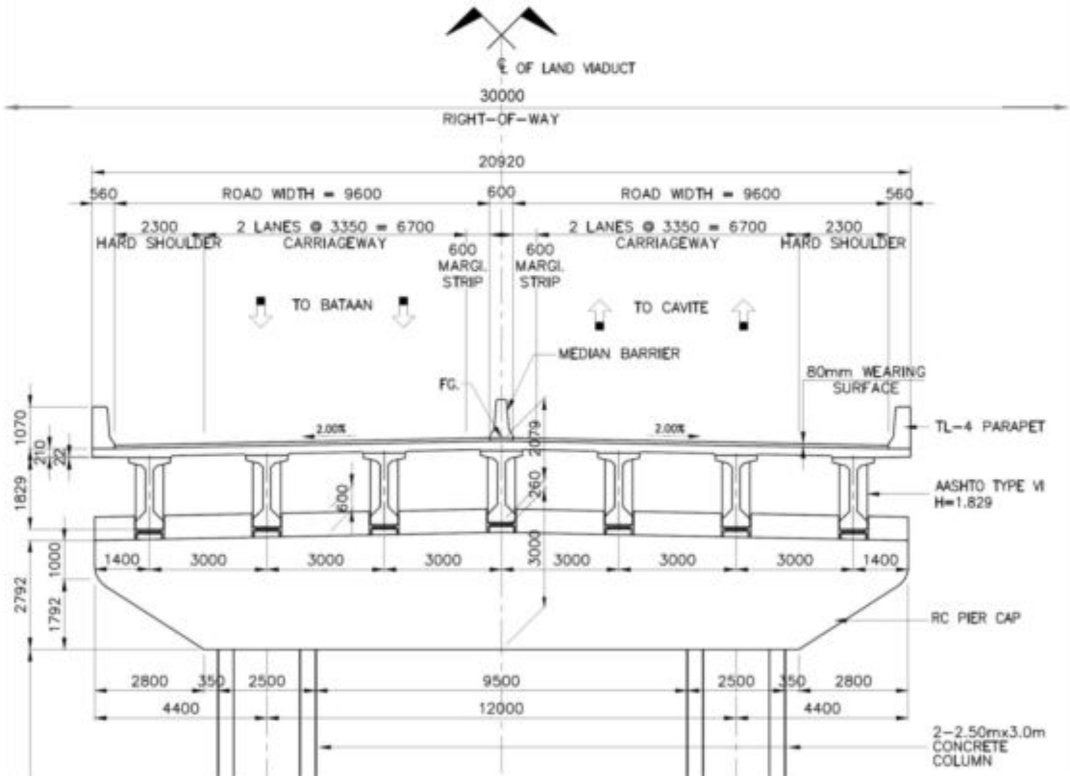


Exhibit 7-11: Cavite Land Viaduct interface with P4 Marine Viaduct

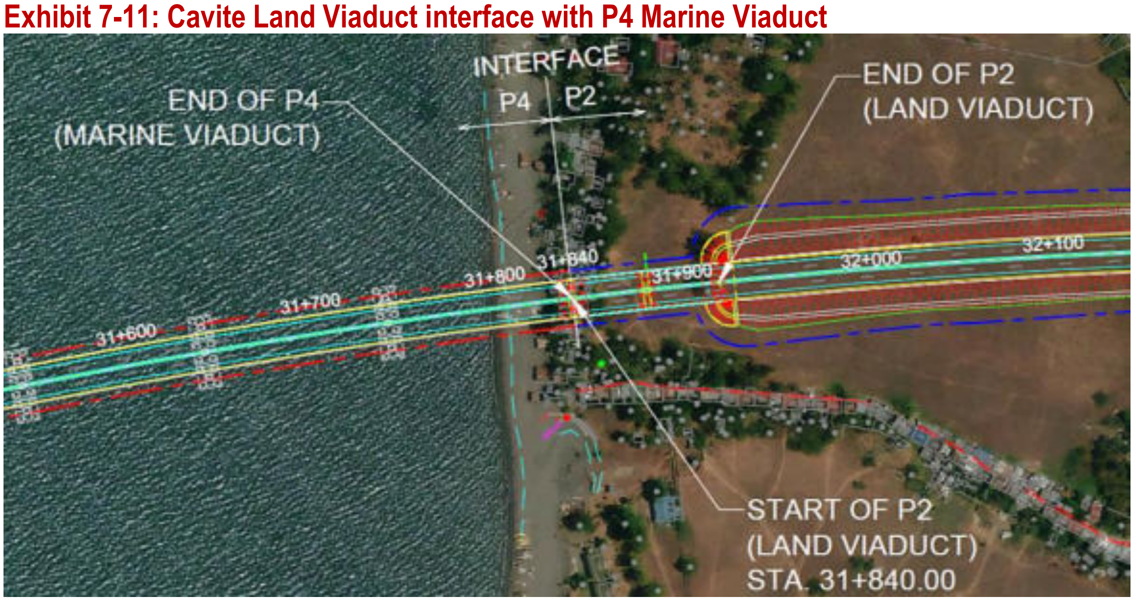
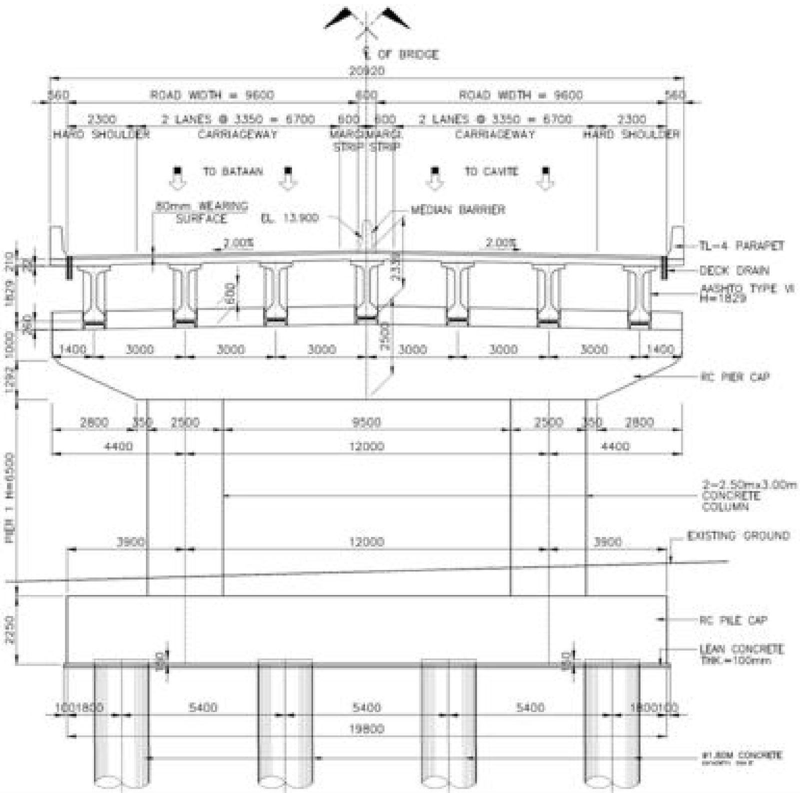


Exhibit 7-12: Typical Cross Section of the Cavite Land Viaduct



7.1.1.3 Increase in Intense Precipitation Events

212. Increased frequency of extreme precipitation events increases the risk for flooding and landslide, which can reduce the service life of bridges through i) damage to bridge and drainage systems due to flooding, ii) increasing the scouring rate of piers and bridge foundations and build-up of sediments, and iii) deterioration of structural integrity of roads and bridges due to increasing soil moisture levels. A potential impact of increased risk of flooding on bridges is that it could lead to total submersion. Bridges designed using a lower return period may lead to premature deterioration or total submersion before its intended lifespan.

213. The rainfall extremes (i.e., maximum 1-day total) are projected to vary temporally with wetter trends in the project sites. The observed design values of Rx1day are 315 mm for the Bataan side and 260 mm for the Cavite project site. Using RCP8.5 CMIP5 extreme ensemble, the assessment estimated the climate change factor for R1xday to be about a 30% increase with a 25-year return period. It supports the need to adjust the design criteria by 30% to handle 97.5% of the projected rainfall intensity extremes. The assessment computed the design values of Rx1day for the future climates are 409 mm for the Bataan side and 338 mm for the Cavite side.

214. Under Package 1 (Bataan Land), the project alignment will traverse on a gully, a wide and deep intermittent waterway at Sta. 4+800. Construction of Mt View Waterway Bridge begins at Sta. 4+757 (back of back wall) and ends at Sta. 4+857. The creek is considered intermittent since there is no observed surface water during the dry season. Also, the hydraulic study revealed that the waterway has maintained its course and alignment for the past 35 years as indicated by Google's historical imageries. However, Mt. View Waterway Bridge is still exposed to moderate erosion that could deteriorate foundations and damage a bridge. Extreme weather events can cause erosion to occur more frequently as they can generate flash floods.

215. Mt View waterway covers a very small catchment (0.20 km^2). Despite assessment of the design values of Rx1day for the future climates, the project design of bridge structures utilizes historical climatic data, including documented peak, 10% increase in design rainfall intensity, and base flows. It was designed to accommodate Q100 (mean flow) discharge.[35] The discharge corresponding to 1:25, 1:50, and 1:100-year storm return periods are computed based on the requirement of the DGCS (DPWH, 2015).

216. Studies suggest that in the next 30 years, floods that currently have a 50-year return period will only have a 20-year return period due to changes in extreme rainfall.[36] With BCIB in place, the design flow used in the hydraulic analysis of bridges, culverts, and roadside ditches, is the flow generated from 1:100 years return period. The hydraulic study added 10% of the calculated rainfall intensity following the provision of Table 9-3 of the DGCS (DPWH, 2015) and considering the impact of climate change, where it is projected to experience higher rainfall extreme in the future. While no flow was observed during the site visit, a base flow was added following the recommendation put forward in the design guideline. Exhibit 7-13 shows the hydrology and hydraulic parameters of Mt View Waterway Bridge.

Exhibit 7-13: Hydrology and Hydraulic Parameters of the Mt View Waterway Bridge

Catchment Area	100-Year Design Discharge (m^3/s)	Max Experienced Flood Level	Computed Flood Level	Design Flood Level	Velocity (m/s)	Remarks/ Recommendation
Mt. View Waterway Bridge	Brgy. Mt. View, Bataan	200 m	32.59	32.59	1.34	Intermittent Waterway

217. Also, the flood analysis for Mt View Waterway Bridge site was conducted using the HEC-RAS software. The hydraulic study was conducted using the calculated discharges derived in the runoff analysis, the river geometry, and the proposed bridge geometry. The design flood water level was calculated to determine the bridge's height considering clearance between the flood water surface level and bridge soffit. Clearance between the design flood level (DFL) and bridge soffit is dictated by the design grade rather than the DFL vis-a-vis discharge. The bridge clearance was pegged at 1.5 m in the feasibility study and detailed design stages (Exhibit 7-14).[37] A clearance

35 DPWH DGCS only requires 15- and 25-years storm return periods for pipe culverts and box culverts, respectively.

36 Amro Nasr, Erik Kjellström, Ivar Björnsson, Daniel Honfi, Oskar L. Ivanov & Jonas Johansson. 2020. *Bridges in a changing climate: a study of the potential impacts of climate change on bridges and their possible adaptations*, Structure and Infrastructure Engineering, 16:4, 738-749, DOI: 10.1080/15732479.2019.1670215

37 The DGCS Volume 5 (DPWH, 2015) provides a minimum clearance of 1.50 m for bridges with the potential of having flows with debris.

between the DFL and the bridge soffit is provided in anticipation of floating debris that may potentially clog the bridge opening.

Exhibit 7-14: Clearance for the Bridge Design

Bridge	Clearance Height(m)	
	BCIB F/S	BCIB Detailed Design
Clearance	1.50	1.50

218. Extreme changes in the magnitude of precipitation events (rainfall extreme magnitude indicators) may pose a severe threat to roads and bridges' safety and structural integrity since designs are mainly based on the assumption of historical rainfall events. Extreme rainfall events (Rx1day) will increase siltation and reduce its useful lifetime. An increase in rainfall may induce an increase in runoff, leading to flash floods. Mt. View Waterway Bridge substructure is designed as a 3-column-pile bent type structure to accommodate the terrain condition and waterway flow on this situation (Exhibit 7-15). Again, the flood discharge and bridge span lengths were calculated according to the rainfall increase considering climate change and base flow (Exhibit 7-16).

219. Also, increased Rx1day rainfall and higher intensities will likely reduce soil stability. This applies to natural slopes and man-made structures, such as road embankments and cuttings. Consequently, the frequency of slope failures affecting the road system along Package 1 is believed to increase in such stations (between 0+050 and 0+150), where more intense rainfall is expected. It means that the area requires slope protection and climate change considerations in making protective measures.

220. In terms of drainage structures, the project will construct and install box and pipe culverts, roadside and median ditches, and gutter flow based on hydrology and hydraulic analysis per station limits. Hydraulic design of all the drainage structures, including the bridges, is based on the flow generated from 1:100 years storm return period. Similarly, there will be an installation of the typical drainage cross-section for land viaducts (Exhibits 7-16 & 7-17). It must be noted that there are no watercourses that traverse P1 and P2, only intermitted waterways and valleys. In P1, flows are discharged to the environment following their natural flow pattern and courses. In P2, however, a parallel drain will be provided to intercept flows from cross drainages considering that the outflows are in residential areas. They firmly are against the direct discharge of flow from culverts to their property.

221. Infiltration is naturally induced in P1 as flows from cross culverts are discharged to natural waterways. Again, using concrete-lined ditches or channels prevents saturation of cut slopes and embankment fill slopes. It may not be similar in P2 due to the social considerations mentioned above.

222. In Bataan interchange section, its configuration was optimized to avoid the steep and unstable slopes observed in the area. This process removes the need to provide the 3-span curve bridge, which considerably lowered the cost. An MSE wall to stabilize the slopes at the northern curve of the Main Ramp replaces the curved bridge. This rationale is behind Design Query (DQ) No 23 that was accepted by the DPWH Bureau of Design (BOD) dated 26 June 2021.

223. Exhibits 7-17 and 7-18 show the optimized Trumpet Interchange avoiding the steep slopes. This resulted in changes to the main ramp with a length of 371.67 m and a spiral length of 100 m with 100 m radius (Exhibit 7-19). The two side ramps have 50 m radius spiral curves (Exhibit 7-20). Ramp 1 has an effective length of 310.11 m and Ramp 2 has an effective length of 233.37 m for (Exhibit 7-21).

Exhibit 7-15: Road Cross Section of Mt View Waterway Bridge in Bataan

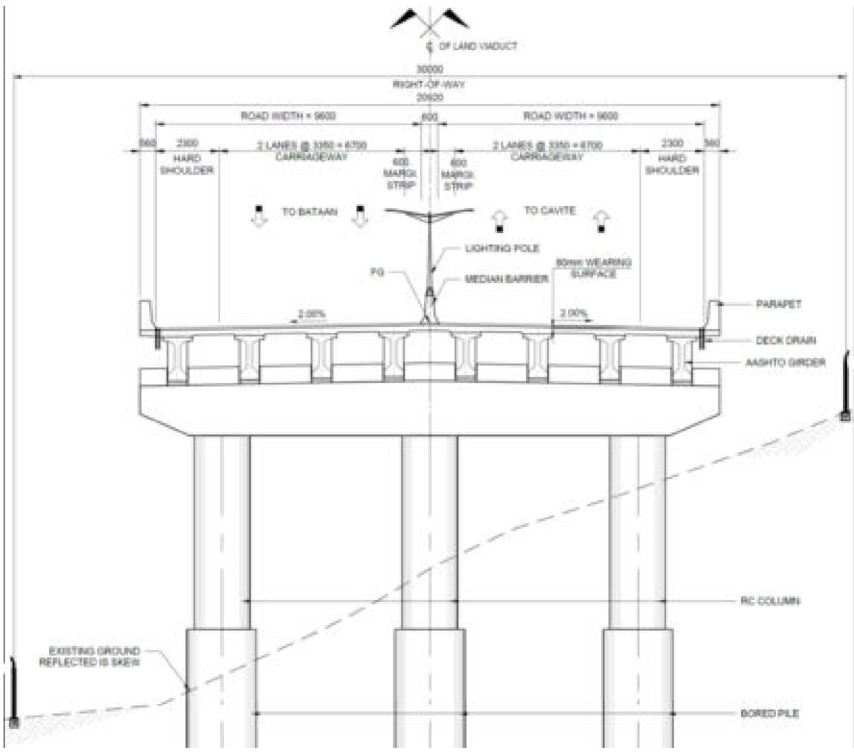


Exhibit 7-16: Span Length for Mt. View Bridge Design

Classification	Flood Discharge (m^3/s)	Minimum Span length (m)	Remarks
50 year + 10% increase in rainfall +base flow	1.13	20	BCIB DED

Source: Bataan-Cavite Interlink Bridge Project. Package 1: Updated Preliminary Engineering Design

Exhibit 7-17: Typical Cut and Fill Road Section on the Main Line in Bataan

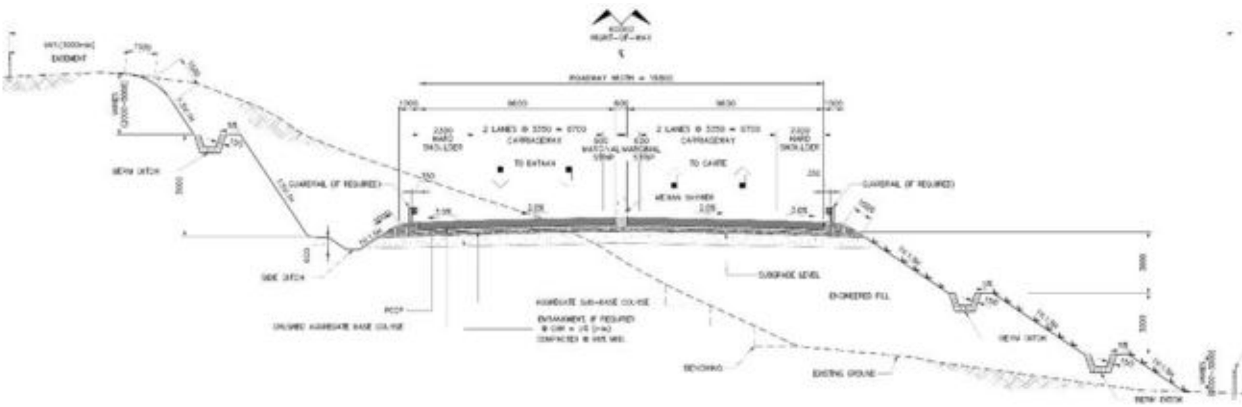


Exhibit 7-18: Mainline Cross Section with Super-elevated Section in Bataan

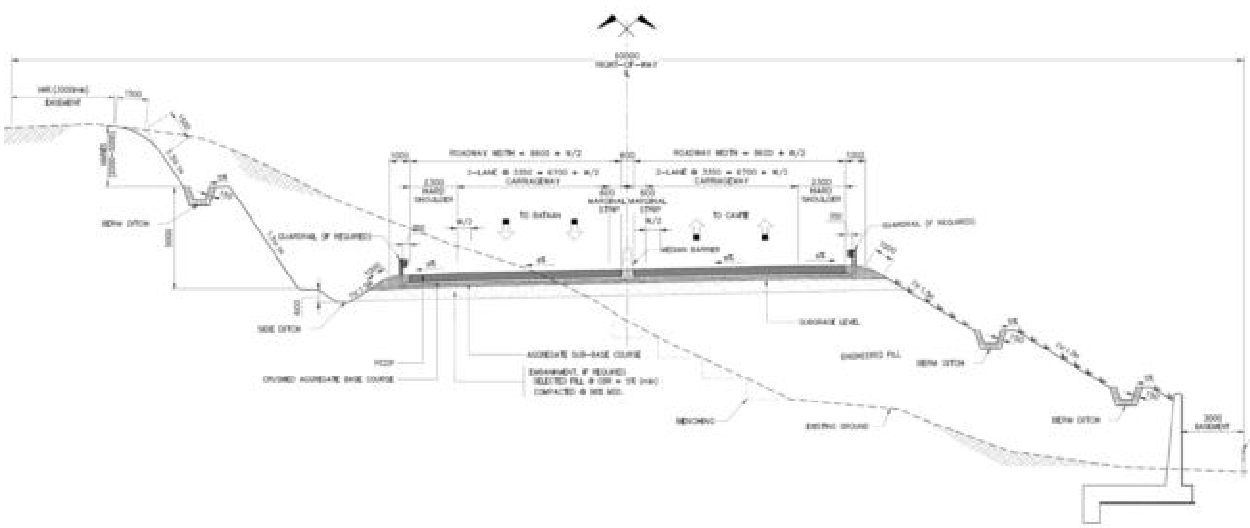


Exhibit 7-19: Overlay of the FS Alignment (grey) and the Optimized Alignment (colored)

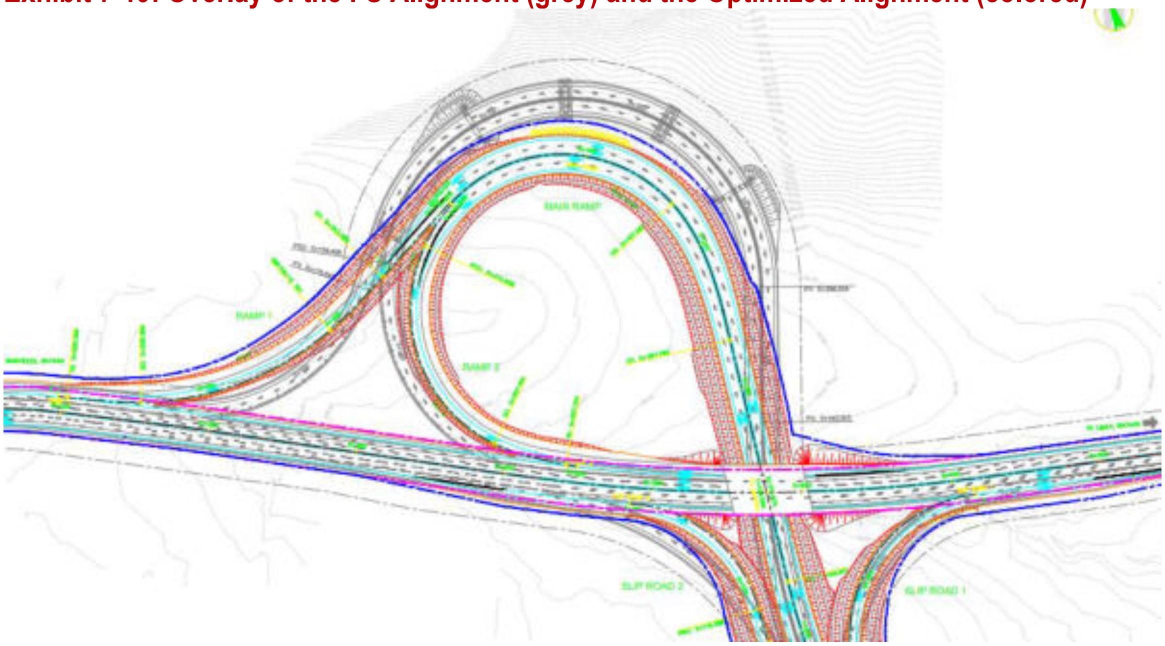


Exhibit 7-20: Road Cross Section at Main Ramp Showing Retaining Wall

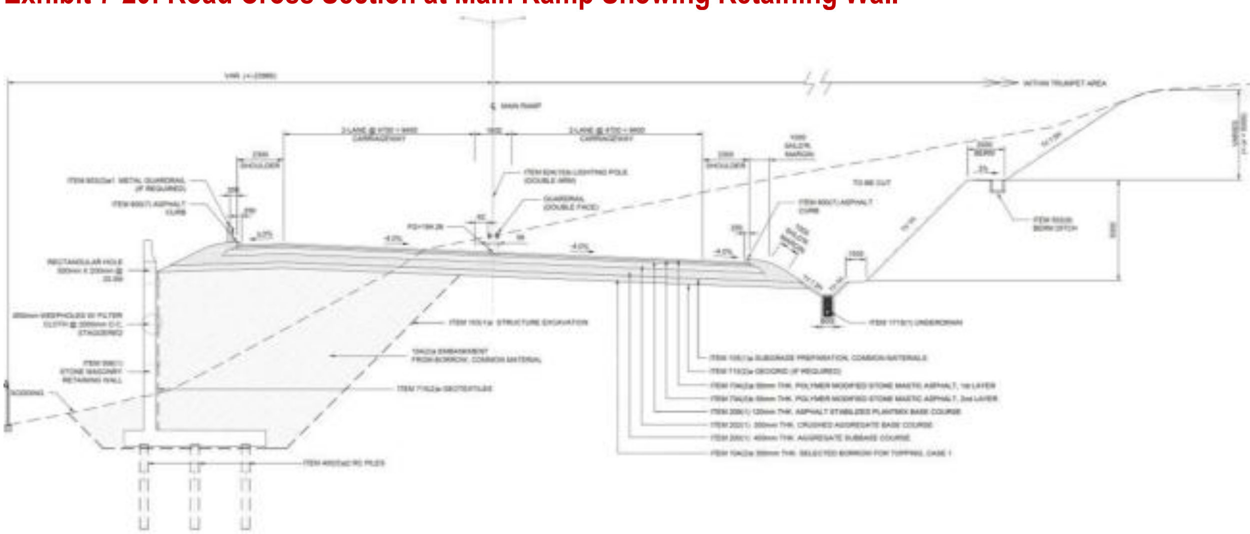


Exhibit 7-21: Road Cross Section at Main Ramp showing Cut and Fill Areas on the Bataan Side

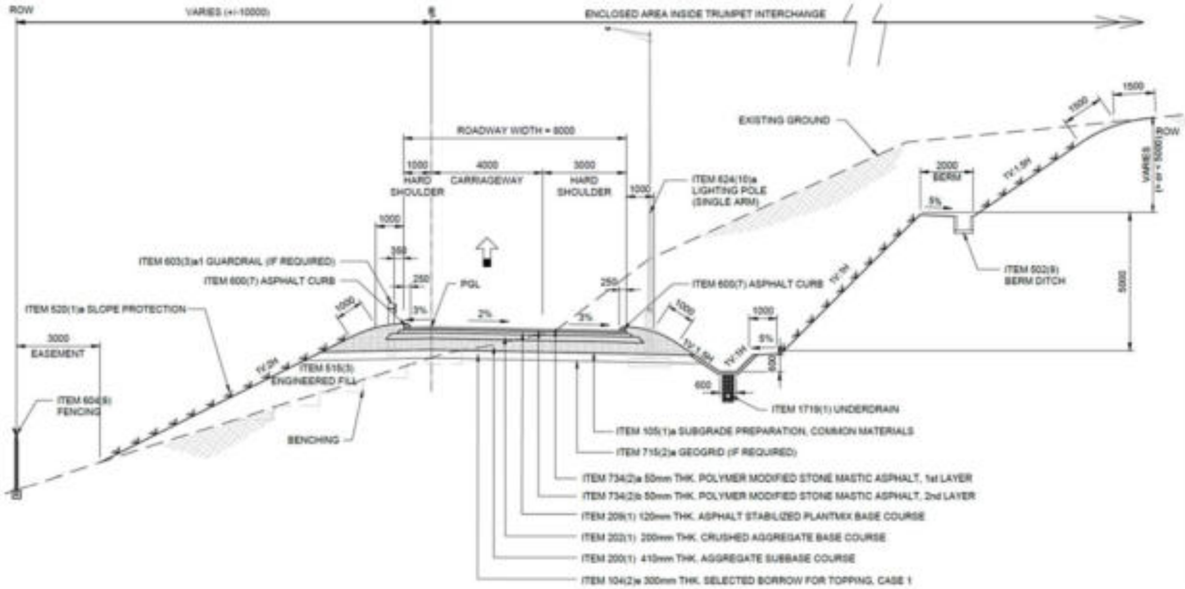


Exhibit 7-22: Ramp at Fill Section on the Bataan Side

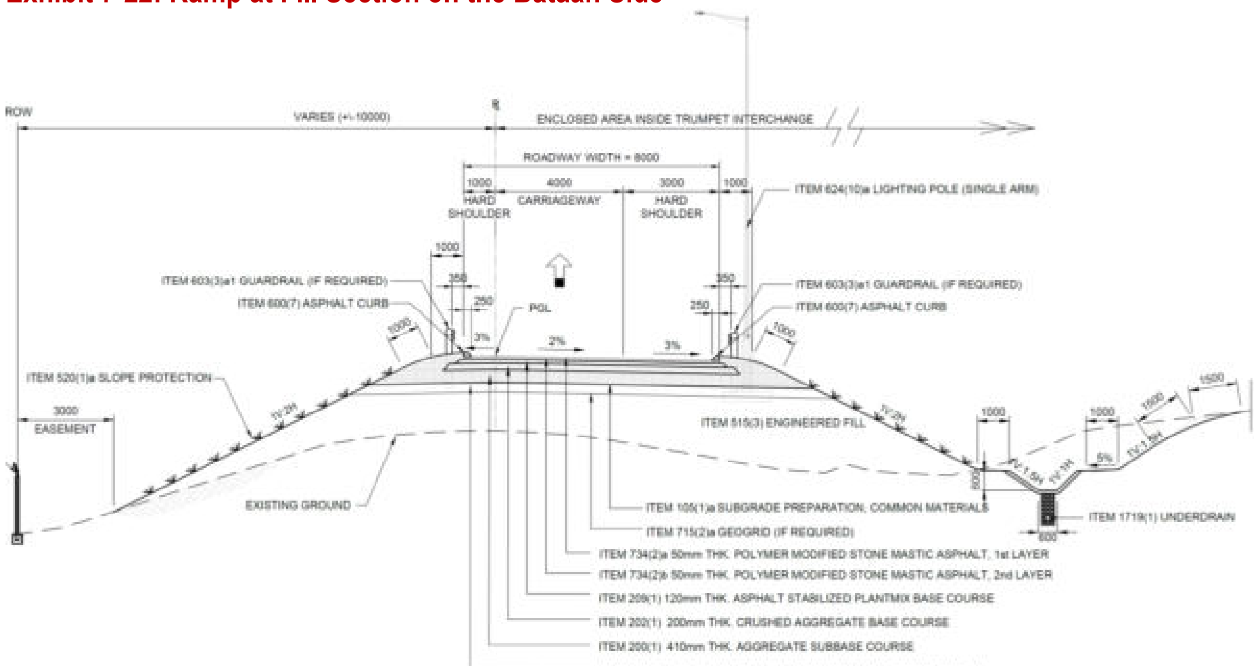
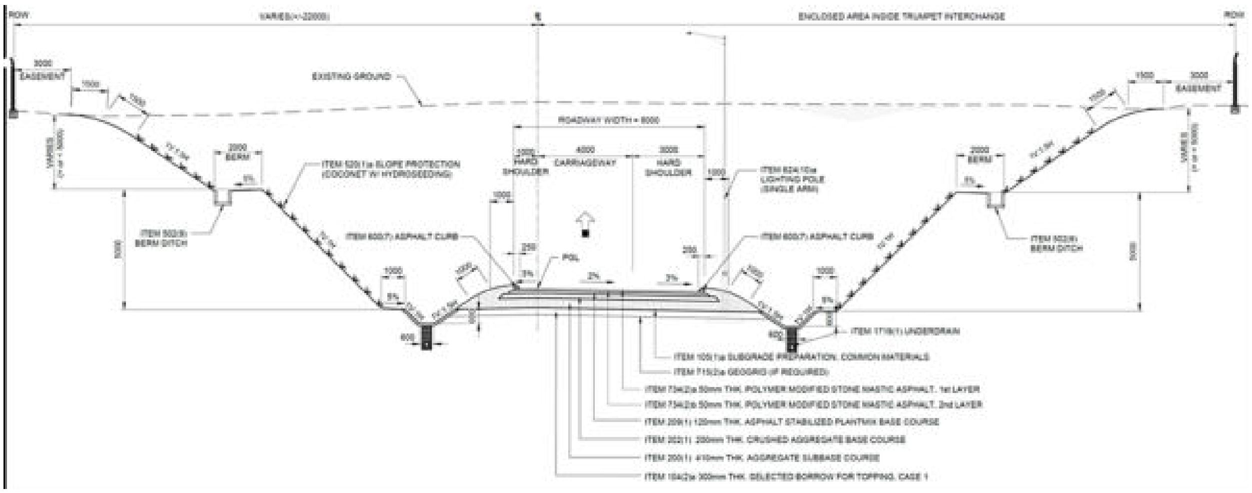
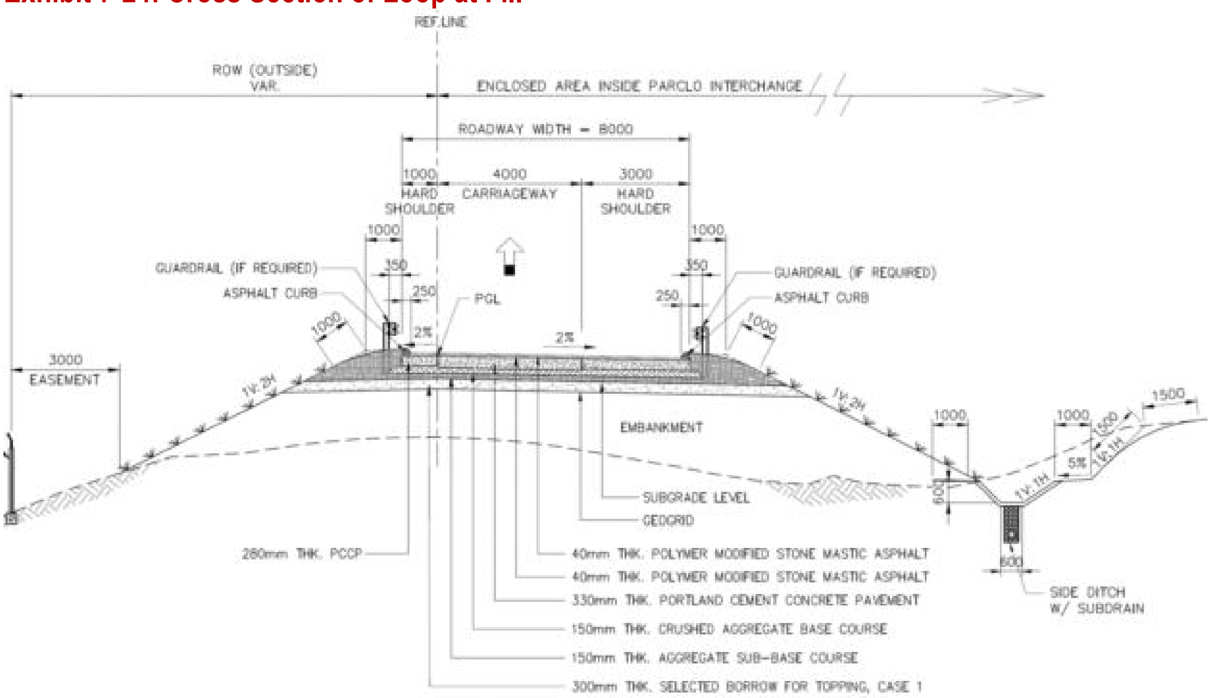


Exhibit 7-23: Ramp Super-elevation at Cut Section on the Bataan Side



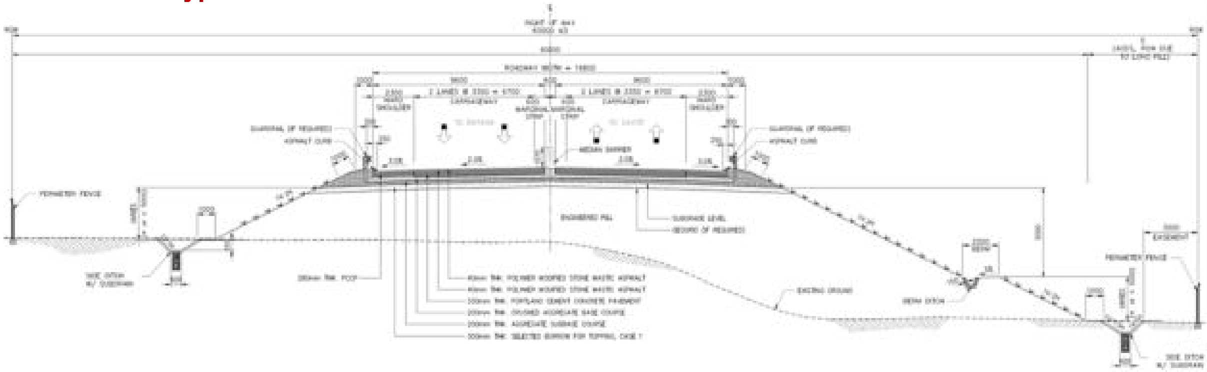
224. Under Package 2 (Cavite Land), between Station 31+600 and Station 32+500 roadway, and from Station 0+100 to Station 0+501.782, interchange areas are highly susceptible to flooding. The preliminary detailed design is going to fill a section of the entire stretch from Sta. 30+800 to Sta. 32+000, and the cover-leaf interchange alignment. The project will also provide a typical drainage on its side based on various hydrologic and hydraulic analyses made in the hydraulic design of cross drainage structures, parallel drains, and bridges (Exhibit 7-24).

Exhibit 7-24: Cross Section of Loop at Fill



225. Again, the BCIB interchange and viaduct components are being designed to an elevation above the projected water level. The project will not be blocking water flows and impeding water drainages because of installation of pipes, box culverts, and side ditches (Exhibit 7-25).

Exhibit 7-25: Typical Mainline Road Section at Fill



226. Exhibit 7-26 shows the vertical difference between the FS (magenta line) and existing grade (gray line) as well as the finished grade (blue line). The maximum gradient of 1.50% continues the gradient from Package 4 and maintains the elevation of 14.50 m at the interface of Sta. 31+840. The height of the mainline at the Antero Soriano Interchange is raised 1.10 m above the current ground level in consideration of the maximum flood level of 0.50 m experienced in the area plus 0.60 m freeboard. The table below summarizes the changes to the alignment during the development of the preliminary engineering design.

Exhibit 7-26: Vertical Difference Between FS and PED

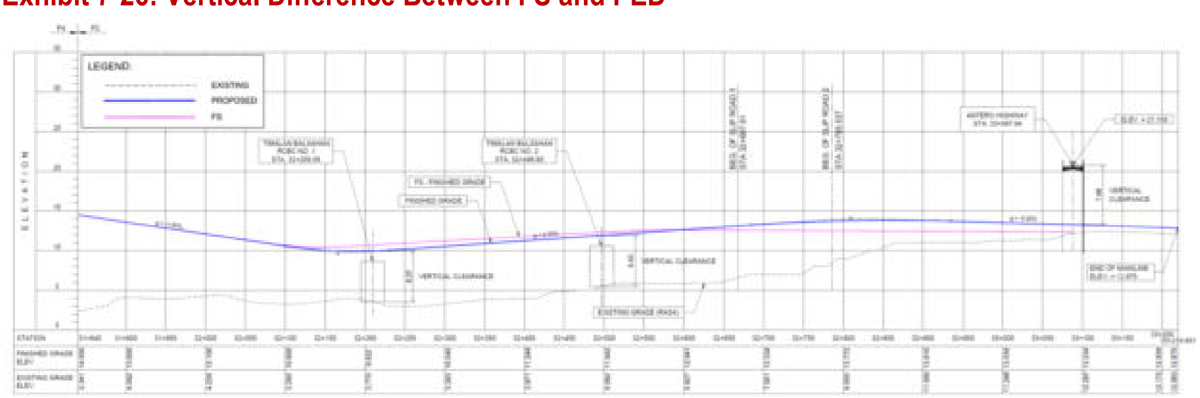


Exhibit 7-27: Summary of Changes in the Design

Parameter	Feasibility Study	Preliminary Engineering Design
Type of Interchange	Directional T-Interchange	Partial Cloverleaf
Level of Antero Soriano Interchange	At-grade	Elevated
Reference Topography	Satellite image from NAMRIA	Actual ground survey and LIDAR data of areas with access problems

Parameter	Feasibility Study	Preliminary Engineering Design
Mainline Elevation at Antero Soriano Interchange	12.36m	Finished grade elevation = 13.27 m. In consideration of the drainage requirements: max flood level of 0.50 m + freeboard of 0.60 m
Antero Soriano Highway Interface Elevation	12.36m	21.15 m; in consideration of the 5.10m vertical clearance

227. Based on the detailed design under Package 3 and 4 (North and South Viaduct), and Package 5 and 6 (North and South Channel Bridge), surface run-off on the deck (marine viaducts) and bridge deck (long-span bridges) will be collected and drained at the low points of the deck surface into the Manila Bay. A flexible pavement is more resistant to the prevalent wet climate condition, especially during the rainy season.

7.1.1.4 Increase of Storm Intensity and Wind Speed

228. The project areas have been exposed to 27 tropical cyclones in the past 7 decades. The intensity of future storms is generally expected to increase, but the frequency of future severe storms is even more uncertain. However, a study on Design Tropical Cyclone Wind Speed when considering climate change indicated that wind speed during tropical cyclones increases by 1.2-1.4 times the historical record (Xu et al., 2020). In essence, the wind speed in Bataan and Cavite sections could increase to well over 300 kph and 315 kph, respectively.

229. Potential impacts on the project include i) damage to bridge infrastructure and increased probability of infrastructure failures, ii) increased threat to the stability of bridge decks, and iii) increased damage to signs, lighting fixtures, and supports.

Wind load on structure

230. Under P3 and P4, the BCIB project design considerations calculated wind loads based on gust wind pressures and solid area exposed to wind. A Boundary Layer Wind Tunnel Model was created for the BCIB Project and the following studies were completed:

- Site-Specific Wind Climate Analysis for North and South Channel Bridge Structures (NCB and SCB) and the Marine Spans
- SCB Section Model Testing
- NCB Section Model Testing
- Marine Span and HLA Section Model Testing
- Tower Section Models and Overall Force-Balance Testing
- Vehicle Overturning Testing

- Wind-Induced Cable Vibration Analysis
- Wind-Induced Light Pole Vibration Analysis
- Review of SCB Full Aeroelastic Tests
- Full Aeroelastic Model Testing of the Free-Standing NCB Tower, the Completed NCB Bridge and the three NCB Construction Stages

231. Gust wind pressure was calculated using the exposure coefficient, a factor of the exposure category, and the directional factor and topographical factor provided in the MDCR. The basic 1700 year return period wind speed was applied differently for each limit state in the "3-second gust wind at 10 m above ground Exposure D" condition as shown in Exhibit 7-28.

Exhibit 7-28: Basic Wind Speed

Load Combination	3-Second Gust Wind Speed, V
Strength III	289 km/hr (80.3 m/s)
Strength V	129 km/hr (35.8m/s)
Service I	113 km/hr (31.4m/s)
Service IV	0.75 of the speed used for the Strength III Limit State

232.

233. Also, additional climate change factor of 1.05 was applied to Strength Design of the bridges in consideration of future climate change effects on wind.

234. The results of the wind modeling revealed that the design met all the stability criteria and the fencing designs around the pylons prevent risk of truck overturning up to wind speeds of 80km/hour. The wind studies provided the BCIB team with inputs to shape of superstructures, construction stage stability, and design loads to ensure that the designs are adequate to resist wind hazards. No further adaption or mitigation is required.

7.1.2 Adaptation Measures

235. The project's detailed engineering design considered climate change adaptation measures to deal with the increased risk of temperature, sea-level rise, storm surge, strong wind, extreme rainfall and flooding (Exhibit 7-29). Other details are found in the Memorandum (dated 17 February 2023) related to the costs associated with climate adaptation for the detailed engineering design of Bataan-Cavite Interlink Bridge Project (Appendix 4).

236. Adaptation aims to minimize climate change-related risks on infrastructure, including damage to assets. It decreases long-term operational and maintenance costs and protects its revenues and socioeconomic benefits. The BCIB critical infrastructures (i.e., buildings, roads, culverts, drainages, waterway bridges, maritime and navigation bridges) must be more resilient to reduce these impacts.

237. Design measures that have been taken to address climate impacts and risks are the following:

(i) The pavement design of the BCIB is Polymer Modified Stone Mastic Asphalt, which has a life of more than three (3) times longer than Conventional Mix Asphalt. Maintenance is required once during the operation period (20 years). Thus, it may also reduce the amount of CO_2 generated during the operation and maintenance period (Exhibit 7-30). Also, the polymer-modified stone mastic asphalt will be considered a surface roadway pavement. PSMA has increased durability to reduced cracking, rutting, and other damages caused by extreme temperature and precipitation.

(ii) Designate the interchange areas in Cavite and Bataan as a green urban corridor. The project will use drought-adapted native tree species in landscaping.

(iii) A drainage ditch will be installed along the roads on both sides. The design is based on hydrologic and hydraulic analysis with the provision of increased and regular monitoring for more intense rainfall events.

(iv) From a foundation design perspective, the BCIB Project considers that the piles will need to be longer by the amount of SLR, and the special concrete at the splash zone will need to be extended to a higher elevation to account for SLR.

(v) Construct slope protection measures (i.e., coconet and retaining wall) on natural slopes and artificial structures, such as road embankments and cuttings in Bataan and Cavite land interchange areas.

(vi) The project will offset all affected trees and coconuts at a ratio of 1:100 (naturally grown) and 1:50 (planted), all preferably of indigenous tree species to be donated to the DENR provincial offices in support of the enhanced National Greening Program (eNGP) and climate change initiatives of the government.

(vii) Undertake preservation and easement retention of natural drainage waterways in conformance with the provisions of the DENR Administrative Order No. 97-05.[38] Trees will be planted and maintained along the easement from the start of the project implementation to enhance soil stability and provide aesthetics.

(viii) The BCIB and Antero Serrano Highway interchange in Cavite has been redesigned as an adaptation measure. The BCIB is elevated in Cavite for numerous reasons, such as to minimize conflicts with the local roadway system, to adjoin the marine viaduct with minimal incline transition conformity, and to meet the 100-year lifespan for the entire project. This results in being placed above the projected 100-year floodplains. However, this also requires that the Antero Serrano Highway be adapted. The BCIB Project owns the adaptation at the interchange, which is attributable to the climate change flooding consequences. Otherwise, the Antero Serrano Highway will have remained at a grade below the BCIB.

[38] Procedures in the retention of areas within certain distances along the banks of rivers, streams, and shores of seas, lakes and oceans for environmental protection.

(ix) Integrate wind fairings to control wind movements passing over the bridge and wind screens to protect the vehicle from overturning.

(x) Incorporate soft digital measures such as sensors to measure temperature, rainfall intensity, wind speed, car speed, and other information and communication technologies. These tools can also be used to ensure road safety against climate disasters or traffic management systems.

(xi) Electronic Notification System is incorporated into the design to provide a climate resilient bridge alert system (including ICT devices, early warning system on natural hazards). This tool will be engaged to alert vehicular traffic of upcoming storm events and/or need to close bridge for severe conditions or collisions.

Exhibit 7-29: Adaptation Measures and Costs taken by the BCIB Project

Climate Drivers	BCIB Design Considerations	Project Design Adaptation Measures
Increases in very hot days and heat waves, decreased precipitation	**Package 1 & 2** The flexible pavement type is considered due to environmental and weather exposure, traffic loading, and constructability. The flexible pavement of a 920 mm (P1) and 750 mm (P2) of polymer modified stone mastic asphalt as the surface course is required to enhance the dynamic shear modulus against permanent deformation **Package 3 & 4** A flexible pavement is considered with an 80 mm of polymer modified stone mastic asphalt. **Package 5 & 6** A flexible pavement is also taken into consideration with a 50 mm (P5) and 80 mm (P6) polymer modified stone mastic asphalt. Steel bridge deck is designed in the project that has many benefits, which include the ability to resist high temperatures **Ancillary facilities:** The color palette is preferably of textured light colors to cool the wall surfaces, minimize solar heat absorption, and to maximize solar heat reflection. Integration of solar panels on roofs and over parking areas to reduce fossil energy use. High-albedo exterior hard surfaces to counteract heating. Rainwater harvesting to reduce pumping needs to reduce fossil energy used in pumping well water Natural light in interior spaces to reduce lighting needs.	Tree replacement - GHG emissions offsetting through the enhanced National Greening Program of the government. Use of Polymer Modified Stone Mastic Asphalt and concrete due to its higher temperature resistance. Use of energy efficient lighting. Adapt Antero Serrano Highway Interchange (Package 2).

Climate Drivers	BCIB Design Considerations	Project Design Adaptation Measures
	Solar hot water to reduce use of fossil energy. High-efficiency equipment, appliances, fixtures to reduce fossil energy use.	
Extreme Precipitation Events, Flooding	**Package 1:** *Construction of Mt View Waterway Bridge* • No observed water level during the dry season. • designed to accommodate Q100 design discharge. • 3-column-pile bent type structure • Clearance between the design flood level and bridge soffit is dictated by the design grade rather than the DFL vis-a-vis discharge • Bridge clearance was pegged at 1.50 m. • Design flood level is 32.59 m. • 1.13 m^3/s flood discharge considering 50 year + 10% increases in rainfall + base flow • 20 m minimum span length (m) *Construction of slope protection* The Bataan Side of BCIB is a cut section from Sta. 1+000 to Sta. 1+500 and from Sta. 2+000 to Sta. 2+600, and fill section from Sta. 1+500 to Sta. 2+000 and Sta. 2+600 to Sta. 4+400. **Package 2:** Fill section is for the entire stretch of Cavite Side from Sta. 30+800 to Sta. 32+000. Provision of the typical drainage at grade road portion of the crossing. Construction/Installation of box and pipe culverts, roadside and median ditches, and gutter flow. Installation of the typical drainage cross-section for land viaducts. **Package 3 & 4, Package 5 & 6** Surface run-off from the deck (marine viaducts) and bridge deck (long span bridges) will be collected and drained at the low points of the deck surface into Manila Bay.	Installation of infiltration trenches along roads Construction of slope protection measures on natural slopes and man-made structures, such as road embankments and cuttings.(Nonstructural barriers, such as vegetated earthen berms and boulder rip rap as well as river stabilization (Timlan River), shoreline and benthic habitat restoration including off site mitigation with planning, protecting and enhancing Corregidor Island Park marine and terrestrial habitat preservation) Preservation and Restoration of Natural Drainages. Adapt Antero Serrano Highway Interchange (Package 2). Tree replacement - GHG emissions offsetting through the enhanced National Greening Program of the government. Electronic Notification System: Traffic monitoring and alert system
Sea Level Rise, Storm Surge	**Package 1:** The substructure is a 2-column pier bent type supported on pilecap and multiple rows of bored pile substructure.	Coastal wall protection: Protection of bridges from powerful storm surges and waves by reinforcing piers, columns and bridge foundations against scouring Raise piles to be longer by the amount of the SLR

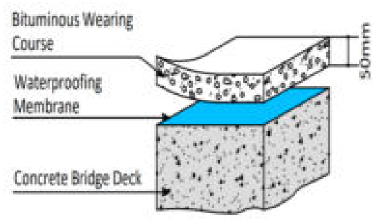
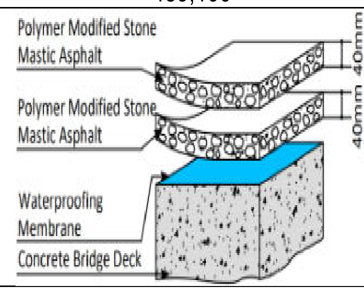
Climate Drivers	BCIB Design Considerations	Project Design Adaptation Measures
	The terrain ground condition has a steep slope from abutment towards the shoreline, and column heights vary from 8 m to 17 m high. **Package 2:** The substructure is a 2-column pier bent type supported on pilecap and multiple rows of bored pile substructure. The terrain ground condition is flat, and the shoreline and column heights vary from 6 m to 7 m high **Packages 3 – 6:** <u>Sea Level</u> Designed to clear a compounded effect of high tide, sea level rise, storm surge and typhoon-generated tidal waves. P3: Minimum Vertical Design Requirements Estimate: • maximum astrometric tide elevation at that location = 0.91m MSL • Typhoon generated maximum wave height (pier CV 43) = 7.60 m MSL • Sea Level Rise Allowance (Preliminary recommendation) = 1 .2 m MSL • Minimum Low bridge/deck member elevation: = 9.51 m MSL **Minimum Vertical Design Requirements Provided (Corregidor Turnaround)** • maximum astrometric tide elevation at that location = 0.91m MSL • Typhoon generated maximum wave height (pier CV 43) = 7.60 m MSL • Sea Level Rise Allowance (Preliminary recommendation) = 1.2 m MSL • Minimum Low bridge/deck member elevation: = 9.51 m MSL The vertical profile of the mainline varies from +21.5 msl to +23.0 msl near Corregidor Island. Highway Alignment Level: Northern Main Navigation Channel = + 47.4 m asl; Corregidor Interchange = +31.1 m asl; Fast Ferry to Corregidor Island = +20.9 m asl P6: Southern Main Navigation Channel = +72.3m; Nearshore Navigation Channel = +23.1m; and Non-navigation Span = +14.5m. Highway Alignment Level: +81.7 m asl; Nearshore Navigation Channel = +32.5 m asl; and Non-navigation Span = +21.5 m asl. P5: Air Draft above MSL (m): Northern Main Navigation Channel = +40.5m;	Preservation and easement retention of natural drainage waterways Enhancement and retention of areas within certain distances along the banks of rivers, streams, and shores of seas for environmental protection Electronic Notification System: Traffic monitoring and alert system

Climate Drivers	BCIB Design Considerations	Project Design Adaptation Measures
	Highway Alignment Level: Northern Main Navigation Channel = + 47.4 m asl; P5: Northern Main Navigation Channel = +40.5m; Corregidor Interchange+21.5m+ 5.10m headroom =+26.6m; Vessel collision force Vessel collision force has been applied considering both current conditions and conditions with 1.6 m of SLR.	
Increase of storm intensity and wind speed	**Package 1 & 2:** Use of a flexible pavement to be more resistant to weather and climate extremes. **Package 3 -6:** Wind design criteria: 1700-year wind standard–industry standard for cable bridges. The horizontal alignment near the landing point at Bataan and Cavite is designed to be perpendicular to the shoreline and perpendicular to the Northern and South Main Navigation Channel. **Package 5 & 6:** *Wind load on structure* Exposure category D ('flat unobstructed areas and water surfaces') was applied. *Wind speeds* Speeds are reported at a reference deck height above sea level for the BCIB project. Wind Speed at Deck Heights (87.6 m) for BCIB (South Channel Bridge) • Hourly Mean: 71.0 m/s (255 kph) • 10 Minute Mean 72.7 m/s • 3s-Gust: 95.8 m/s Wind Speed at Deck Heights (48.4) for BCIB (North Channel Bridge) • Hourly Mean: 67.2 m/s (242 kph) • 10 Minute Mean 68.8 m/s • 3s-Gust: 91.9 m/s (331 kph)	Coastal wall protection: Protection of bridges from powerful storm surges and waves by reinforcing piers, columns, and bridge foundations against scouring. Wind fairings and shields (Package 5 and 6). Electronic Notification System: Traffic monitoring and alert system

[a] ADB. 2014. *Climate proofing ADB investment in the transport sector: initial experience*. p.9.

Exhibit 7-30: Comparison of Maintenance of Conventional Mixtures Asphalt and Polymer Modified Stone Mastic Asphalt

DIV	Conventional Mixtures Asphalt	Polymer Modified Stone Mastic Asphalt

Maintenance and Repair cycle (Total 20 years)		Construction → Replacement of the Asphalt Surface Layer 50mm (5 years) → Replacement of the Asphalt Surface Layer 50mm (5 years) → Replacement of the Asphalt Surface Layer 50mm (5 years) → Reconstruction	Construction → Replacement of the PSMA Layer 40mm (10 years) → Reconstruction
Total Replacement of the Asphalt Quantities (ton) [a]		1,834,128	489,100
Pavement Structure			
CO_2 Emissions (ton CO_2)	Maintenance [b]	610,264	162,736
	Running Vehicles [c]	1,083,851	412,895
	Asphalt Disposal [d]	40,438	10,783
	Total	1,734,553	586,414

Source: Hong JW. Assessment of Life Cycle Carbon Dioxide Emissions for Asphalt Road: G901: A-0005558937

[a] The quantity is based on the data prepared by ARUP at the FS stage, so it will be changed when DED is completed.

[b] CO_2 emission during maintenance = CO_2 emission during Asphalt Processing + CO_2 emission during Asphalt Transporting + CO_2 emission during the construction equipment.

[c] CO_2 emission during Running Vehicles (20 Years) = CO_2 emission during normal operation + CO_2 emission due to reductio n in vehicle speed during maintenance work.

[d] CO_2 emission during Asphalt Disposal = CO_2 Emissions from Asphalt Demolition + CO_2 Emissions from Asphalt Disposal

7.1.3 Estimated Climate Change Adaptation Cost

238. A total of about US$ 52.1 million of the civil works will be spent on addressing (adaptation) climate change risks. The estimated costs for adapting to climate change risks are shown in Exhibit 7-31.

Exhibit 7-31: Estimated Costs for Adaptation Measures of the Project

Description	Extent	Amount	
		Pesos (PhP)	US Dollar ($)
1. SLR of 1.6m increasing height of bridge	Marine Bridges	1,326,341,324	23,971,468
2. Energy efficient lighting	Project-wide	712,650,400	12,880,000
3. Security items/ Electronic Notification System	Project-wide	430,855,840	7,787,020
4. Wind fairings and shields	Cable-Stayed Bridges	134,567,065	2,432,081
5. Polymer modified stone mastic asphalt	Project-wide	129,127,962	2,333,778
3. Slope protection measures	Landside	45,792,691	827,629
4. Installation of infiltration ditches	Landside	17,172,259	310,361
5. Preservation and restoration of natural drainages	Landside	11,448,173	206,907
6. Adapt Antero Serrano highway interchange	Landside - Cavite	37,386,281	675,696
7. GHG Emissions Offsetting (seedling replacement)[a]	Project-wide	40,750,545	736,500

Description	Extent	Amount	
		Pesos (PhP)	US Dollar ($)
8. Shoreline and benthic habitat restoration and Corregidor Island Park marine and terrestrial habitat preservation *(Part of the Biodiversity Action Plan)*	Landside/ offshore restoration post construction	165,989,922	3,000,000
9. Green Buildings Application	BMMC and Tourist Facility	193,654,829	3,500,000
10. Installation of electric vehicle charging stations	Outside BCIB footprint	16,599,013	300,000
11. Climate mitigation approaches integrated in O&M manual and capacity training	Project wide	33,198,019	600,000
Total		**3,295,534,586**	**59,561,442**

Source: Memorandum dated 17 Feb 2023. Cost Associated with Climate Adaptation for the Detailed Engineering Design of Bataan-Cavite Interlink Bridge Project.

[a] Based on the Department Order 116, S-2018. Tree cutting and earth-balling permit application process and requirements for DPWH infrastructure projects.

7.2 GHG Emission/Contribution of the Project to Climate Change

7.2.1 Construction Phase

239. During the construction stage, the project is expected to contribute approximately 445,200 tCO_2e, which is a small contribution to the total anthropogenic CO_2 load of the country. The construction of the project releases 89,000 tons of CO_2 (tCO_2) annually. This emission amount is below ADB's general threshold of 100,000 tCO_2 per year and the project's construction is an insignificant source of emissions. The estimated CO_2e emissions will be contributed from fuel consumption in i) producing the main materials (828 tCO_2e), ii) transporting the main materials (82,677 tCO_2e), iii) different equipment (361,368 tCO_2e), and iv) vehicles, buildings, and road facilities (371 tCO_2e) in the project construction phase.

240. To minimize unnecessary CO_2 generation, the following measures should be employed by the project: i) minimize vegetation removal and alteration of topography, if possible, ii) implement regular inspection and preventive maintenance of heavy equipment, machinery, and service vehicles in conformance with the DENR emission standards; and iii) use electric or fuel-efficient equipment, machinery, and vehicles and maximize their operation.

241. Before a land clearing preparation, the project needs to secure tree cutting permits following DENR guidelines (i.e., Forest Management Bureau Technical Bulletin No. 3) with consideration of the DPWH Department Order 116, series of 2018 on the tree cutting and earth-balling permit application.[39] Also, a coconut cutting permit must be secured from the Philippine Coconut Authority provincial office.

242. The project roadways, navigational bridges, marine viaducts, and interchanges shall be well-lighted throughout the alignment during construction. It will provide adequate lighting and safety for the road users (land), shipping navigation (sea) and air transport to see roadside facilities. The project prefers use of Light Emitting Diode (LED) luminaries because the other types of vapor lamps would require twice the number of fixtures and produce low quality of illumination. The

[39] Department Order 116, S-2018. Tree cutting and earth-balling permit application process and requirements for DPWH infrastructure projects.

lighting system of the project will be able to function with low power consumption and running cost. Lighting will be arranged depending on the roadway alignment of each component.

7.2.2 Operational Phase

243. The project can still be considered on the low-end GHG emitter level based on average annual CO_2 equivalent emissions (34,700 tCO_2e) in forecast years. However, necessary measures will likely be enforced to further reduce its possible impacts and that of climate change on the BCIB project.

244. To sustain its contribution to reducing GHG emission, the project must implement necessary adaptation measures during operation. These include: i) planting of local or endemic trees along its land roadway alignment and facilities between Station 0+000 and Station 31+840 on the Cavite side, and between Station 0+000 and Station 5+800 on the Bataan segment; ii) provision of the roadway lighting powered by the latest solar technology that is durable and weather resistant, ii) implementing energy/water conservation programs such as use of energy-efficient products and monitoring carbon footprint; iv) use of a color palette of textured light colors to cool the wall surfaces, minimize solar heat absorption and to maximize solar heat reflection, plus various service areas (i.e. parking areas for different vehicle types and an impound yard, and various green/ soft-scaped areas), v) designating the interchange areas in Cavite and Bataan as a green urban corridor, and vi) regularly inspecting and properly maintaining road systems and facilities, and equipment and machinery.

245. Additionally, as the science and technology continue to develop, decarbonization strategies will continue to be integrated through the foresight to continue discussions as will be required through the Operation and Maintenance Manual which is under development. This effort will include capacity training. The adaptation costs for policy dialogues by BCIB's climate change working group and the decarbonization strategy is expected to be supported by ADB.

8. CONCLUSIONS AND RECOMMENDATIONS

8.1 Conclusions

246. The BCIB project climate risk classification is high. This CRA has been prepared to assess the climate and climate change threats to the BCIB project, consider the project adaptation measures, determine to what extent the performance and design are vulnerable to climate change, and recommend actions that will improve the project climate resilience.

247. The climate risk assessment found that the project is exposed to climate hazards based on the current and future time frames. The project location experienced climate and geophysical hazards in the past and is expected to experience these in the future with high intensity, frequency, or duration. However, the project components are not likely sensitive to the climate conditions

such as temperature and rainfall extremes, flooding, sea-level rise, storm surge, strong winds, drought, and heatwaves. Based on the design standards adopted for the BCIB project detailed designs, the road and bridge design criteria are robust to meet the context of the Manila Bay geotechnical conditions, large expanse of the crossing and secure against the potential for vessel collision, and therefore additional measures for climate change mitigation and adaptation are not necessary.

248. Although climate hazards are treated separately here, it is essential to recognize that they can be concurrent. For instance, tropical cyclones typically bring heavy rainfall, high wind speeds, and storm surges. Therefore, the BCIB project should reflect the possibility of climate-driven changes in multi-hazards at a site. This assessment is a step forward towards an efficient management of roadways, bridges, and other facilities of the project in a changing climate.

8.2 Recommendations

249. In terms of marine ecosystem influences, nature-based solutions are recommended. Healthy natural systems can provide many of the critical services communities seek from engineered, hard infrastructure - for example, mangroves can provide coastal protection by reducing the impact of waves, storm surge, and coastal erosion. Nature-based solutions (NBS) are now becoming a popular risk management approach that involve working with nature and enhancing ecosystem services to help address collective goals. According to Nesshöver et al. (2017), actions cover a spectrum of interventions, from protecting, restoring, and improving the management of marine or terrestrial ecosystems, to the creation of natural processes in modified or artificial ecosystems. A vital advantage of using NBS for disaster management in the context of climate change is that they can be flexible in the face of changing conditions if not disturbed (Spalding et al., 2014). In addition, NBS can provide co-benefits in a way hard infrastructure may not. Looking at mangroves in Bataan and Cavite coastal areas, they can provide coastal protection and support fisheries and food security, tourism, and act as a significant carbon sink (Narayan et al., 2016).

250. The project needs to develop green corridors to the interchange areas in Bataan and Cavite and the existing riparian galleries during its operation. Vegetation along roads contributes to environmental protection, reducing noise, pollution, and protecting the road from direct sunlight. It will help to reduce roadways' vulnerabilities to fires and heatwaves and serve as a carbon sink within the project areas. The use of fire-resistant, endemic, and indigenous flowering trees is proposed for landscaping.

251. It would be advisable to implement a climate change communication notice process to communities through community-based adaptation options and activities, including film showing and local videos, to increase the level of acceptance of communities to interventions and heighten their involvement in the adaptation options.

252. Overall, BCIB overwater infrastructure development has not been planned "as usual." Investment decisions have specifically been robust to address the geotechnical context and scale that makes it defensive against future climate change risks.

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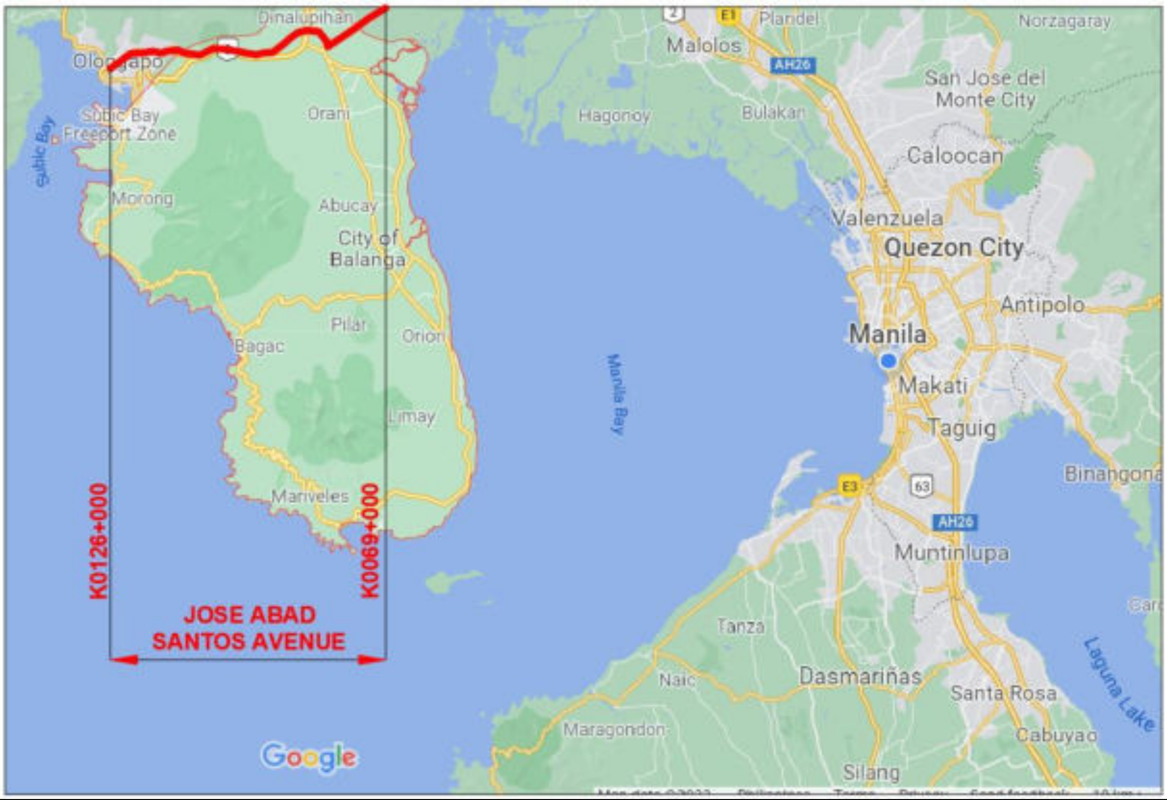
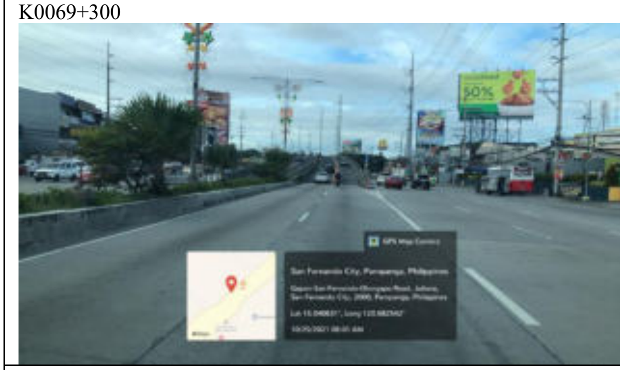
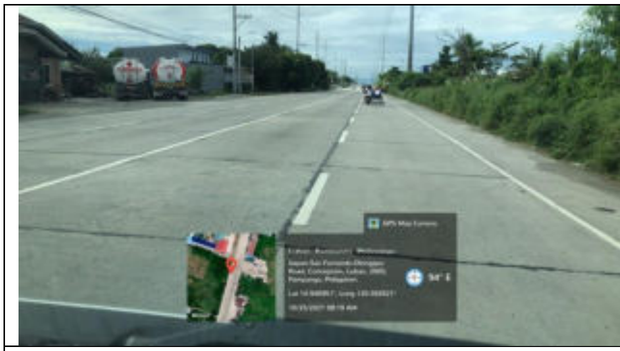
APPENDICES

Appendix 1: Documentation of the Conditional Road Surveys Conducted in Bataan and Cavite

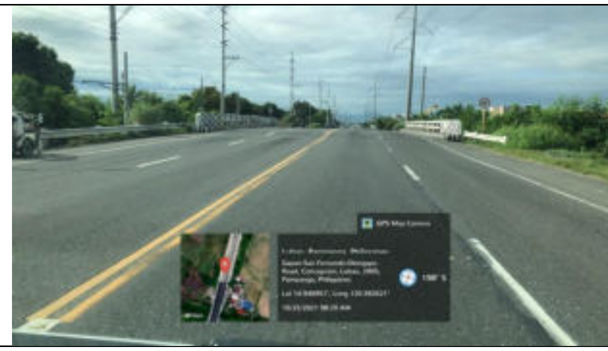
Jose Abad Santos Avenue (K0069+000 - K0126+000)



K0069+300	K0074+700 (Barbara Bridge)
	
K0083+250	K0083+800 (San Antonio Bridge)



K0086+900 (Santa Cruz Bridge)



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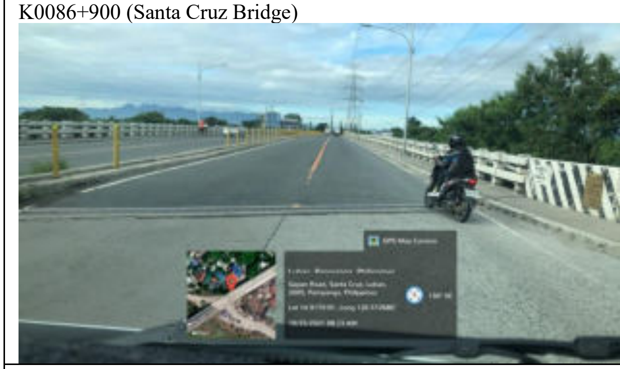
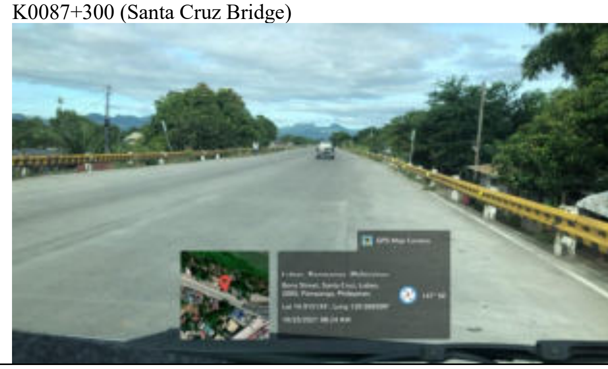
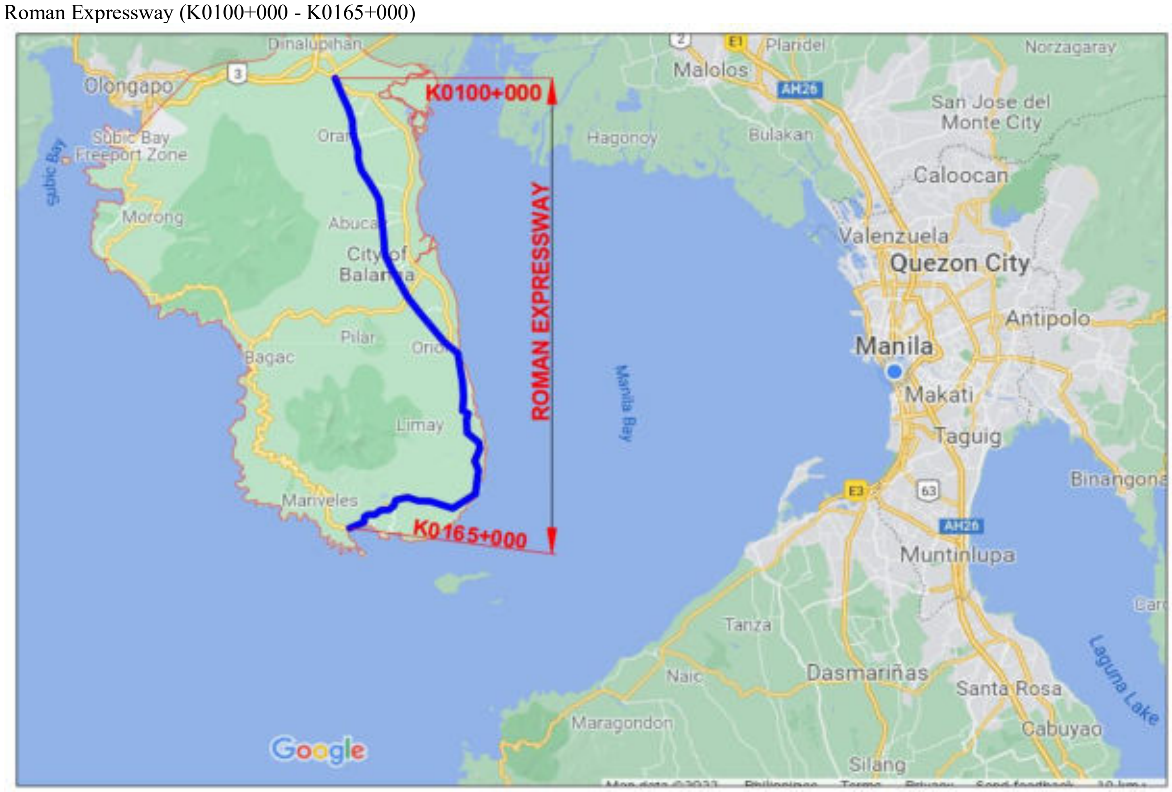


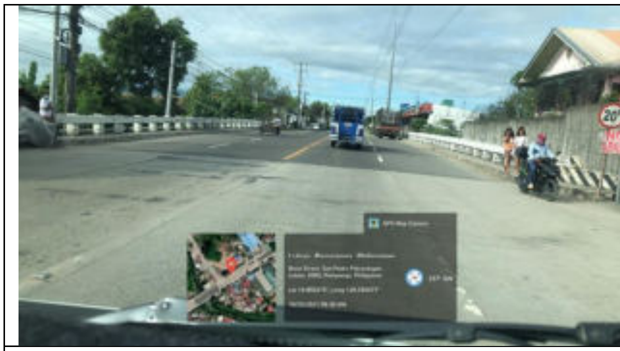
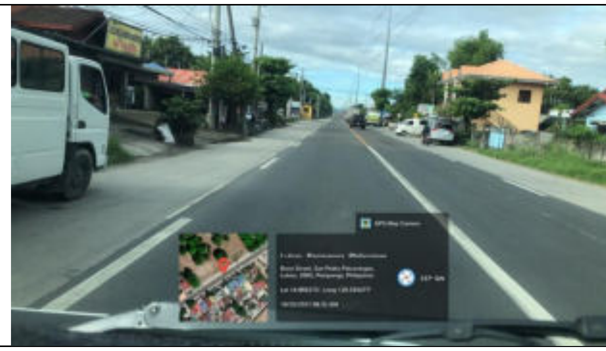
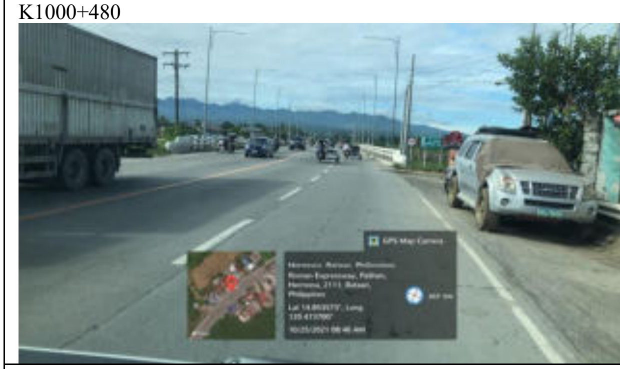
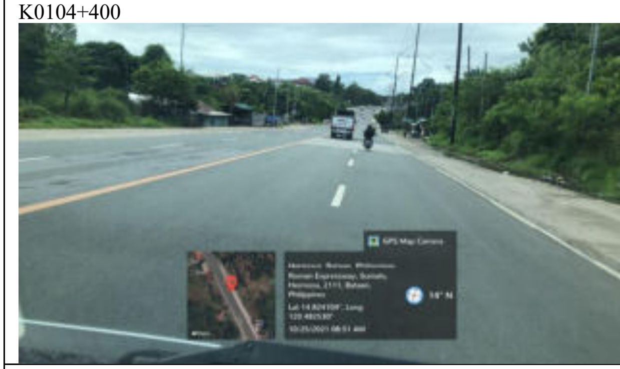
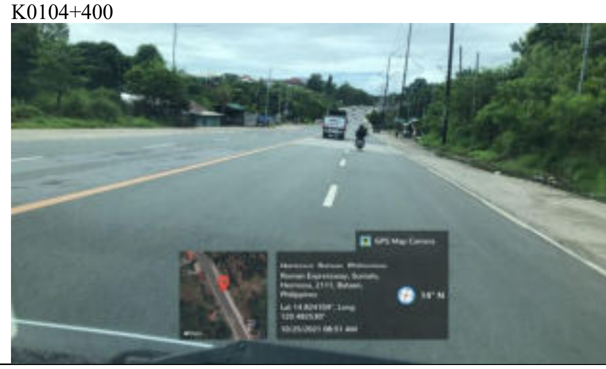


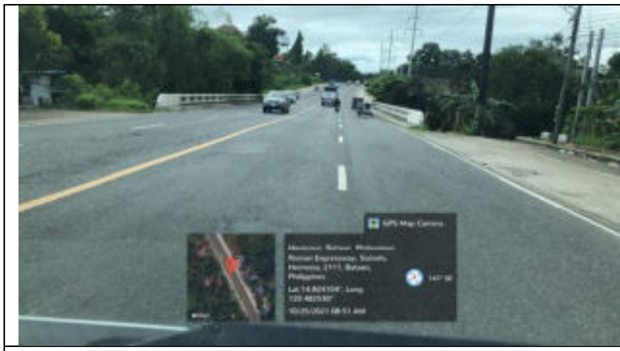
Roman Expressway (K0100+000 - K0165+000)



K0091+750 (Lauc Pao Bridge)

K0093+100

	
K0100+375 (Layac Bridge 3)	K0100+400 (Layac Bridge 3)
	
K1000+480	K0100+500
	
K0104+400	K0104+400
	
K0104+500 (Mambog Bridge)	K0104+550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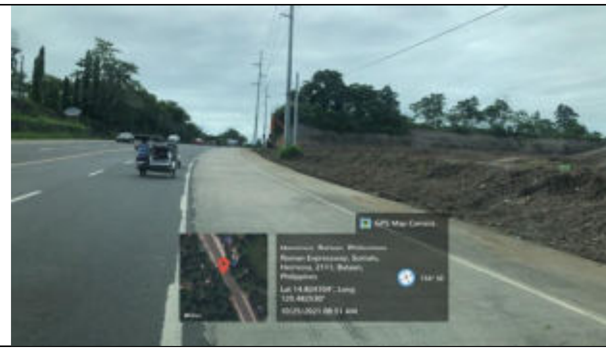
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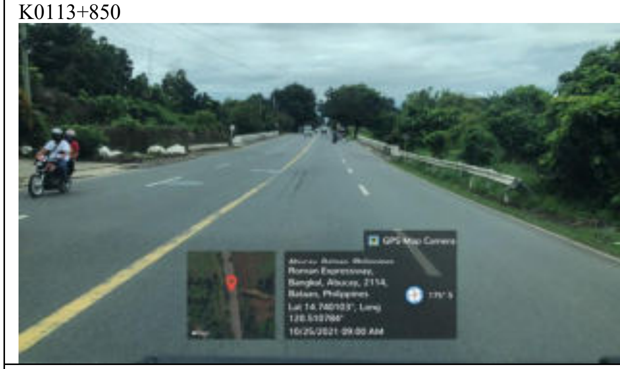
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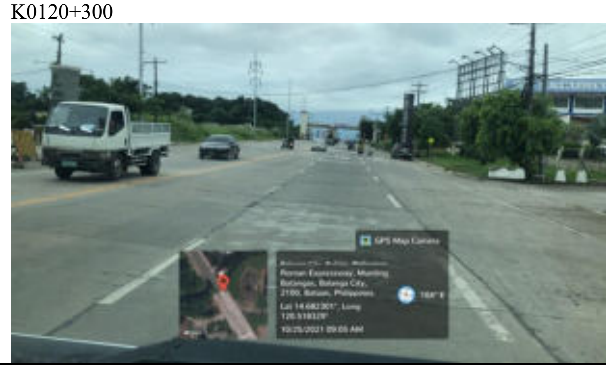
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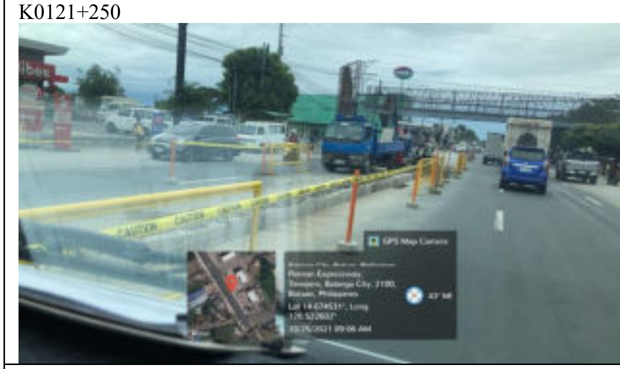
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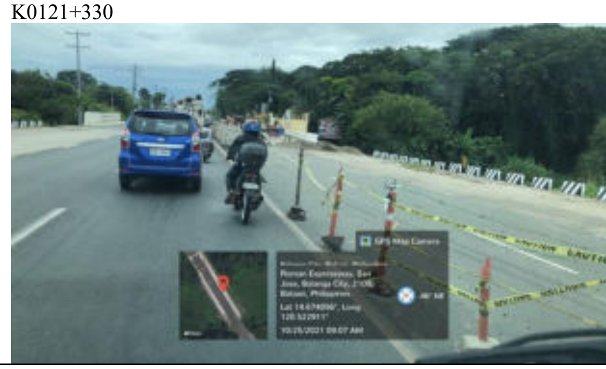
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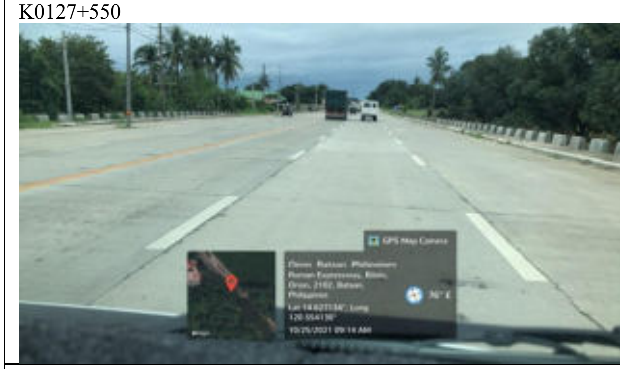
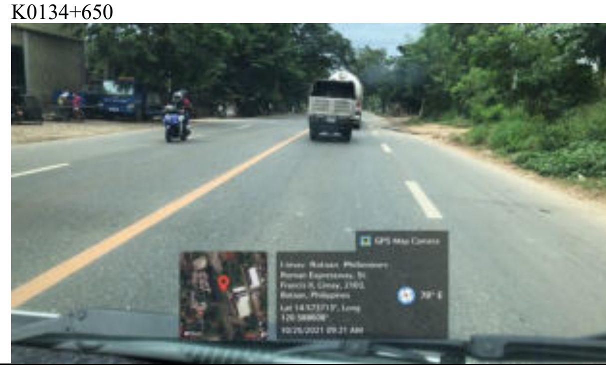
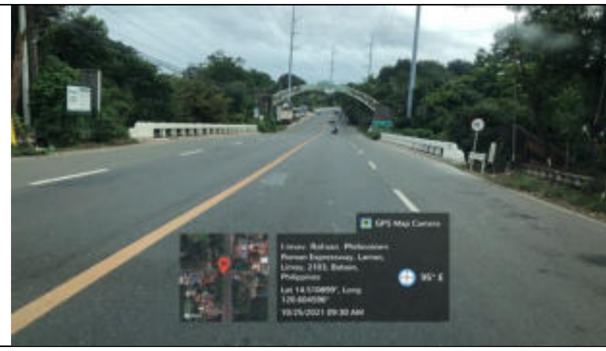

K0140+150


K0142+675 (Lamao Bridge)

K0135+550 (Mamala Bridge)

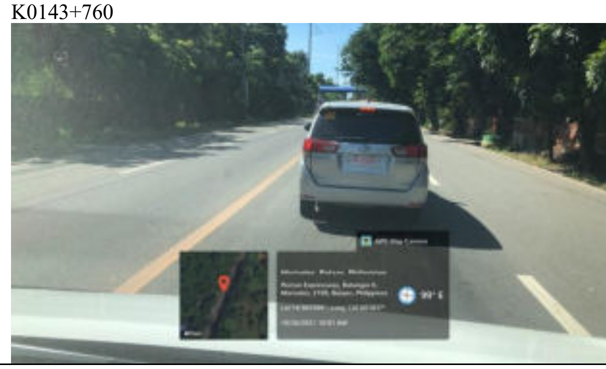


K0135+600 (Mamala Bridge)

K0135+959 (T. Kaliwa Bridge)

K0143+760

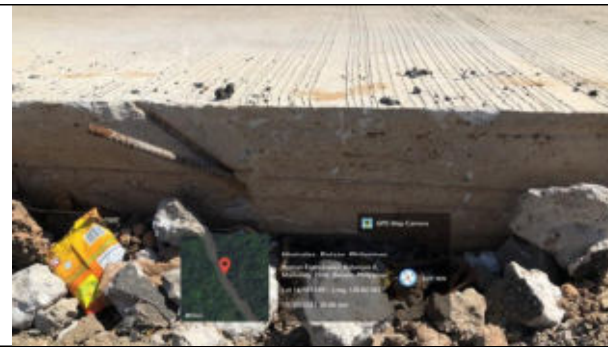
K0143+760



K0143+760

K0143+760

K0143+760

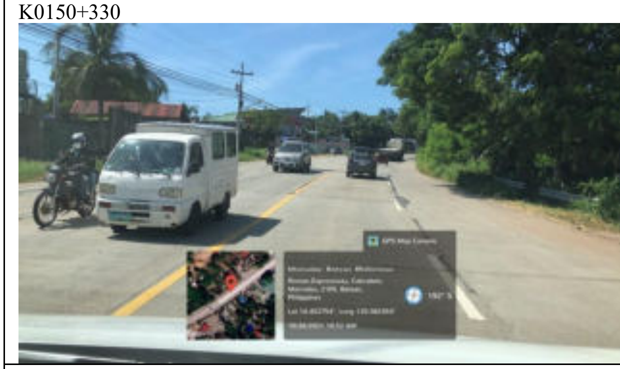


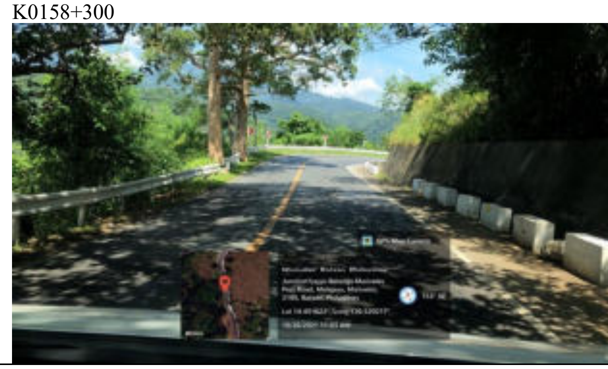
K0146+930 (Lucanin Bridge)

K0146+930 (Lucanin Bridge)

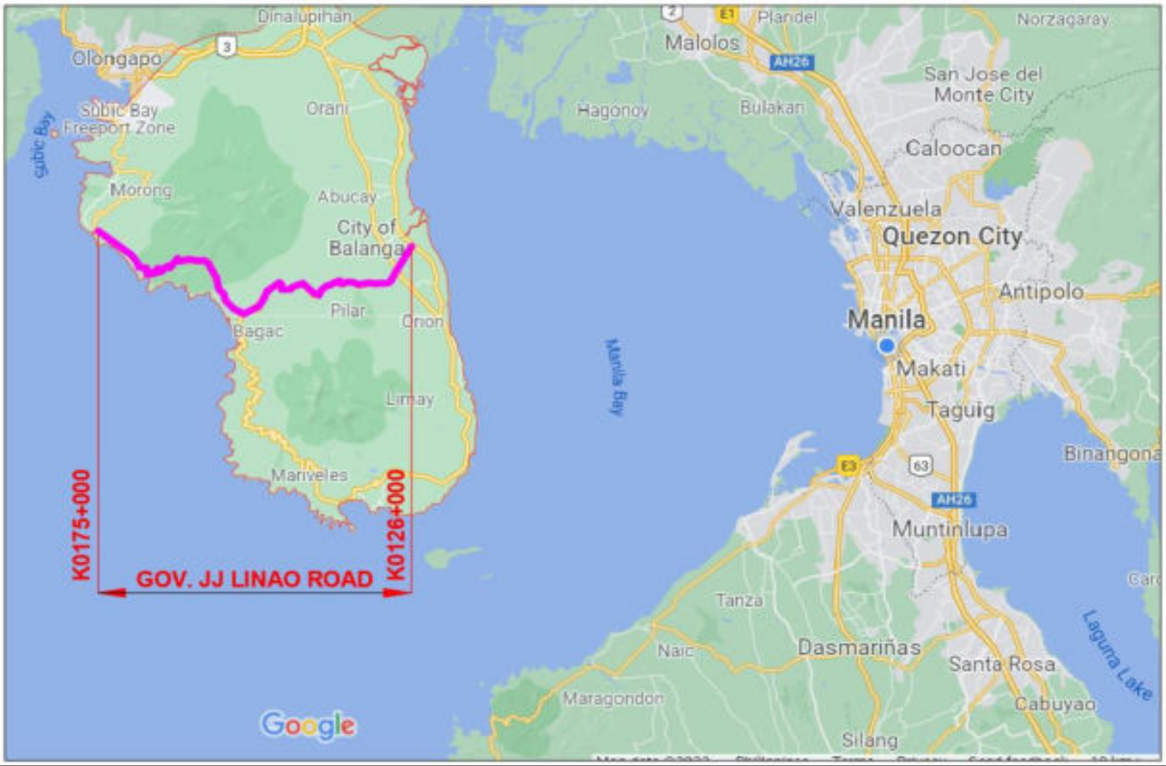
K0150+330

K0158+300

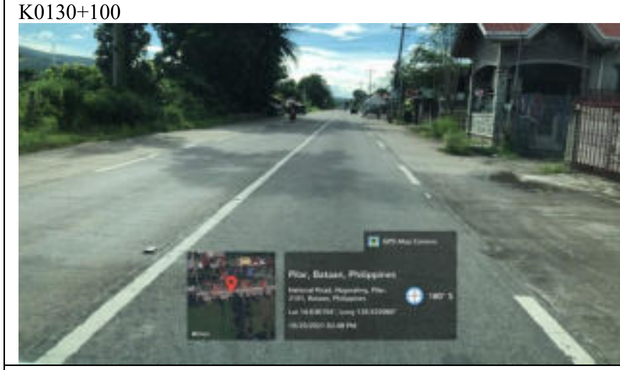




Gov. JJ Linao Road. (K0126+000 to K0175+000)



K0130+100



K0132+088 (Uyong Bridge)

K0132+088 (Uyong Bridge)

K0132+088 (Uyong Bridge)

K0132+088 (Uyong Bridge)

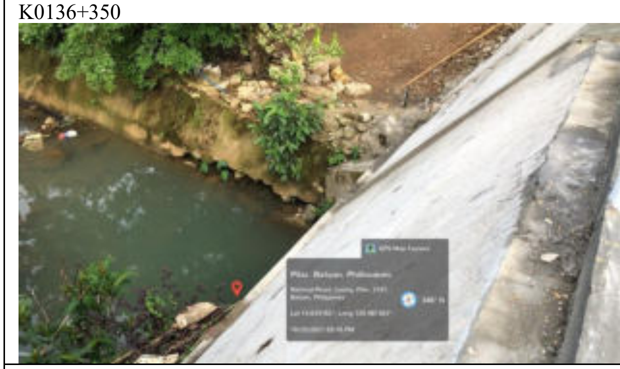
K0133+350 (Catmon Bridge)


K0133+350 (Catmon Bridge)


K0135+645


K0136+350


K0136+350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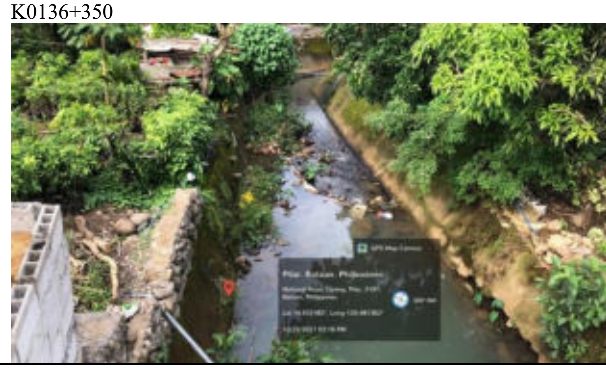
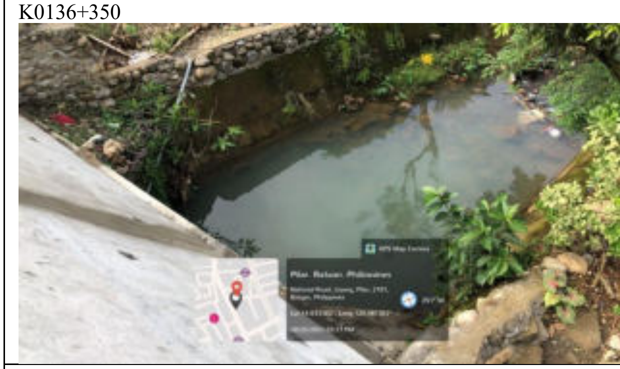

K0137+013 (Pantingan Bridge)


K0137+013 (Pantingan Bridge)


K0137+013 (Pantingan Bridge)

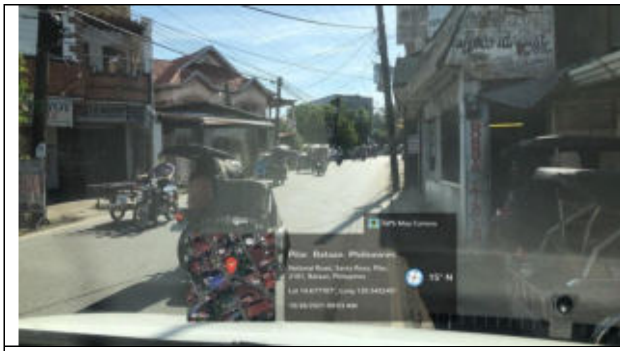
K0137+013 (Pantingan Bridge)

K0137+013 (Pantingan Bridge)

Junction. Layac-Balanga Mariveles Port Road (K0102+000 to K0142+000)

K0124+500

K0124+700 (Camacho Bridge)



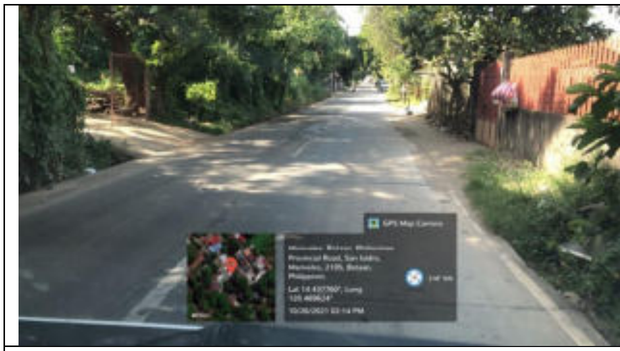
K0124+700 (Camacho Bridge)

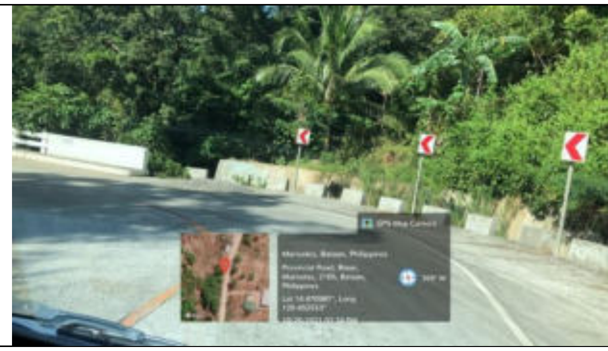
K0132+450 (Orion Bridge)

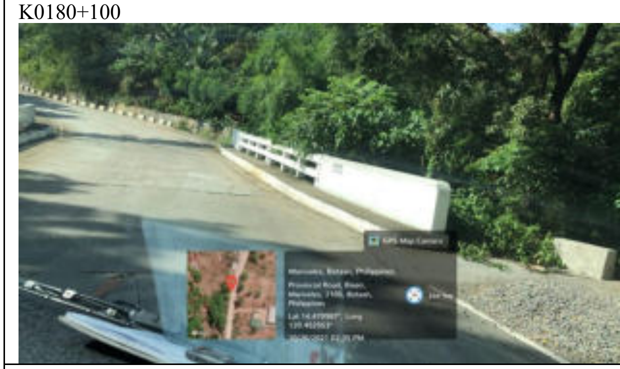
Bagac-Mariveles Road. (K0152+000 to K0195+000)

K0193+780

K0186+100


K0180+100


K0174+100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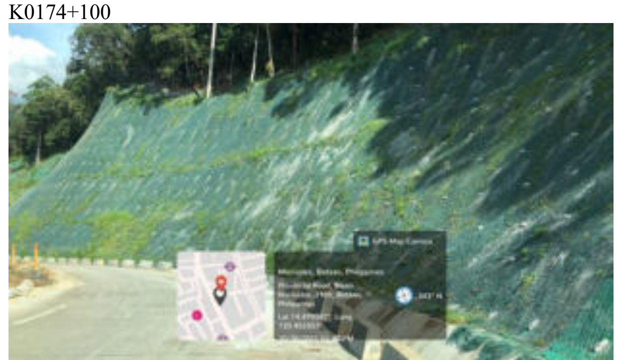
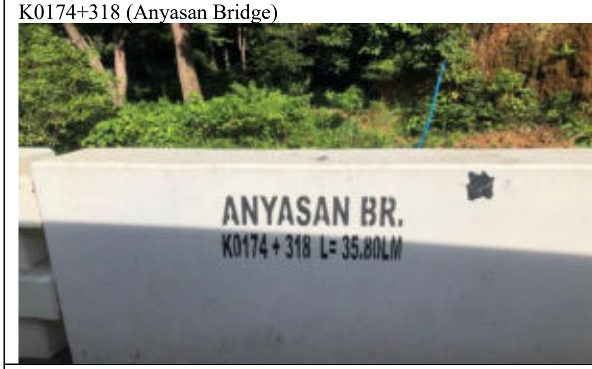

K0172+400


K0174+318 (Anyasan Bridge)

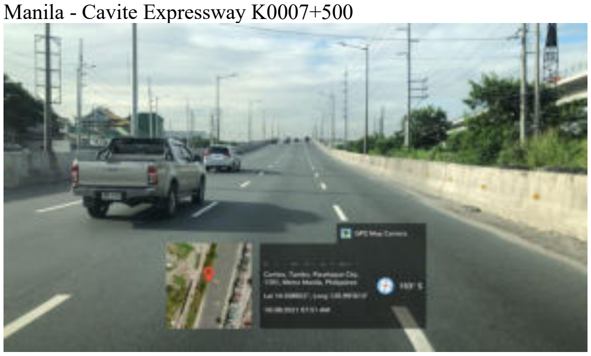
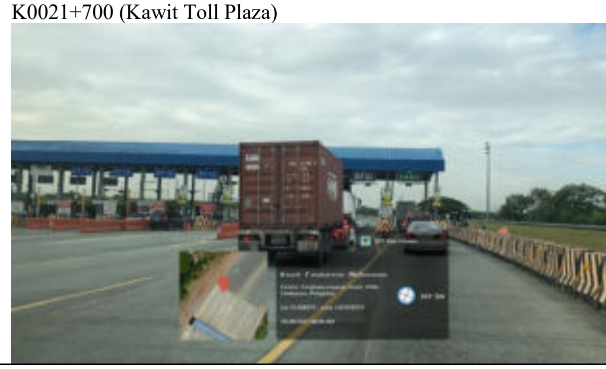

K0174+318 (Anyasan Bridge)

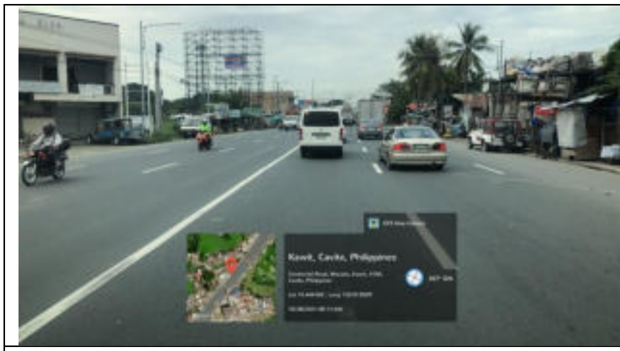


K0169+254 (Binuangan Bridge)

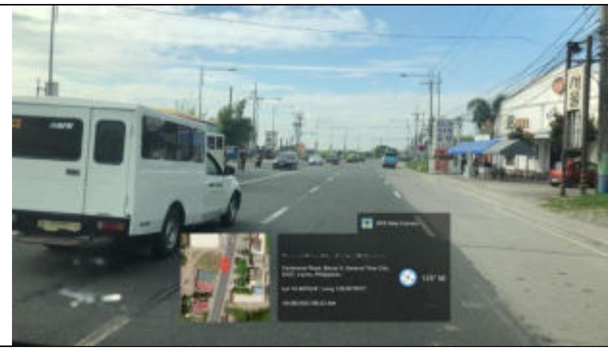

K0169+254 (Binuangan Bridge)

	
K0161+650 (Bulingal Bridge)	K0160+135 (Banayam Bridge)
	

Manila - Cavite Expressway K0007+500	K0007+900 (Parañaque Toll Plaza)
	
Manila - Cavite Expressway K0021+000	K0021+700 (Kawit Toll Plaza)
	
Kawit-Noveleta Div. Road K0022+000	Noveleta-Rosario Div. Road K0028+700



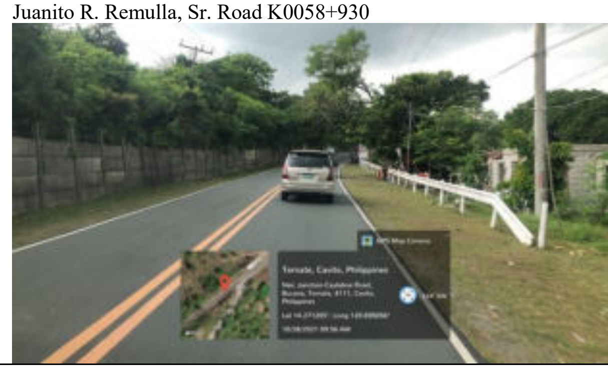
Noveleta-Naic-Tagaytay Road K0036+925



Noveleta-Naic-Tagaytay Road K0039+525

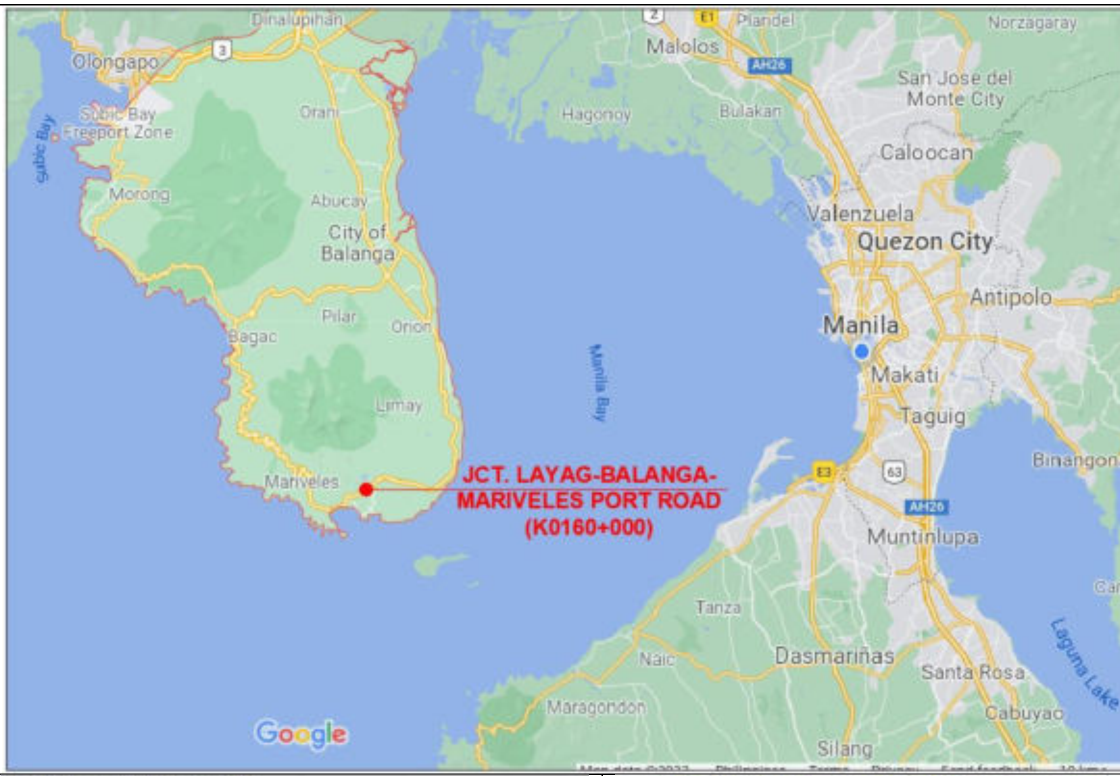
Noveleta-Naic-Tagaytay Road K0043+600

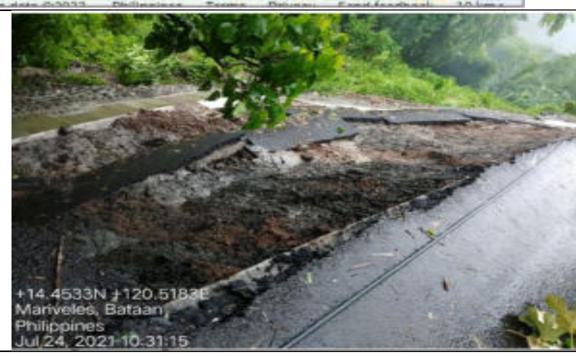
Juanito R. Remulla, Sr. Road K0058+930



Typhoon FABIAN and JOLINA Survey Report by DPWH,2021

Junction Layac Balanga-Mariveles Port Road(K0160+000 - K0160+030)





Source: Typhoon FABIAN and JOLINA Survey Report by DPWH,2021

Talisay Bridge - Roman Expressway (K0124+142)

Source: Typhoon FABIAN and JOLINA Survey Report by DPWH,2021

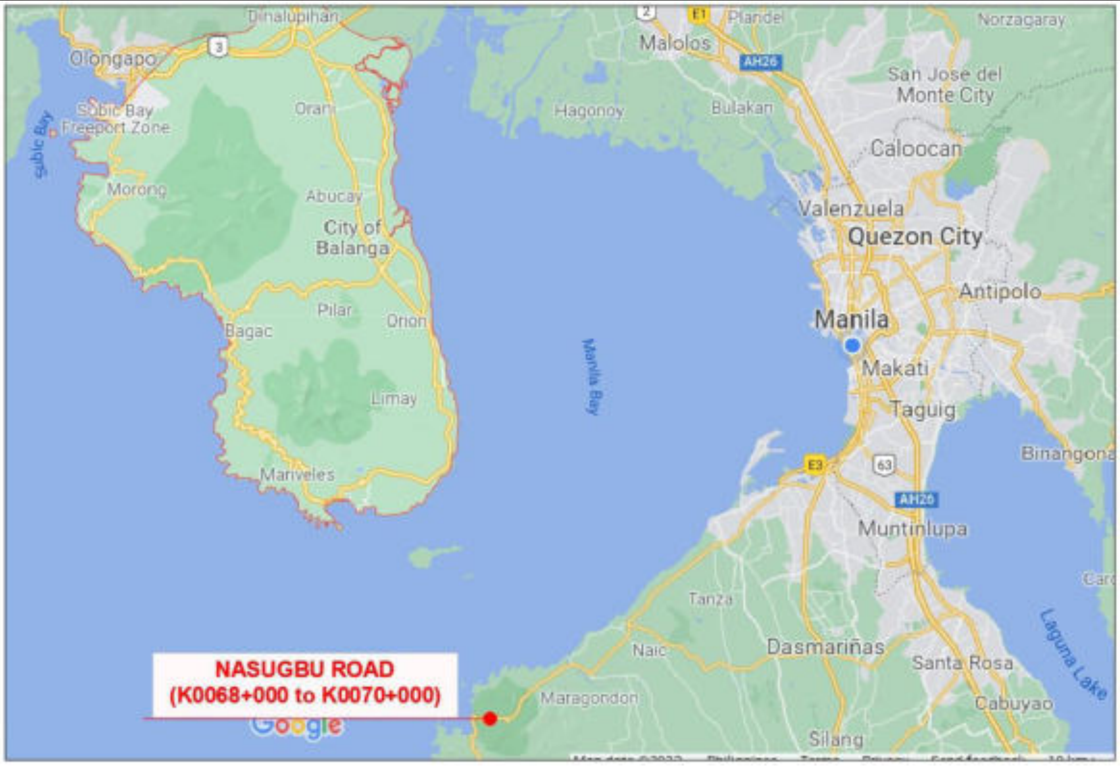
Gov. JJ Linao Road (K0151+829)-Umagol Bridge

Source: Typhoon FABIAN and JOLINA Survey Report by DPWH,2021

Roman Expressway (K0126+188)-Capot Bridge

Source: Typhoon FABIAN and JOLINA Survey Report by DPWH,2021

NASUGBU ROAD, K0068+800, Clearing Operation of Fallen Rocks and Debris



Source: Typhoon FABIAN and JOLINA Survey Report by DPWH,2021

NASUGBU ROAD, K0069+190, Road Close due to Landslide

Source: Typhoon FABIAN and JOLINA Survey Report by DPWH,2021

NASUGBU ROAD, K0069+350, Road Close due to Landslide

Source: Typhoon FABIAN and JOLINA Survey Report by DPWH,2021

NASUGBU ROAD, K0069+350, Road Close due to Landslide

Source: Typhoon FABIAN and JOLINA Survey Report by DPWH,2021

NASUGBU ROAD, K0069+500, Road Close due to Landslide

Source: Typhoon FABIAN and JOLINA Survey Report by DPWH,2021

NASUGBU ROAD, K0069+500, Road Close due to Landslide

Source: Typhoon FABIAN and JOLINA Survey Report by DPWH,2021

NASUGBU ROAD, K0069+750, ROAD CLOSE due to Landslide

Source Typhoon FABIAN and JOLINA Survey Report by DPWH,2021

NASUGBU ROAD, K0069+750, ROAD CLOSE due to Landslide

Source: Typhoon FABIAN and JOLINA Survey Report by DPWH,2021

1. NASUGBU ROAD, SINALAM BRIDGE, Damaged Slope Protection @ Abutment "A"

Source: Typhoon FABIAN and JOLINA Survey Report by DPWH,2021

Appendix 2: List of Participants, Photographs, and Guide Questionnaire Used During the Interview

List of Participants in Bataan Province

Name	Designation	Office
Gladys Gomez	EMS	MENRO, Mariveles, Bataan
Alvin Binondo Marcelo Serrano	Officer 1 MDRRO Head	MDRRM, Mariveles, Bataan
Leoncio Lungcay	Brgy Chairman	Mt. View, Mariveles, Bataan
Sitoy Doculan Ricky Ritomalta	Bantay Dagat, Brgy. Tanod	Mt. View, Mariveles, Bataan
Maria Concepcion Tua	Brgy. Secretary	Brgy. Alas-asin, Mariveles, Bataan

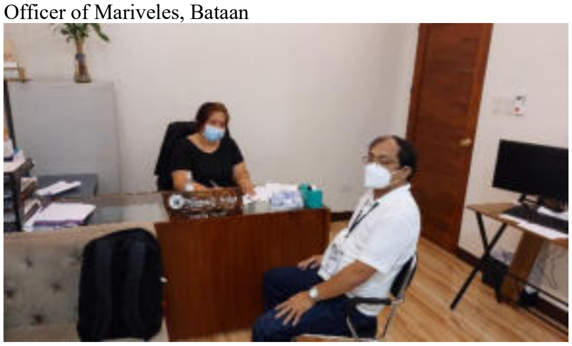
List of Participants in Cavite Province

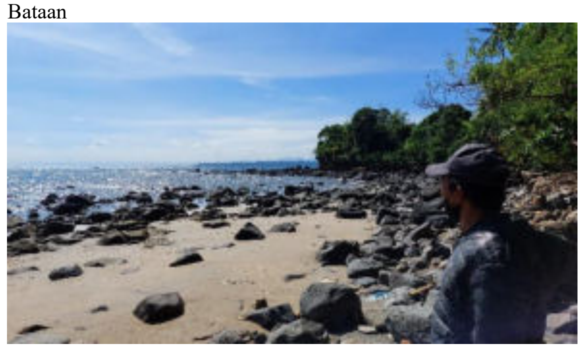
Name	Designation	Office
Jesty Gonzales	MDRRO Head	MDRRMO Naic, Cavite
Christopher Cabuhat	Brgy Chairman	Balsahan Timalan, Naic Cavite
Marissa Pabiton	Brgy. Chairman	Timalan Concepcion, Naic Cavite
Nick Salvador	Bantay Dagat, Brgy. Tanod	Timalan Conception, Naic Cavite

Photographs During Interviews


Interview with the Municipal Disaster Risk and Management Officer of Mariveles, Bataan


Interview with the Barangay Administrator, Mt. View, Mariveles, Bataan


Interview with the Barangay Secretary, Alas-asin, Mariveles, Bataan


Interview with the Bantay Dagat and local resident, Mt. View, Mariveles, Bataan


Interview with the Municipal Disaster Risk and Management Officer of Naic, Cavite

Interview with the Barangay Chairman, Timalaya Conception, Naic, Cavite

Interview with the local community in Barangay Mt. View, Mariveles, Bataan


Interview with the local community in Barangay Timalaya Conception, Naic, Cavite

Interview with the Barangay Chairman, Balsahan Timalaya, Naic, Cavite

CLIMATE RISK ASSESMENT - QUESTIONAIRE

Name:			
Position/Designation			
Location		**Date**	

Confirmatory Questions	Answer (Yes/No)	Remarks/Findings
Areas frequently visited and/or hard-hit by **climate hazards**:		
Extreme temperature The temperature recorded from Sangley Point and Cubi Point both have the lowest value during December then escalates from January to May. • Sangley Point Weather Station recorded an average temperature at 24.6°C, with the highest temperature at 38.5°C on 13 and 16 May 1987, and lowest temperature at 18°C on 1 February 1982 and 14 December 1988. • Cubi Point weather station recorded an average temperature at 24.6°C, with the highest temperature at 38.9°C on 4 May 2016, and lowest at 18°C on 25 January 2014.		
Extreme rainfall The average rainfall from the PAGASA daily data indicates that the total monthly rainfall is constantly low during the first quarter of the year then escalates from May, reaching its highest value in August, then declines until December. The highest average monthly rainfall reaches 488 mm at Sangley Point and 837 mm at Cubi Point both in August, while the lowest recorded is 15 mm at Sangley Pt. in March and 4 mm at Cubi Point in February. The total average rainfall from 1980-2017 recorded was 2,148 mm with an annual average number of 130 rainy days at Sangley Point, while the total average rainfall from 1994-2017 recorded at Cubi Point was 3,451 mm with an annual average number of rainy days of 125.		
Extreme flooding The alignment will transact areas where are moderately to highly susceptible to flooding in the Cavite side. On the other hand, the Bataan side generally has a sloping ground, hence, this area is not significantly affected by flooding. Flooding in the Cavite coastal area is primarily due to water inundation from marine waters. On the other hand, the Bataan coastal region is located at a relatively higher elevation.		
Drought-prone areas:		

Sea level rise or extreme tides?		
Seasonally occurring very high waves?		
Areas frequently visited or hard-hit by typhoons: With a high to medium risk, Cavite and Bataan are hit by 1 typhoon per year. Recently in November – December 2019, typhoon Kammuri, with local name Tisoy, hit Central Luzon and Bataan with maximum sustained winds of 150 kilometers per hour (kph) and gustiness of up to 185 kph, which has caused moderate wind damage all over these provinces. Another noted tropical storm is in 2014 named Glenda that caused widespread flooding due to heavy downpours having a peak at 120 kph with gusts as strong as 165 kph.		
Storm surge-prone areas: These are abnormally high sea waves driven by extreme weather conditions such as strong typhoons. As the site is within the coast, it may be affected by abnormal disturbances of sea level.		
Is the project area vulnerable to wildfire?		
Is the project area vulnerable to heatwaves?		
Areas frequently visited and/or hard-hit by **geophysical/seismic hazards**:		
Earthquakes The seismic hazard of Bataan-Cavite areas is mainly contributed by several seismic sources such as subduction along Manila Trench, active faulting of Valley Fault System, Philippine Fault Zone and Lubang-Verde Passage Fault System. These seismic sources have generated earthquakes with magnitude greater than 6 in the past including 1990 Luzon earthquake of magnitude 7.7 along Philippine Fault Zone.		
Is the project area vulnerable to landslides or mass movement? The proposed BCIB will be running through a gently sloping interfluve terrain at coastal area at the Bataan end of the alignment where the susceptibility to landslide is low.		

At the Cavite end of the proposed BCIB, the alignment will be running through a gentle to flat alluvial plain at the shoreline where the susceptibility to landslide is negligible.		
Tsunami According the Tsunami Hazard Maps published by PHIVOLCS in 2014, the coast of the Bataan City where the BCIB project transects has a thin frame of tsunami inundation of more 6 metres, potentially up to 8 metres. High tsunami inundation is noted more inland along the river situated roughly 120 metre northeast of the proposed alignment. Along the coastline of Corregidor Island, a tsunami inundation of 5 metres to 6 metres is recorded. At the Cavite side, the BCIB alignment lies on an alluvial plan with a tsunami inundation of less than 1 metre. As the coastlines of Bataan side and Corregidor Island of the BCIB project are prone to tsunami events, mitigation measures such as breakwaters or wave dissipating blocks and coastal structures will be considered. Final designs will be based on the results of a more detailed study of the area.		
Liquefaction The Cavite side of the BCIB is within a zone that is prone to liquefaction. The offshore region of the BCIB is considered to have a considerable thickness of superficial deposits which may comprise soft/loose material including loose sand. As such, it is anticipated that liquefiable soil is highly likely to be present.		
Lateral Spreading In the BCIB, the onshore area along the waterfront of Cavite side is located on a sloping ground and lateral spreading may potentially occur. Though there are no liquefaction susceptible soils being indicated from liquefaction susceptibility map at both onshore area of Bataan and Corregidor island, the bathometry data suggests that the nearshore area of Bataan and Corregidor island exhibit a relatively steeper slope.		
Ground acceleration Based on these maps, the location of the BCIB will likely experience 0.3g, 0.3g-0.4g, and 0.4g for rock site areas at return periods of 500, 1000 and 2500 years, respectively (Figure 2.33 to Figure 2.36). For areas with stiff soils, it is modelled that the BCIB location will have an expected PGA of 0.3g in 500-year return period events.		
Ground Rupture and Fault Creep Along the proposed alignment of the BCIB, ground traces of local faults were not observed both on the Bataan and Cavite sides of the project.		
Volcanic hazards The nearest active volcanic centres to the BCIB project is the Taal Volcano and the Pinatubo Volcano, which is located approximately 50 kilometres to the southeast and 80 kilometres to the north northwest respectively. The potentially		

active volcanos are Mt. Corregidor on the Corregidor Island located about 4.4 kilometres west to the proposed alignment and Mt. Mariveles located 10.3 kilometres northwest to the proposed alignment. The closest inactive volcanic centre is Mt. Palay, which is around 16 kilometres southwest to the proposed alignment. Considering the distance of the project to the active volcanoes, it is expected that the only volcanic hazard that could impact the development is ashfall.		
Others:		

Signature

Investigator/Signature

Samples:

- ☐Mariveles, Bataan MDRMO
- ☐Affected barangay (Bgry Mt. View Mariveles, Bataan)
- ☐Local residents in Brgy. Mt. View, Mariveles Bataan
- ☐Naic, Cavite MDRMO
- ☐Affected barangay (Bgry Timalan Balsahan, Naic, Cavite)
- ☐Local residents in Bgry Timalan Balsahan, Naic, Cavite

Appendix 3: A Copy of the BCIB Project Internal Memo 001 – Sea Level Rise of BCIB Bridges

IPIF ROADS & BRIDGES | Republic of the Philippines Department of Public Works and Highways | ADB ASIAN DEVELOPMENT BANK

Bataan-Cavite Interlink Bridge Project

Internal Memo 001 – Sea Level Rise of BCIB Bridges

September 06, 2022

Prepared By: BY Lin

TYLin PEC

A JOINT VENTURE

T.Y. Lin International | Pyunghwa Engineering Consultants Joint Venture

Document Code: 481714-BCIB-xxx-xxx-xxx-xxx-00xx

Revision: 0x

481714-BCIB-xxx-xxx-xxx-xxx-00xx_R0x	BATAAN-CAVITE INTERLINK BRIDGE PROJECT Sea Level Rise of BICB Bridges	TYLin PEC A JOINT VENTURE

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Intergovernmental Panel on Climate Change (IPCC). 2019. The Ocean and Cryosphere in a Changing Climate (SROCC) Report Chapter 4: Sea Level Rise and Implications for Low-Lying Islands, Coasts and Communities.
Moss, R. H., Edmonds, J. A., Hibbard, K. A., Manning, M. R., Rose, S. K., van Vuuren, D. P., Carter, T. R., Emori, S., Kainuma, M., Kram, T., Meehl, G. A., Mitchell, J. F. B., Nakicenovic, N., Riahi, K., Smith, S. J., Stouffer, R. J., Thomson, A. M., Weyant, J. P. and Wilbanks, T. J. (2010), 'The next generation of scenarios for climate change research and assessment', Nature 463(7282), 747–756.

[1] Since 1997, Department for International Development (DFID) is the department of the UK government that manages Britain's aid to developing countries and aims to eliminate extreme poverty worldwide.

481714-BCIB-xxx-xxx-xxx-xxx-00xx_R0x	BATAAN-CAVITE INTERLINK BRIDGE PROJECT Sea Level Rise of BICB Bridges	TYLin PEC A JOINT VENTURE

Revisions:

Date	Description	Revision	Originator	Reviewer	Approver
2022-Sep-06	Issue for SLR	00	Booyoung Lin (PEC)	FirstName LastName (company)	Marwan Nader (TYLI/ PEC JV)

	Printed Name	Signature	Date
Originators:	Boo Young Lim		2022-08-28
Reviewer:	Edwin Combalicer		2022-08-28
QAQC:	Jodi Ketelsen		2022-08-28

Table of Contents

List of Exhibits

1 PURPOSE

The Design Memorandum is prepared to

- document the evolution of SLR projection,
- document information sources used and to support the Climate Risk and Adaptation (CRA) assessment report for the Bataan - Cavite Interlink Bridge (BCIB) project and
- provide a confirmation of Sea Level Rise projections for the Philippines for the design joint venture partners and sub-consultants to rely upon in their design considerations.

2 BACKGROUND

The Department of Public Works and Highway (DPWH) was previously entrusted to carry out the feasibility study to provide Infrastructure Preparation and Innovation Facility Output 1 (IPIF1) – Roads and Bridges. The BCIB project is one of the sub-projects assignments under the IPIF1. The feasibility study for the BCIB was originally prepared by Ove Arup & Partners Hong Kong Ltd (Arup).

Section 2.3.1.2 of the Feasibility Study Environmental Impact Assessment Report prepared by ARUP states that sea level in the Philippines is expected to increase by approximately 20 cm by the end of 21st century under RCP8.5 scenario, and such projected increase in sea level might worsen storm surge hazards particularly on coastal communities.

3 SEA LEVEL RISE

3.1 Selection of Information Sources

Information Sources to support ADB Climate Risk Assessments and Management was published by ADB in September 2018. Appendix 3 of this publication provides sources of information about future climates based on Global Climate Model (GCM) and downscaled regional climate scenarios (Exhibit 1).

Exhibit 1: Global Climate Model Projection (CMIP5)

Description	Advantages	Disadvantages	Source
Global climate model projections (CMIP5)	An atlas of global and regional climate projections from the IPCC Fifth Assessment Report; a point of reference for projected seasonal and annual precipitation and temperature changes relative to 1986–2005; maps show the 25th, 50th, and 75th percentiles of the ensemble for 2016–2035, 2046–2065, and 2081–2100; maps cover SREX regions as well as the Caribbean, Indian Ocean, and Pacific island states and land and sea areas of the two polar areas; hatching denotes areas with weak signals relative to model variability	Seasonal and annual climate changes are based on the unweighted ensemble, averaged across large regions (i.e., regional climate change signals may be obscured); note that the underlying climate model output can be accessed by the KNMI Climate Explorer (see above)	IPCC AR5 Annex 1

Source: ADB. 2018. Information Sources to Support ADB Climate Risk Assessments and Management. Appendixes p.47.

The Intergovernmental Panel on Climate Change (IPCC) is currently in its Sixth Assessment cycle, during which the IPCC will produce the Assessment reports of its three Working Groups, three Special Reports, a refinement to the methodology report and the Synthesis Report. The Synthesis Report will be the last of the AR6 products, due for release in late 2022 or early 2023.

The AR6 SYR is based on the content of the three Working Groups Assessment Reports and three Special Reports: WGI – The Physical Science Basis, WGII – Impacts, Adaptation and Vulnerability, WGIII – Mitigation of Climate Change, and the three Special Reports: Global Warming of 1.5°C, Climate Change and Land, The Special Report on Ocean and Cryosphere in a Changing Climate (SROCC).

For the BCIB Project, SROCC recent study results found in IIPC's AR5, Annex 1 are applied relative to the sea level rise (SLR) projections.

3.2 Components of SROCC

3.2.1 Scenarios

The assessment of the projected future changes in SROCC is based mainly on CMIP5 climate model projections using Representative Concentration Pathways (RCPs). RCPs are scenarios that include time series of emissions and concentrations of the full suite of greenhouse gases (GHGs), aerosols and chemically active gases, and land use/land cover.

The word 'representative' signifies that each RCP provides only one of many possible pathways that would lead to the specific radiative forcing characteristics. The term 'pathway' emphasizes the fact that the long-term concentration levels, and the trajectory taken over time to reach that outcome are of interest.

SROCC uses RCP2.6 and RCP8.5 in its assessment, reflecting the available literature. RCP2.6 represents low greenhouse gas emissions and high mitigation future that in CMIP5 simulations gives a two in three chance of limiting global warming to below 2°C by 2100.

By contrast, RCP8.5 is a high greenhouse gas emissions scenario in the absence of policies to combat climate change, leading to continued and sustained growth in atmospheric greenhouse gas concentrations. Compared to the total set of RCPs, RCP8.5 corresponds to the pathway with the highest greenhouse gas emissions.

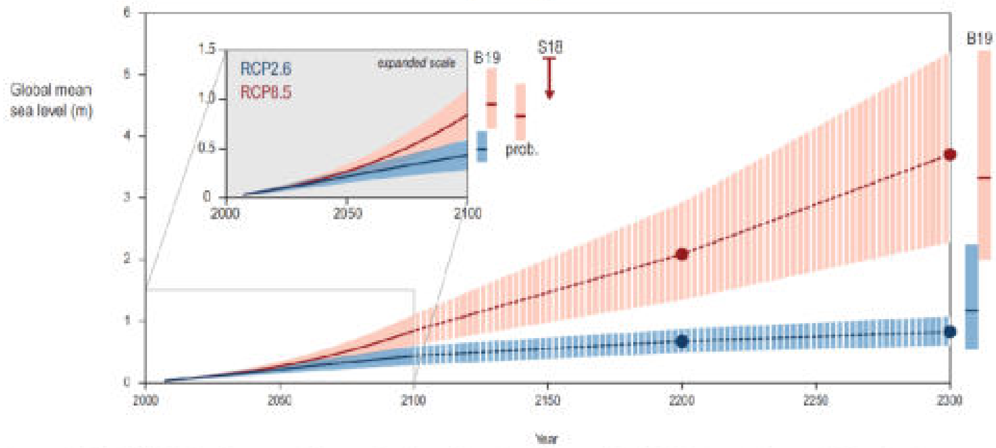
3.2.2 Baselines

A baseline provides a reference period from which changes can be evaluated. In the context of anthropogenic climate change, the baseline should ideally approximate the 'pre-industrial' conditions before significant human influences on the climate began. The IPCC 5th Assessment Report (AR5) and SR15 (Allen et al., 2018) use 1850–1900 as the pre-industrial baseline for assessing historical and future climate change. Atmospheric greenhouse gas concentrations and global surface temperatures had already begun to rise in this interval from early industrialization (Abram et al., 2016; Hawkins et al., 2017; Schurer et al., 2017). However, the scarcity of reliable climate observations represents a major challenge for quantifying earlier pre-industrial states (Hawkins et al., 2017). To maintain consistency across IPCC reports, the 1850–1900 pre-industrial baseline is used wherever possible in SROCC, recognizing that this is a compromise between data coverage and representativeness of typical pre-industrial conditions.

In SROCC, the 1986–2005 reference interval used in AR5 is referred to as the recent past, and a 2006–2015 reference is used for present day, consistent with SR15 (Allen et al., 2018). The 2006–2015 reference interval incorporates near-global upper ocean data coverage and reasonably comprehensive remote-sensing cryosphere data (Section 1.8.1) and aligns this report with a more current reference than the 1986–2005 reference adopted by AR5. This 10-year present day period is short relative to natural variability. However, at this decadal scale the bias in the present-day interval due to natural variability is generally small compared to differences between present day conditions and the pre-industrial baseline. There is also no indication of global average surface temperature in either 1986–2005 or 2006–2015 being substantially biased by short-term variability (Allen et al., 2018), consistent with the AR5 finding that each of the last three decades has been successively warmer at the Earth's surface than any preceding decade since 1850 (IPCC, 2013).

SROCC commonly provides future change assessments for two key intervals: A near term interval of 2031–2050 is comparable to a single generation time scale from present day and incorporates the interval when global warming is likely to reach 1.5°C if warming continues at the current rate (IPCC, 2018). An end-of-century interval of 2081–2100 represents the average climate conditions reached at the end of the standard CMIP5 future climate simulations and is relevant to long-term infrastructure planning and climate-resilient development pathways (CRDPs).

Exhibit 2 Projected Sea Level Rise at 2100 and up through 2300



Source: IPCC. 2019. The Ocean and Cryosphere in a Changing Climate (SROCC) Report Chapter 4: Sea Level Rise and Implications for Low-Lying Islands, Coasts and Communities. p.327.
Note: The inset shows an assessment of the likely range of the projections for RCP2.6 and RCP8.5 up to 2100 (within a medium confidence). Projections for longer time scales are highly uncertain but a range is provided (low confidence). For context, results are shown from other estimation approaches in 2100 and 2300(Section 4.1.2). The two sets of two bars labelled B19 are from an expert elicitation for the Antarctic component (Bamber et al., 2019), and reflect the likely range for a 2 °C and 5 °C temperature warming (low confidence). The bar labelled "prob." indicates the likely range of a set of probabilistic projections(Perrette et al., 2013; Slangen et al., 2014a; Grinsted et al., 2015; Jackson and Jevrejeva, 2016). The arrow indicated by S18 shows the result of an extensive sensitivity experiment(Schlegel et al., 2018) with a numerical model for the Antarctic Ice Sheet (AIS) combined, like the results from B19 and "prob.", with results from Church et al. (2013) for the other components of SLR. S18 also shows the likely range(Section 4.2.3).

3.3 Future Projections of SLR

3.3.1 Design Life

The design life of BCIC Bridges is 100 years. Assuming funding comes efficiently, a build of 2030 means we are considering a design life through 2130.

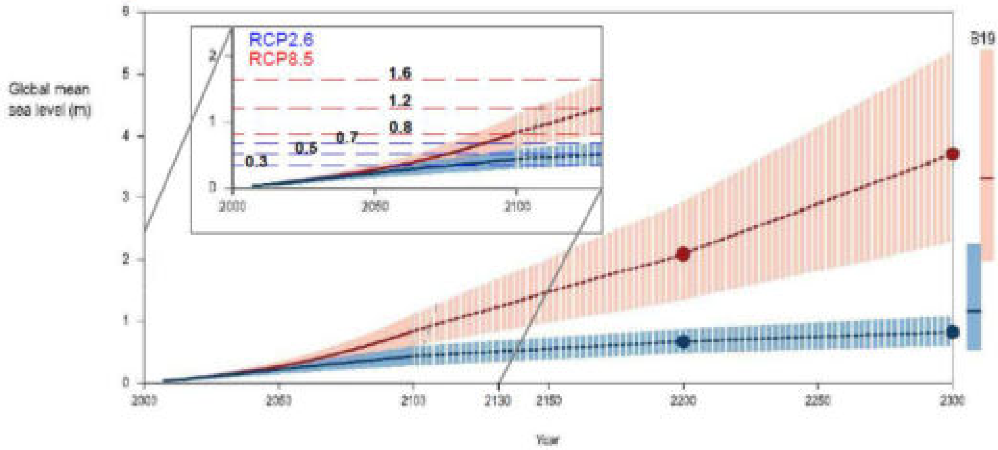
3.3.2 Sea Level Rise Concerns the BCIB Design

Future projections of SLR might affect the design of the BCIB. For instance, it is essential that the bridge does not restrict the movement of vessels into and out of Manilla Bay. The bridge needs to be designed to have sufficient navigation clearance to small vessels and large vessels. SLR could influence bridge clearance, points of collision and overall structural integrity.

3.3.3 Future of Projection of SLR

Based on the SROCC, the Global Mean Sea Level (GMSL) will rise between 0.45 m (based on the 0.30–0.70 m range, from projected RCP2.6) and 0.84 m (based on the 0.80–1.60 m range from projected RCP8.5) by 2130 (within a medium confidence level) relative to the baseline period (1986–2005) (Exhibit 3).

Exhibit 3 Projected Sea Level Rise Until 2130



Source: IPCC. 2019. The Ocean and Cryosphere in a Changing Climate (SROCC) Report. Chapter 4: Sea Level Rise and Implications for Low-Lying Islands, Coasts and Communities. p.327.

3.4 Sea Level Rise Consideration

The projected values of the SLR are in maximum, minimum, and average confidence.

The average confidence has been applied during the design engineering stage of the project. The BCIB project estimated the future regional SLC for the Philippines by using projections for the global mean sea level changes from the IPCC AR5 and combining them with regional non-uniform patterns of sea level change around the Philippines. The methods follow those presented by Cannaby et al. (2016).[2]

The projections for the global mean change are provided in the AR5 supplementary data files as an annual time series with a range of estimations. These include the upper (95th) and lower and (5th) percentiles, and the median estimations for the contribution of future thermal expansion, glacier and ice sheet mass changes, and terrestrial water inputs, under different climate change scenarios (Moss et al., 2010)[3]. The thermal expansion component

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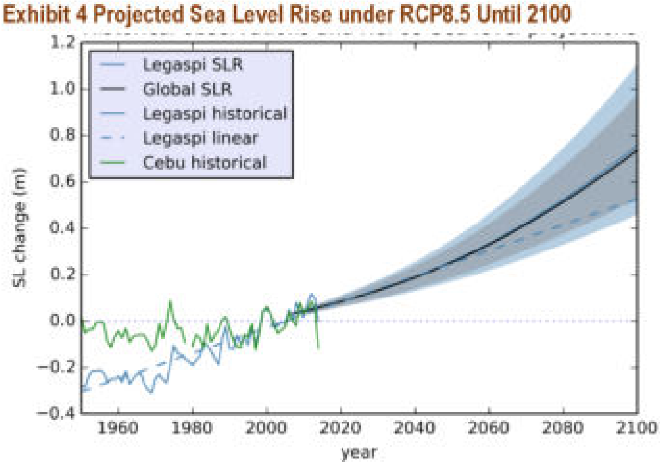
[2] Cannaby, H., Palmer, M. D., Howard, T., Bricheno, L., Calvert, D., Krijnen, J., Wood, R., Tinker, J., Bunney, C., Harle, J., Saulter, A., O'Neill, C., Bellingham, C. and Lowe, J. (2016), 'Projected sea level rise and changes in extreme storm surge and wave events during the 21st century in the region of Singapore', Ocean Science 12(3), 613–632.

[3] Moss, R. H., Edmonds, J. A., Hibbard, K. A., Manning, M. R., Rose, S. K., van Vuuren, D. P., Carter, T. R., Emori, S., Kainuma, M., Kram, T., Meehl, G. A., Mitchell, J. F. B., Nakicenovic, N., Riahi, K., Smith, S. J., Stouffer, R. J., Thomson, A. M., Weyant, J. P. and Wilbanks, T. J. (2010), 'The next generation of scenarios for climate change research and assessment', Nature 463(7282), 747–756.

was obtained from a set of 21 coupled AOGCMs participating in the World Climate Research Program Coupled Model Intercomparison Project Phase 5 (CMIP5). The other components (glaciers, ice sheet and terrestrial water inputs) were obtained from offline model simulations, mainly driven by the GCMs output of temperature and precipitation fields and by extrapolation of observation datasets (Church et al., 2013a).[4]

From these inputs, the sea level change (SLC) in the Philippines at the end of the 21st century is projected to be slightly larger than the global mean (Exhibit 4). The time series of the projected SLC under RCP4.5 and RCP8.5 are presented in Exhibit 5 (global mean) and Exhibit 6 (Manila mean). The solid line represents the central (50th percentile, or median) estimate, and the shaded range of uncertainty covers the likely (66-100%) rather than the full range of possible future sea level changes.

Exhibit 4 Projected Sea Level Rise under RCP8.5 Until 2100



Source: Department for International Development [1]. 2016. Projections of mean sea level change for the Philippines, p.2.
Note: Plot shows the sum of SLR components discussed in this study for the global ocean (black line as the mean SLR projection and the range of uncertainty noted in grey) and for the coastal region of Legaspi City in the South of Luzon Island in the Philippines (blue line, with uncertainty), under the RCP8.5 future scenario. Projections for the City of Legaspi, Philippines are generally 3-5% higher than the global average. Annual mean tide-gauge measurements from Legaspi (blueline) and Cebu City located below Negros Island (green line) are also presented. A linear trend is added to the observations from Legaspi because the observed historical sea level trend from the tide gauge in Cebu is much smaller than at Legaspi. The plotted actual changes in SLR preceding 2020 indicates that a simple extrapolation of the trends would underestimate the projected values for the Philippines regardless of the reference city used.

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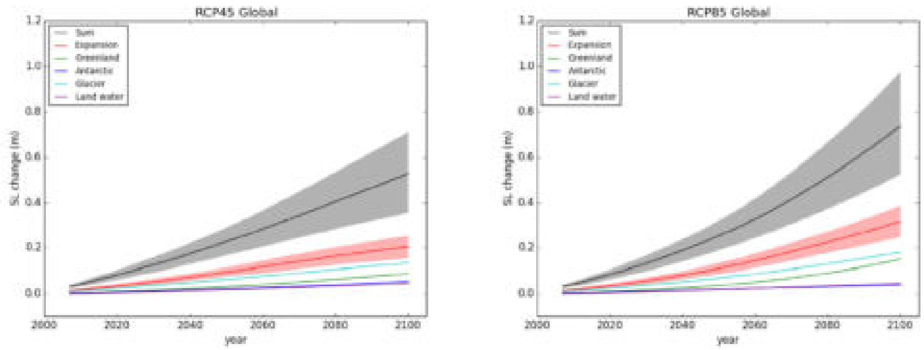
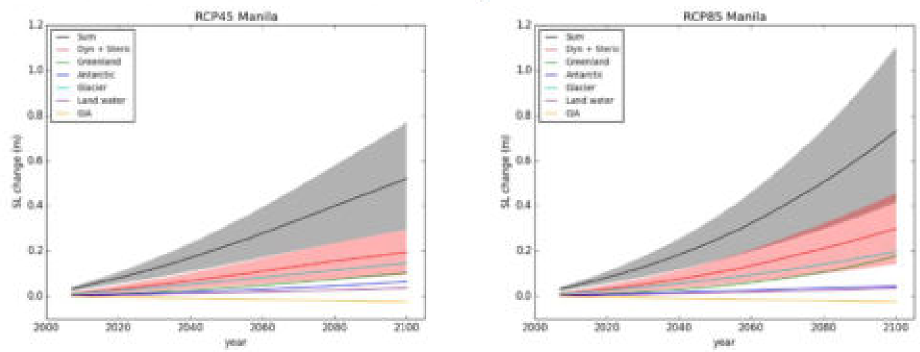
4 Church, J., Clark, P., Cazenave, A., Gregory, J., Jevrejeva, S., Levermann, A., Merrifield, M., Milne, G., Nerem, R., Nunn, P., Payne, A., Pfeffer, W., Stammer, D. and Unnikrishn, A. (2013a), Sea level change, Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA chapter 13, pp. 1137–1216.

Exhibit 5 Time Series of the Global Mean Sea Level Change Projections Under RCP4.5 and RCP8.5



Source: DFID. 2016. Projections of mean sea level change for the Philippines, p.23.
Note: The solid line represents the central estimate and shaded area represents the uncertainty of the likely range.

Exhibit 6 Time Series of the Mean Sea Level Change for Manila



Source: DFID. 2016. Projections of mean sea level change for the Philippines, p.24.
Note: The solid line represents the central estimate and shaded area represents the uncertainty of the likely range.

4 CONCLUSION

Following the SROCC projection (of AR5) that the sea level rise is likely to be in the range of 0.80 to 1.60 m by 2130, the BCIB Project proposes that the design should consider accommodating a sea level rise of 1.20 m in 2130. This recommendation is based on the global sea level rise experience demonstrating that the Asian-Pacific International engineering community (based on Cadangan Project Jambatan Temburong in Brunei and Hongkong) comfortably relies on the medium confidence line which indicates a central estimate of a 1.2 m SLC in Manilla Bay by 2130. The BCIB design team considered a 1.2 m rise by 2130 during its project engineering design. Also, the BCIB design team (TYLI, PEC, DCCD) found that current the BCIB Project design already accommodates the most conservative projection of 1.6 m by 2130.

ANNEX 8: UPDATED TRAFFIC STUDY REPORT (APRIL 15, 2023)

Bataan-Cavite Interlink Bridge Project

Updated Traffic Study Report

15 April 2023

Prepared By:

A JOINT VENTURE

T.Y. Lin International | Pyunghwa Engineering Consultants Joint Venture

Document Code: 481714-BCIB-DED-PEC-TS-RPT-0002

Revision: 02

Design/ Provisional Sums Reference:

Reference:
Terms of Reference Section II. “Scope of Services”, Item J. “Economic and Financial Viability,” Task 21 “Updating the Traffic forecasts prepared under the FS.”

Revisions:

Date	Description	Revision	Originator	Reviewer	Approver
2022-11-15	Issue for Coordination	00	Lyoong Oh (PEC) & Roberto Rito Jr. (DCCD)	Peter Bang (PEC)	Marwan Nader (TYLI/ PEC JV)
2023-02-15	Issue to DPWH	01	Lyoong Oh (PEC) & Roberto Rito Jr. (DCCD)	Peter Bang (PEC)	Marwan Nader (TYLI/ PEC JV)
2023-04-15	Issue to DPWH (NEDA ICC Final Report)	02	Lyoong Oh (PEC) & Roberto Rito Jr. (DCCD)	Peter Bang (PEC)	Marwan Nader (TYLI/ PEC JV)

Table of Contents

List of Exhibits

1 TRAFFIC STUDIES

1.1 Traffic Demand Forecast Validation

During the Feasibility Study (FS) stage of the project, the Transport Demand Model (TDM) from the MUCEP Study developed by JICA (2015) was updated. According to the FS, the transport model developed by Arup is only an assignment model calibrated to base year 2019 by adjusting the trip matrices from the MUCEP model to match the traffic survey count conducted in 2019. The model assumes the design opening year in 2030 and forecast up to year 2075. The output of the FS model is limited in its vehicle classifications where truck volumes are not disaggregated. In the FS, vehicles were classified into seven (7) types namely: motorcycle/tricycle/pedicab, private car, taxi, jeepney, bus, light goods vehicle, and truck.

For the Detailed Engineering Design (DED) stage, an updated TDM is necessary to validate the results of the previous model and to provide a less conservative and more precise traffic forecast. However, due to the pandemic, challenges in the collection of the data necessary for inputs in the transport model limited the analysis to the use of the calibrated 2019 base traffic data from the feasibility study.

The conduct of a traffic volume survey is greatly affected by the strict observance of the community quarantine in the greater Metro Manila area. Travel patterns, both regional and local trips, were affected with the new work arrangements, reduced activities, and mobility. Particularly in the Greater Manila Area (Metro Manila including Cavite, Bulacan and Rizal), the supposedly schedule and conduct of traffic survey coincided with the restricted travel. Almost all people were directed to stay inside their homes and allowed only 1 adult family to buy the needed food and medicine.

These events do not allow for the development of the typical 4-step TDM indicated in the Inception Report. The development of a 4-step TDM from the same data will only lead to a duplication of the existing FS model with no added value, even when using a different software such as EMME4.

Given the limitation, efforts were focused on providing the outputs necessary for the design of the infrastructure that were not determined during the conduct of the FS. These efforts extended the demand forecast from the main bridge as provided by the FS towards the ramps, interchanges, and the adjacent and existing roadways. The level of service (LOS) of each road facility was determined and evaluated with the purpose of identifying the appropriate interchange type, and number of lanes based on the demand forecast. Multi-criteria analysis, with traffic as one of the components, was used to identify alternatives.

Still, the study team pursued to develop a similar TDM in CUBE Voyager taking off from the trip assignment of the MUCEP model. Several refinements were done to address the limitations of the MUCEP model and the FS Arup model even when using similar inputs such as previous traffic count data, network, and zoning. This report details the development of the travel demand model specifically to be utilized during this DED stage.

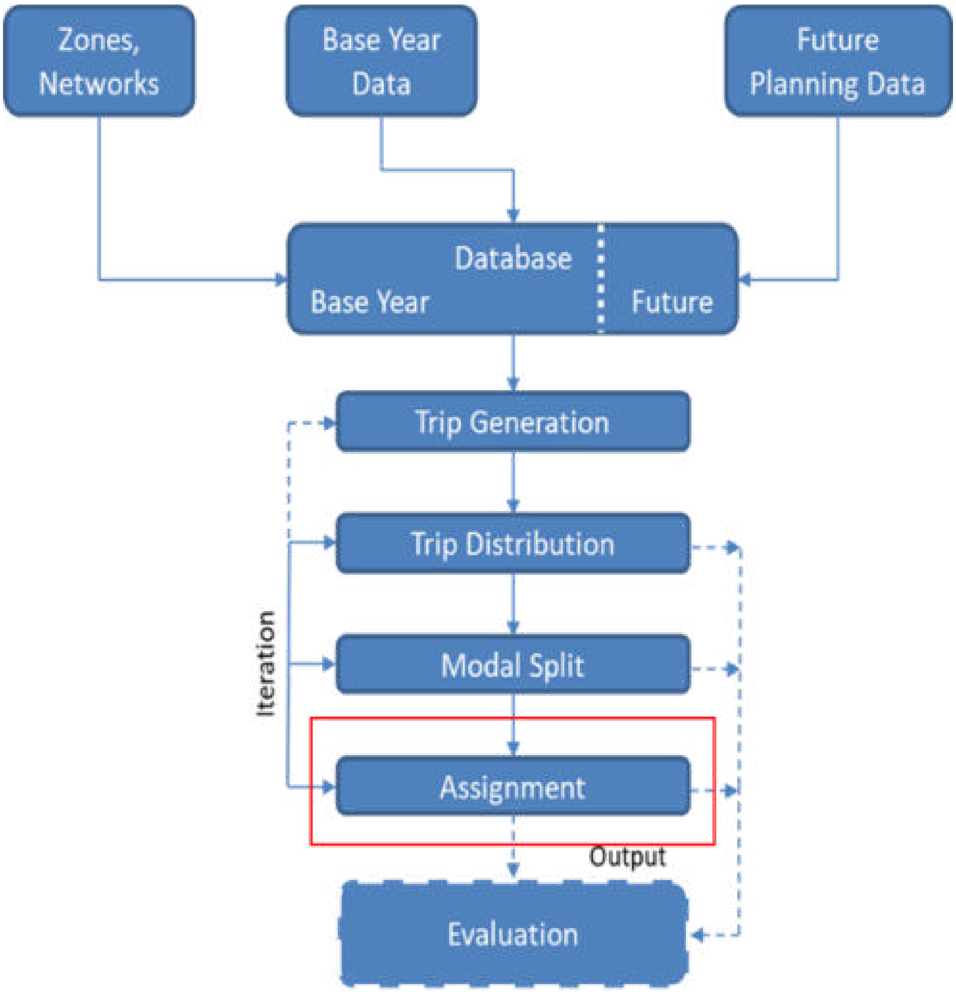
1.1.1 Development of the Travel Demand Model

A typical traffic forecasting model follows the 4-step process with these four basic phases:

1. Trip generation
2. Trip distribution
3. Mode choice
4. Trip assignment

The structure of the Travel Demand Model (TDM) consists of the following stages as shown in the figure below.

Exhibit 1-1: Typical 4-Step Traffic Forecasting Model



The approach starts by considering a zoning and network system, and the collection and coding of planning, calibration and validation data. These data include population in each zone as well as levels of economic activity for the base year.

The travel demand model is presented as a sequence given by the four-sub model: trip generation, trip distribution, modal split, and assignment.

The input data as presented by the model structure are utilized to estimate the total number of trips generated and attracted by each zone. This is done during the trip generation stage. The next stage, trip distribution, allocates the generated and attracted trips to destinations.

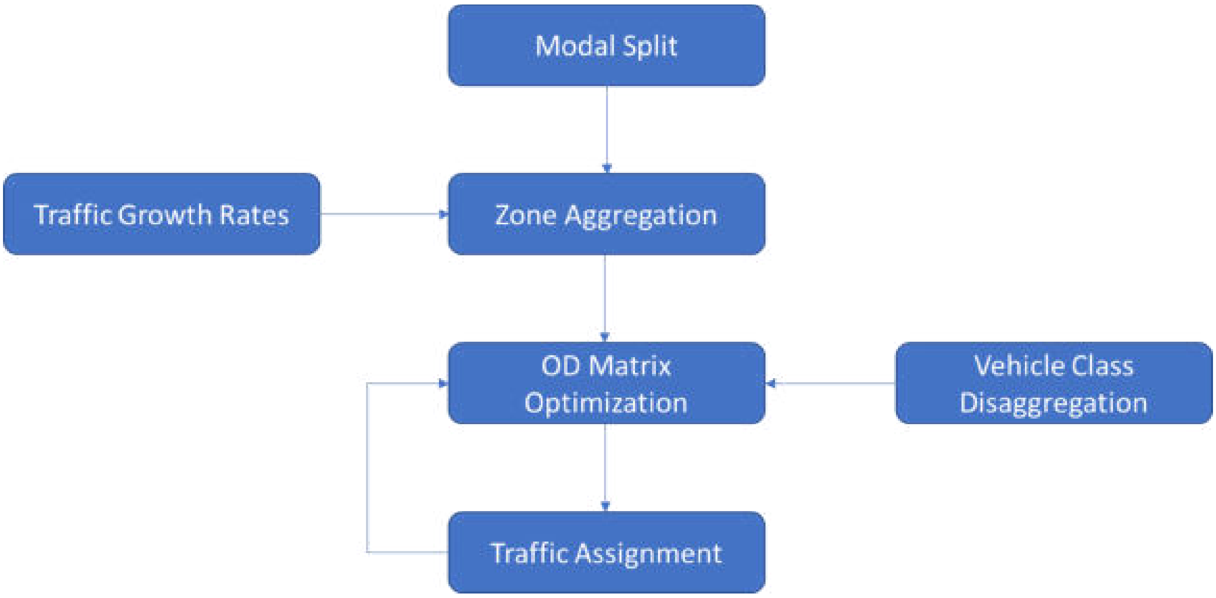
The following stage then involves splitting of these trips into different modes. Finally, the model requires the assignment of the trips by each mode to the corresponding road networks.

Moreover, the model incorporates calibration and validation for the base year conditions for it to be applied to different planning horizons and forecast scenarios. Results are then evaluated, and the model is run again to simulate its performance.

Since the TDM heavily relies on the inputs from the MUCEP model conducted in 2014, the same calibration for the trip generation and distribution is adopted.

Further, the TDM applies a recalibration after the modal split to rerun a simpler model with less zoning required for the area of concern in Cavite and Bataan, and considering other areas as external zones. The model then refines the vehicular traffic into the appropriate vehicle classification of DPWH. The flowchart below shows the additional steps in the recalibration of the TDM starting from the modal split then aggregating to larger zones wherein the OD matrices are again estimated, and trips given an assigned route until an optimized OD and trip assignment is achieved.

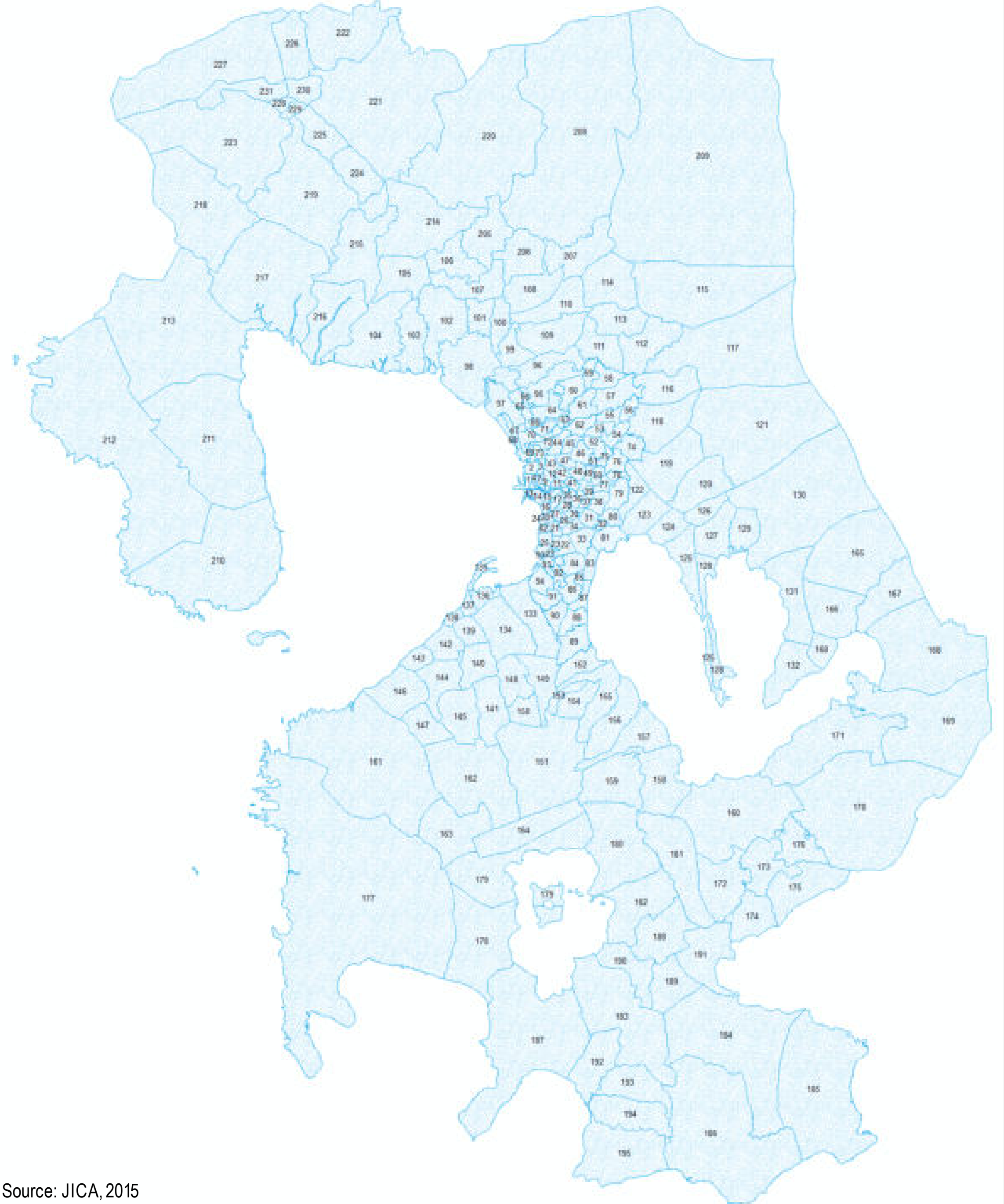
Exhibit 1-2: Traffic Demand Model Recalibration Structure



1.1.2 Zoning System and Road Network

The establishment of origin and destination points for various trips is through the aggregation or disaggregation of barangays and municipalities within Luzon Island designated as Traffic Analysis Zones (TAZ). A total of 235 TAZs was established, 231 of which are internal zones and shown in the succeeding figure. Trips coming from two zones from the northwest, one zone from the northeast, and another zone from the southeast are considered as external trips going to and coming from the study area.

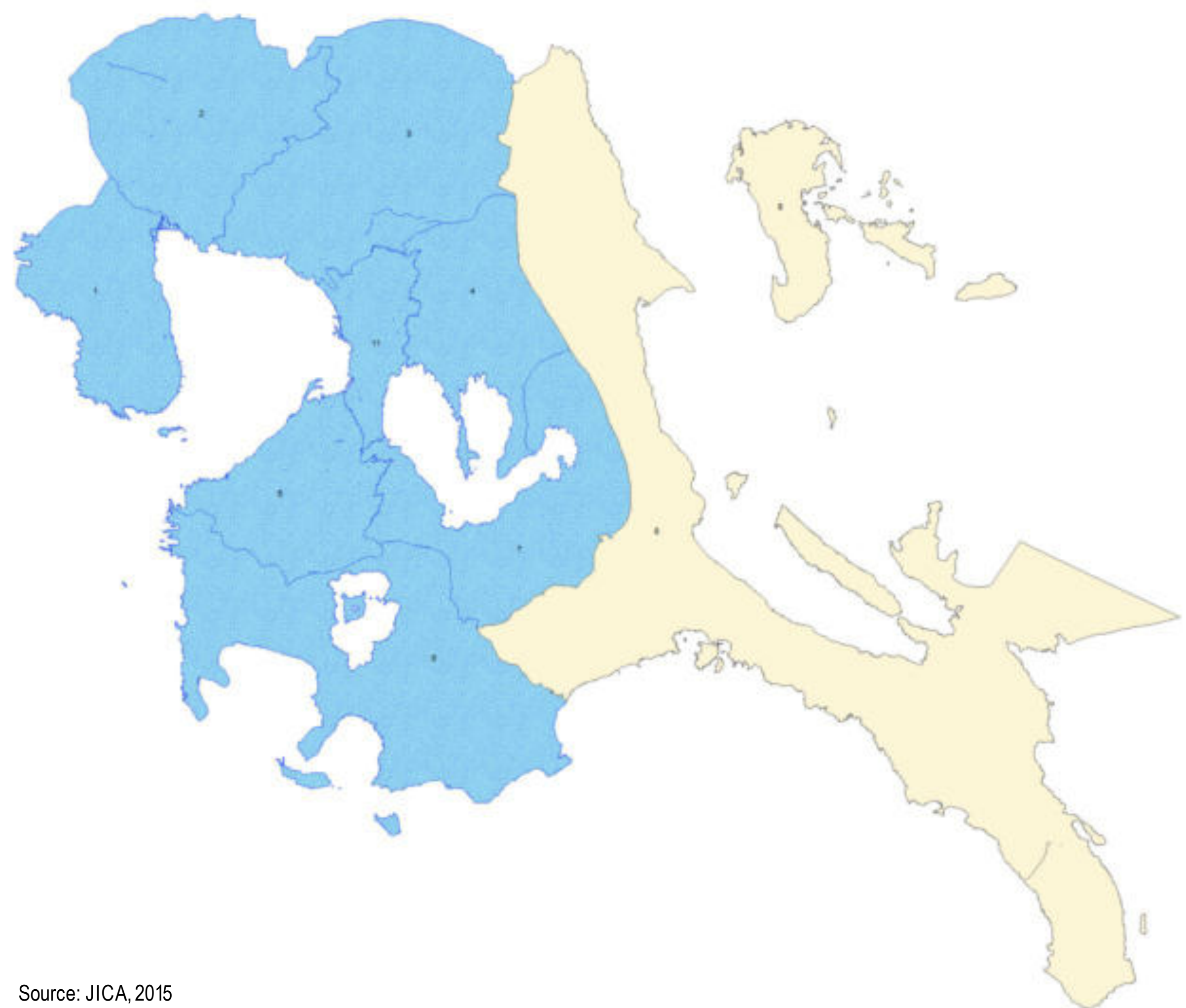
Exhibit 1-3: Traffic Analysis Zones including Metro Manila, Region III and IV-A



Source: JICA, 2015

Furthermore, in order to compare similar zoning used in the feasibility study, the aggregated larger zones shown in the next figure and detailed in the table below are used as reference.

Exhibit 1-4: Aggregated Zoning



Source: JICA, 2015

Exhibit 1-5: Aggregated Zoning Coverage

Year	Coverage
1	Bataan Province
2	Pampanga Province
3	Bulacan Province
4	Rizal Province
5	Cavite Province
6	Batangas Province
7	Laguna Province
8	Quezon Province and Bicol Region
11	Metro Manila

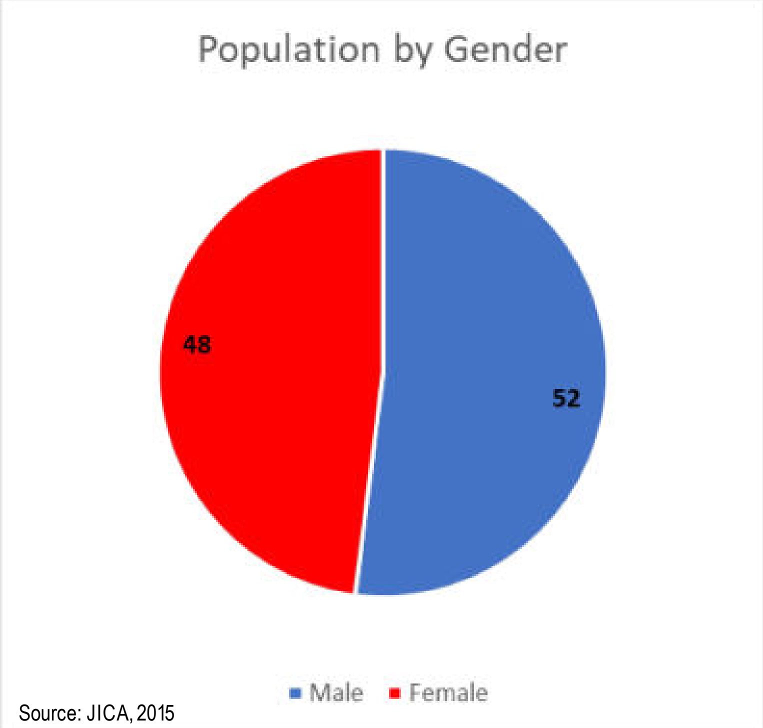
The road network of the model consists of nodes and links. Each of the links represents a section of the road and each of the major nodes represents an intersection. The elements used in a link are length, maximum speed, capacity, transit system, directional regulation, and volume-speed relationship. Links are also classified into different types of road facilities such as expressways, arterial roads, collector roads and local roads. These link attributes are important and critical in the highway assignment later in the simulation process. Highlighted in the figure below are the main road links to and from Cavite to Bataan, with the striped blue and white representing the BCIB. The orange links are the non-toll roads while the red, green, and yellow links are expressways. Highlighted in black is EDSA.

Exhibit 1-6: Road Network

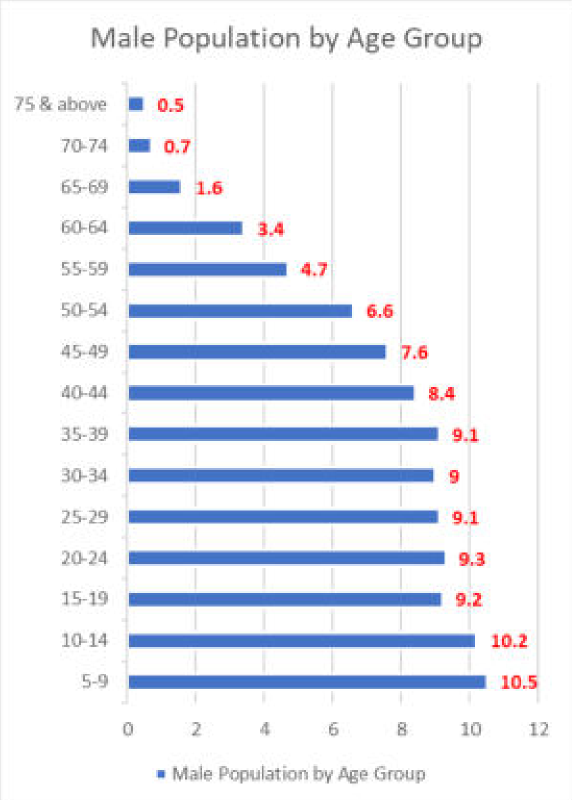
1.1.3 Demographic and Socio-Economic Characteristics

The demographic and socio-economic conditions discussed in this chapter follows the structure presented in the MUCEP Study which was conducted in 2014. The key input is the population count per zone which is further broken down by gender, age group, employment, income, and car ownership. These data were necessary inputs to the trip generation stage discussed later in this chapter. These are presented as percentages in the graphs below which were sourced from the same MUCEP Study. Other representation of these data is also shown in a map, based on the data size per area.

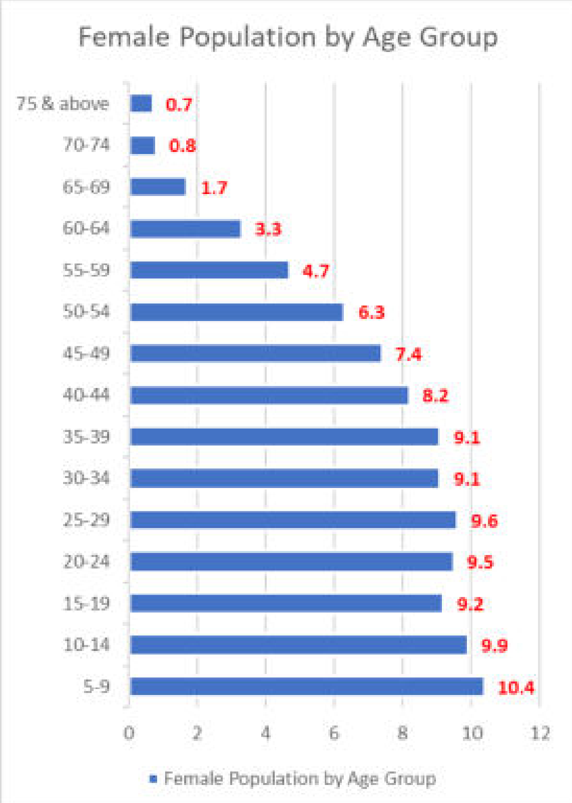
Exhibit 1-7: Population Breakdown



Source: JICA, 2015

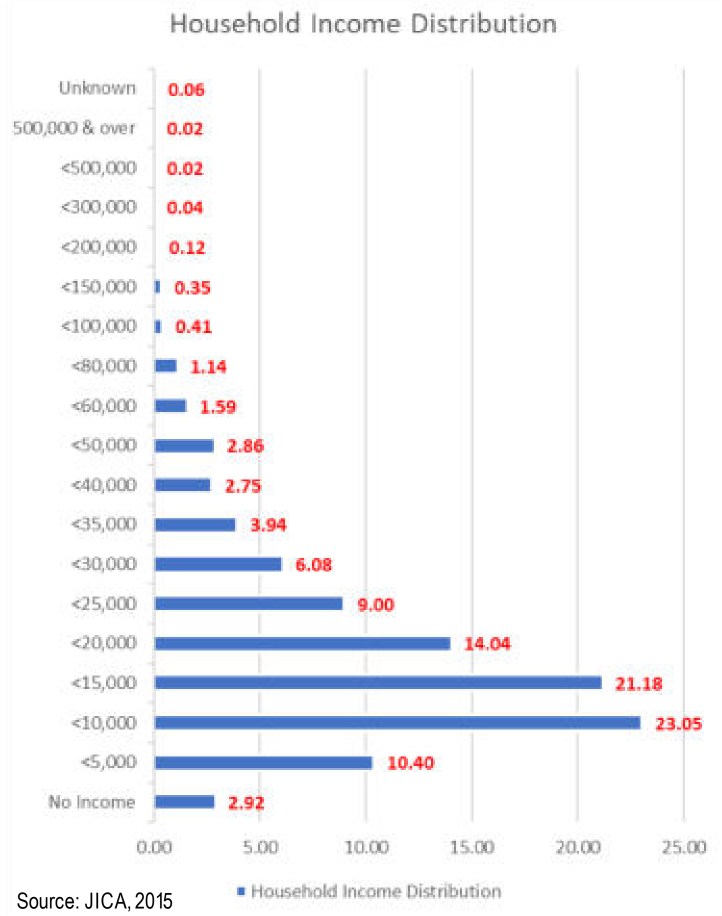


Source: JICA, 2015



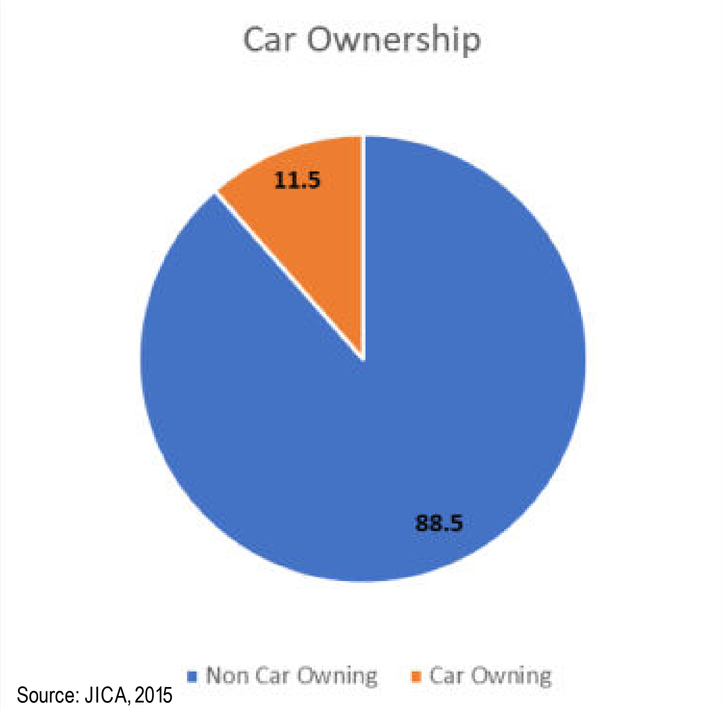
Source: JICA, 2015

Exhibit 1-8: Household Income Distribution



Source: JICA, 2015

Exhibit 1-9: Car Ownership



Source: JICA, 2015

Exhibit 1-10: Population by Area

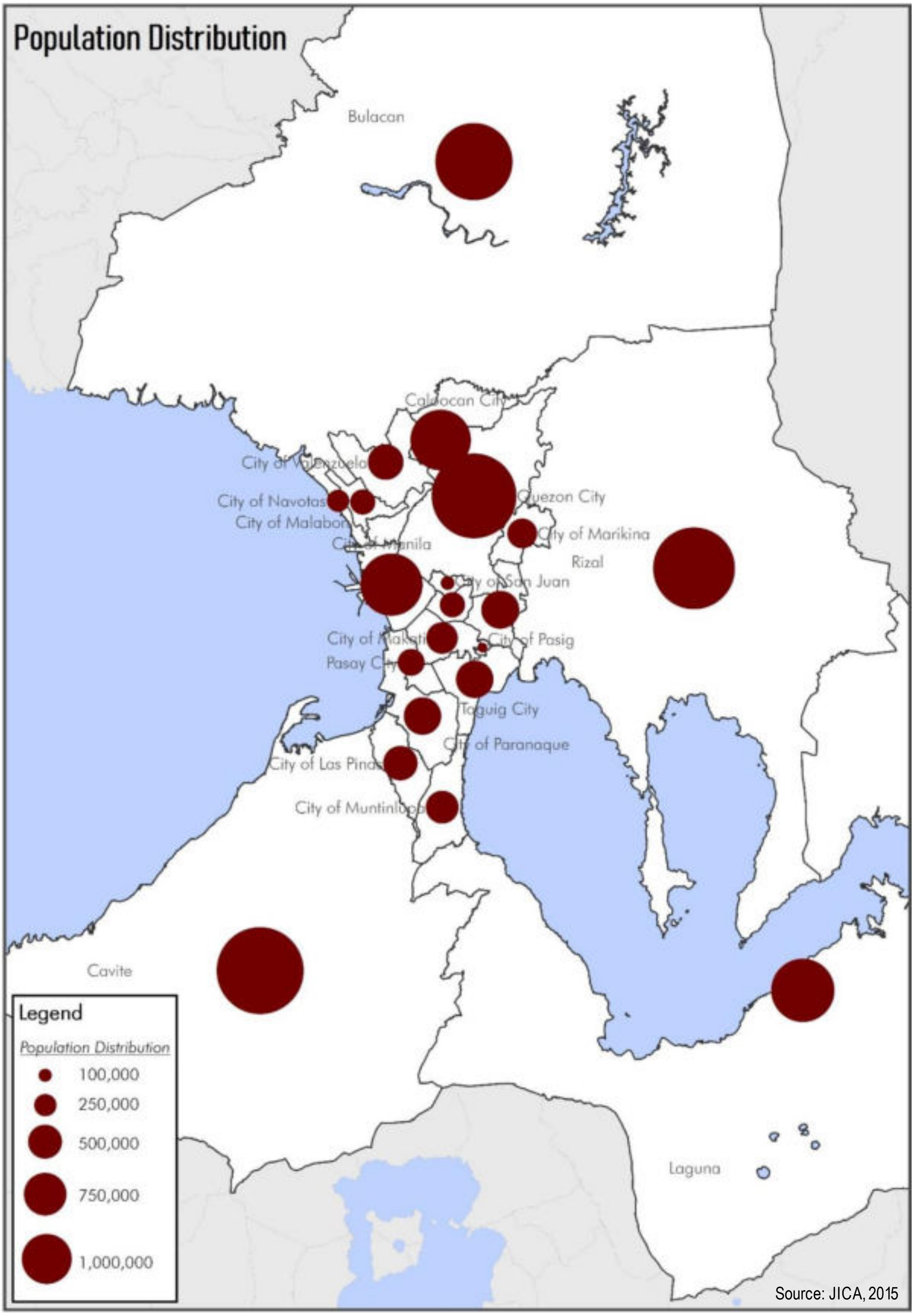
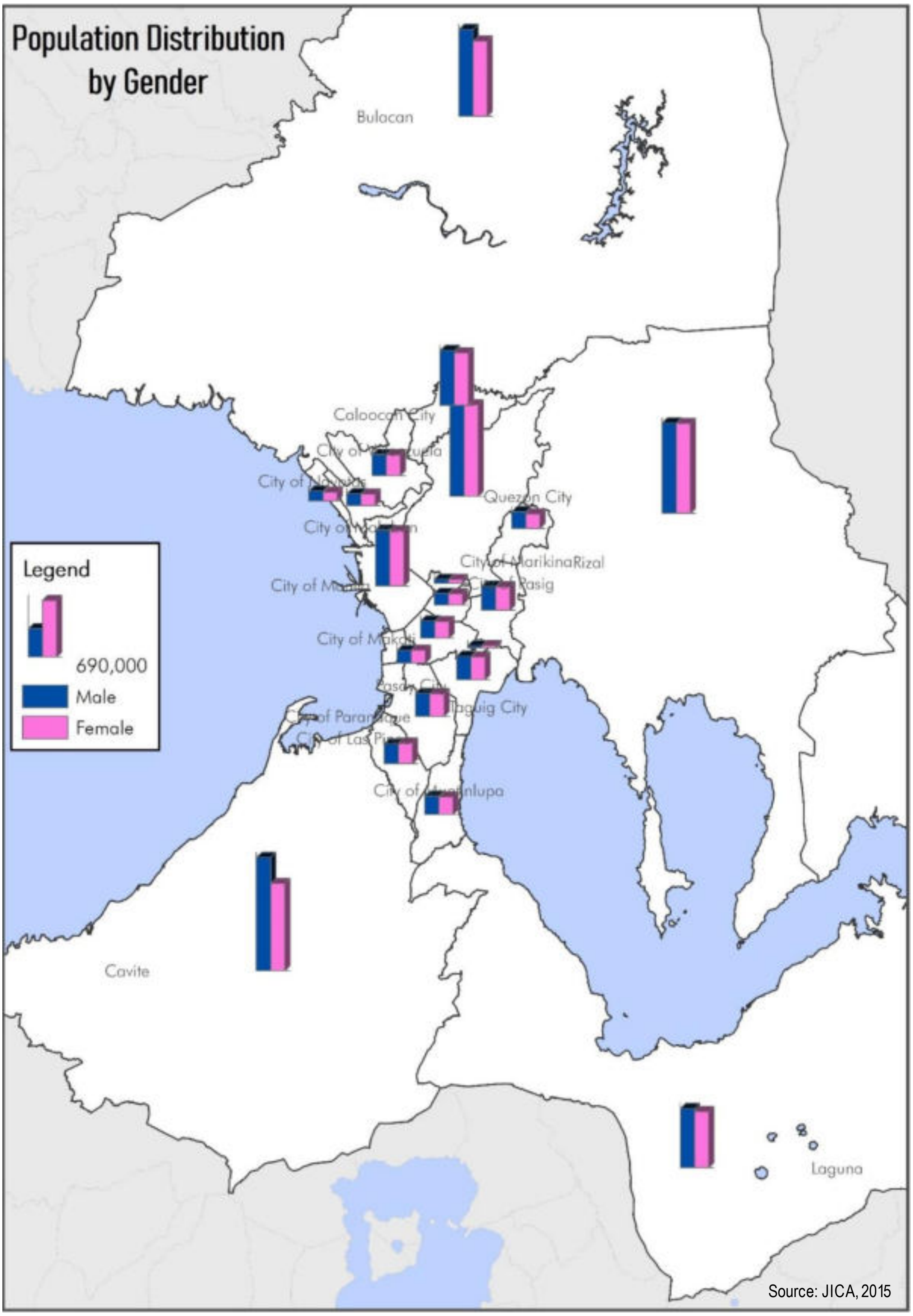


Exhibit 1-11: Population Distribution by Gender



Source: JICA, 2015

Exhibit 1-12: Daytime-Nighttime Population Ratio

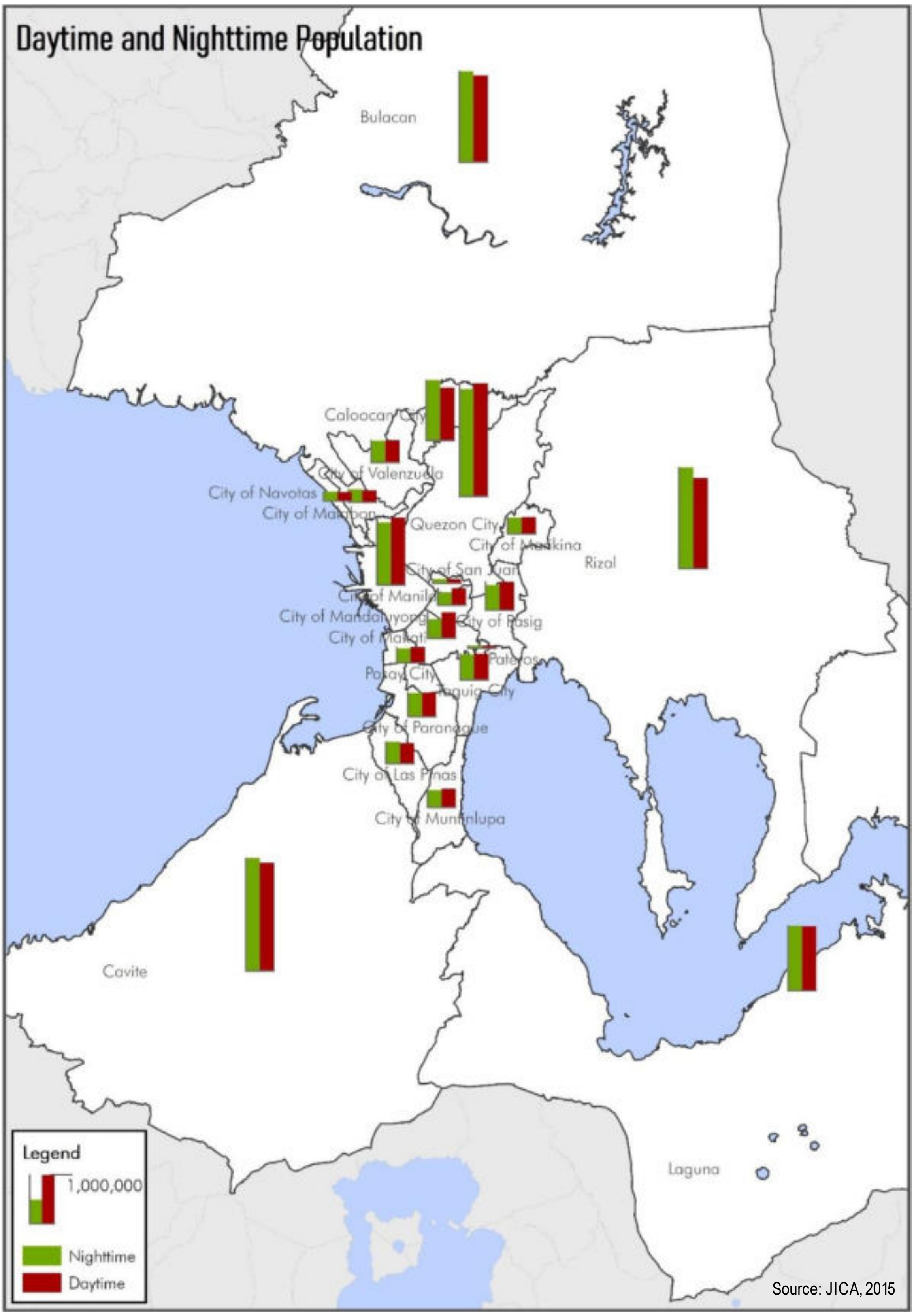
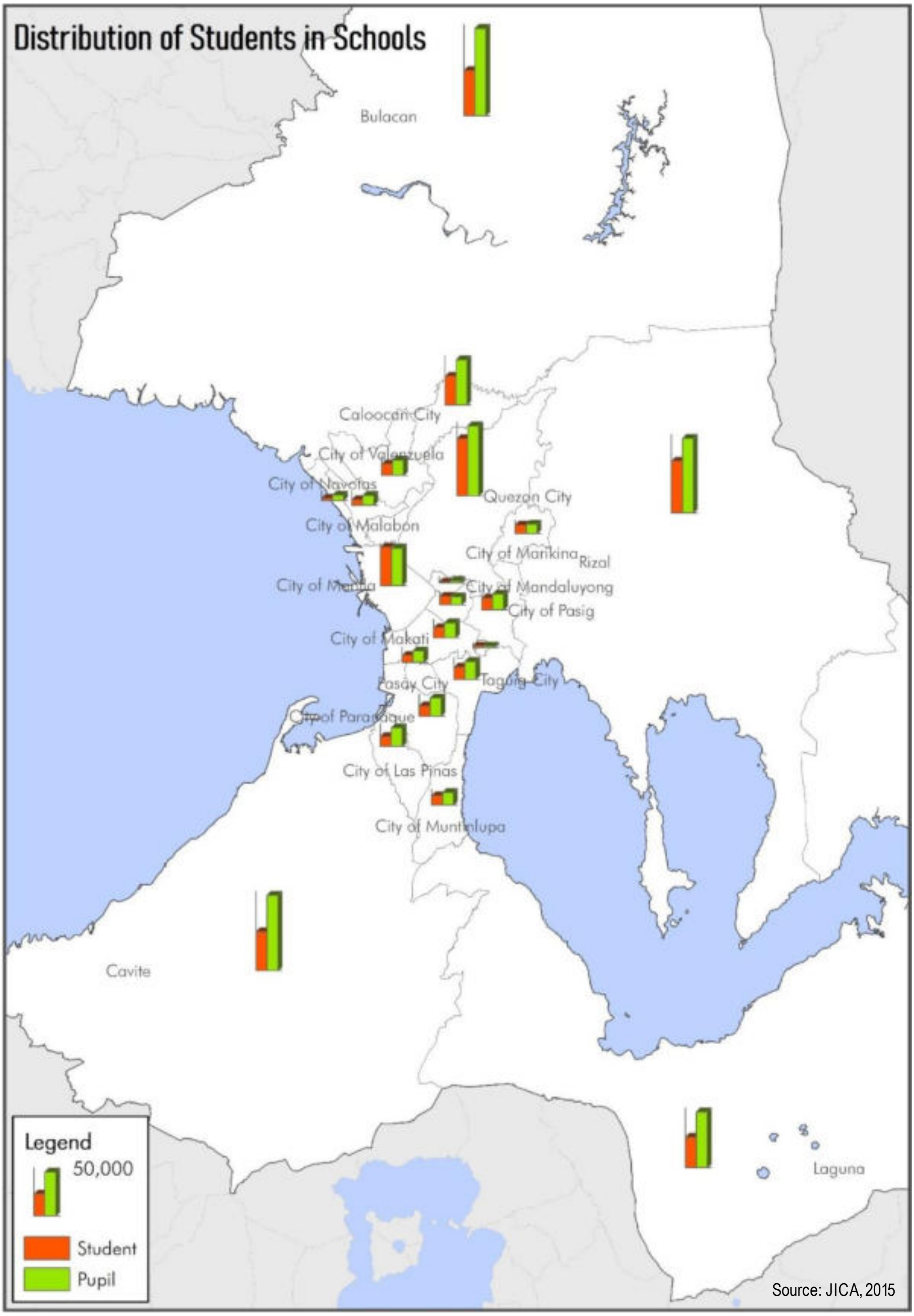


Exhibit 1-13: Student Density Map



1.1.4 Four-Step Travel Demand Model

As mentioned earlier in the transport model structure, the model is composed of the main 4-step travel demand model: the trip generation, trip distribution, mode choice and finally traffic assignment. The succeeding sections discuss the assumptions and inputs utilized in the different stages of the model.

1.1.4.1 Trip Generation

Trip generation step takes the zonal trip data as input and produces an array of production and attraction values. Zonal data such as population, employment, and different trip purposes are processed to generate trip end data. These are the trips produced within and attracted to each Traffic Analysis Zone (TAZ).

The trip rates applied were adopted from the MUCEP Study (JICA, 2015) which were calibrated and validated from the extensive household interview survey conducted in 2014. Trip generation equations for home-based work (HBW), home-based other (HBO), non-homebased (NHB), and school trips were converted into CUBE Voyager scripting language. The generation and attraction rates are presented below. These rates are multiplied by the associated demographic variable to calculate the number of trips produced by or attracted to each TAZ. The concept of model transferability was utilized so that these rates can be adopted to nearby TAZs not covered in the MUCEP Study.

Exhibit 1-14: Generation and Attraction Model

Zone	Trip Purpose					
	To Home	To Work	To School	Business	Private	Total
City of Manila	1.07	0.29	0.28	0.20	0.38	2.21
Manila (1)	1.06	0.28	0.30	0.17	0.35	2.15
Manila (2)	1.06	0.29	0.26	0.23	0.46	2.30
Manila (3)	1.13	0.30	0.27	0.22	0.42	2.34
Manila (4)	1.04	0.29	0.25	0.22	0.34	2.14
Pasay	1.22	0.40	0.31	0.10	0.42	2.46
Makati	1.16	0.36	0.32	0.14	0.39	2.37
Mandaluyong	1.16	0.43	0.32	0.10	0.40	2.41
San Juan	1.20	0.46	0.28	0.12	0.37	2.43
Quezon City	1.15	0.38	0.31	0.15	0.34	2.33
Quezon (I)	1.18	0.40	0.29	0.15	0.37	2.39
Quezon (II)	1.02	0.36	0.29	0.12	0.32	2.11
Quezon (III)	1.18	0.41	0.31	0.15	0.39	2.43
Quezon (IV)	1.17	0.38	0.31	0.16	0.34	2.35
Caloocan City	1.11	0.35	0.35	0.08	0.35	2.24
Caloocan (S)	1.13	0.36	0.34	0.07	0.37	2.27
Caloocan (N)	1.10	0.34	0.35	0.09	0.33	2.22
Valenzuela	1.11	0.36	0.34	0.09	0.34	2.24
Malabon	1.13	0.35	0.32	0.11	0.37	2.27
Navotas	1.08	0.39	0.32	0.09	0.30	2.19
Marikina	1.17	0.41	0.32	0.12	0.34	2.35

Zone	Trip Purpose					
	To Home	To Work	To School	Business	Private	Total
Pasig City	1.10	0.37	0.31	0.09	0.35	2.22
Pateros	1.02	0.36	0.26	0.11	0.31	2.06
Taguig	1.02	0.33	0.33	0.07	0.31	2.05
Parañaque	1.31	0.47	0.40	0.09	0.37	2.65
Muntinlupa	1.21	0.45	0.34	0.11	0.34	2.44
Las Piñas	1.21	0.43	0.36	0.09	0.33	2.42
Metro Manila Total	1.14	0.37	0.32	0.12	0.35	2.31
Bataan	1.12	0.33	0.45	0.18	0.29	2.38
Bulacan	1.12	0.33	0.45	0.18	0.29	2.38
Cavite	1.03	0.48	0.26	0.08	0.20	2.06
Laguna	1.12	0.38	0.33	0.10	0.32	2.24
Rizal	0.96	0.29	0.32	0.07	0.30	1.94
Province Total	1.05	0.37	0.34	0.10	0.27	2.13
Total	**1.10**	**0.37**	**0.33**	**0.11**	**0.32**	**2.23**

1.1.4.2 Trip Distribution

The trip distribution step which is performed using the Gravity Model in order to match the productions and attractions for each zonal pair in order to define a trip are conducted for Home-based-Work (HBW), Home-based Others (HBO) and Non-Home-based (NHB) trips. The gravity model assigns trips based on the number of productions, attractions, a friction factor, and a k factor. The friction factor is a value that is inversely proportional to distance, time, or cost, which measures the impedance between the zonal pairs. "k" is a scaling factor that is used during calibration to limit or increases the traffic volume that crosses a section of the network. The gravity model is represented by the formula below.

$$T_{ij} = k \times \frac{G_i^{\alpha} A_j^{\beta}}{\int d_{ij}}$$

Where;

T_{ij}=Traffic Distribution from Zone i to j

G_i^{α}=Traffic Generation in Zone i

A_j^{β}=Traffic Attraction in Zone j

d_{ij}=Travel time Distance from Zone i to j

k, α, β=Parameter

1.1.4.3 Mode Choice

The mode choice step applies a logit model to split the motorized trips into the following travel modes:

1. car
2. motorcycle
3. public transport, and

4. freight

This split is based on the trip distance, travel time inside a vehicle, travel time outside a vehicle, and development density at both ends of the trip. The output of this step is a binary matrix by trip purpose with the number of daily vehicle trips between each pair of zones.

The specific modal split models were also adopted from the MUCEP Study. These are presented in the table below.

Exhibit 1-15: Mode Choice Model

Mode	Formula
1. Truck	Trip = [Present Volume] x [Increase Ratio of GRDP/Capita]
2. Private Mode	Private Mode = $\frac{1}{1 + \mathrm{Exp}(\alpha\Delta t + \beta\Delta C + \gamma)}$ Where, Δt : Travel time differences in minutes (private mode – public mode) ΔC: Travel time differences in PHP (private mode – public mode) α, β, γ: Parameters in Exhibit 1-16
Public Mode	Remaining Trips

Exhibit 1-16: Modal Split Parameters between Private and Public Modes

Type	Purpose	α	β	γ
1. Car-owing HHs	To Work	−0.7596	−0.0341	−0.7499
	To School	−0.4930	−0.0312	−0.2468
	To Business	−0.6120	−0.0399	−0.1511
	Private	−0.0868	−0.0098	−0.5184
	To Home	−0.6840	−0.0337	−0.8248
2. Non-car-owning HHs	To Work	−0.2765	−0.0184	−0.1975
	To School	−0.4930	−0.0312	−0.2468
	To Business	−0.6120	−0.0399	−0.1511
	Private	−0.0868	−0.0098	−0.5184
	To Home	−0.1903	−0.0217	−0.4856

1.1.4.4 Highway Assignment

After trip patterns have been estimated, these trips are converted to traffic flows on network links. The model currently assigns trips based on the stochastic user equilibrium method, i.e., users choose routes which minimize the impedance measured in travel distance, time, or cost. This is an iterative convergent process that when complete, no traveler can improve their path by changing links.

Moreover, two travel time functions have been applied in the assignment model. First is the Bureau of Public Roads (BPR) function shown below:

$$T_i = T_0\left(1 + \alpha\left(\frac{Q_i}{C_i}\right)^{\beta}\right) + \frac{Toll\ Fee}{Time\ Value}$$

Where;

T_i=Congested Travel Time of Link i

T_0=Free Flow travel time of Link i

Q_i=Traffic Volume of Link i

C_i=Road Traffic Capacity of Link i

α=Scale Parameter (0.48-Expressway, 0.1-Rail)

β=Shape Parameter (2.82-Expressway, 100-Rail)

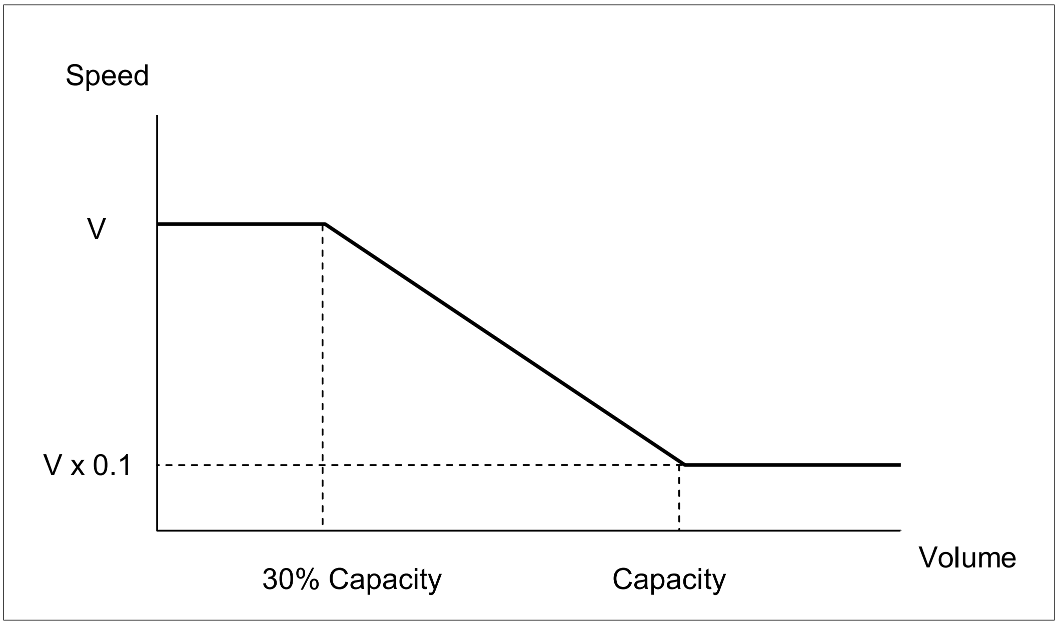
The parameters α and β were adopted from the Japan Society of Civil Engineers. The initial values also provide the preliminary results for the initial simulation run. However, future runs will need calibration of these parameters to determine the volume-delay relationship for each type of road facility.

Second is the Q-V Formula based on the flow-speed relationship which is applied to other types of road facilities. This is represented by the equation below:

$$T_i = \frac{Distance_i}{Speed_i\left(Road\ Facility, {}^{Volume_i}/_{Capacity_i}\right)} \times 60$$

The flow-speed relationship also means that the travel time of vehicles changes due to congestion, that is, the more traffic volume, the longer the traffic time on the link. The model incorporates such speed reduction by traffic volume as a link cost function depending on the road facility and the current V/C ratio at the time of iteration. This relationship is shown in figure below.

Exhibit 1-17: Volume-Speed Relationship



Furthermore, the highway network is loaded using vehicle trips in passenger car units or PCU. Passenger Car Equivalent Factors (PCEF) are based on the values adopted by DPWH as shown below.

Exhibit 1-18: Passenger Car Equivalent Factors

Vehicle Type	PCEF
Passenger Car	1.0
Passenger Utility	1.5
Goods Utility	1.5
Small Bus	1.5
Large Bus	2.0
Truck	2.5
Motorcycle-Tricycle	0.75*

Source: DPWH Department Order No. 22 Series of 2013
** The DO suggests a 2.5 PCEF for Motor-Tricycles. This study utilizes the standard 0.75 PCEF which is based on the theoretical passenger car equivalent on the road and the travel demand model already considers the behavior of the vehicles relating to the effects on speed and road capacity thus the PCEF need not be that high.*

The road capacity utilized in the computation is provided in the table below.

Exhibit 1-19: Road Capacity

Carriageway Width (meters)	Hourly PCU	
	Rural	Urban
Single: < 4	600	600
4.0 - 5.0	1200	1200
5.1 - 6.0	1900	1600
6.1 - 6.7	2000	1700
6.8 - 7.3	2400	1800
2 x 6.7 or 2 x 7.3	7200	6700

Source: DPWH Department Order No. 22 Series of 2013

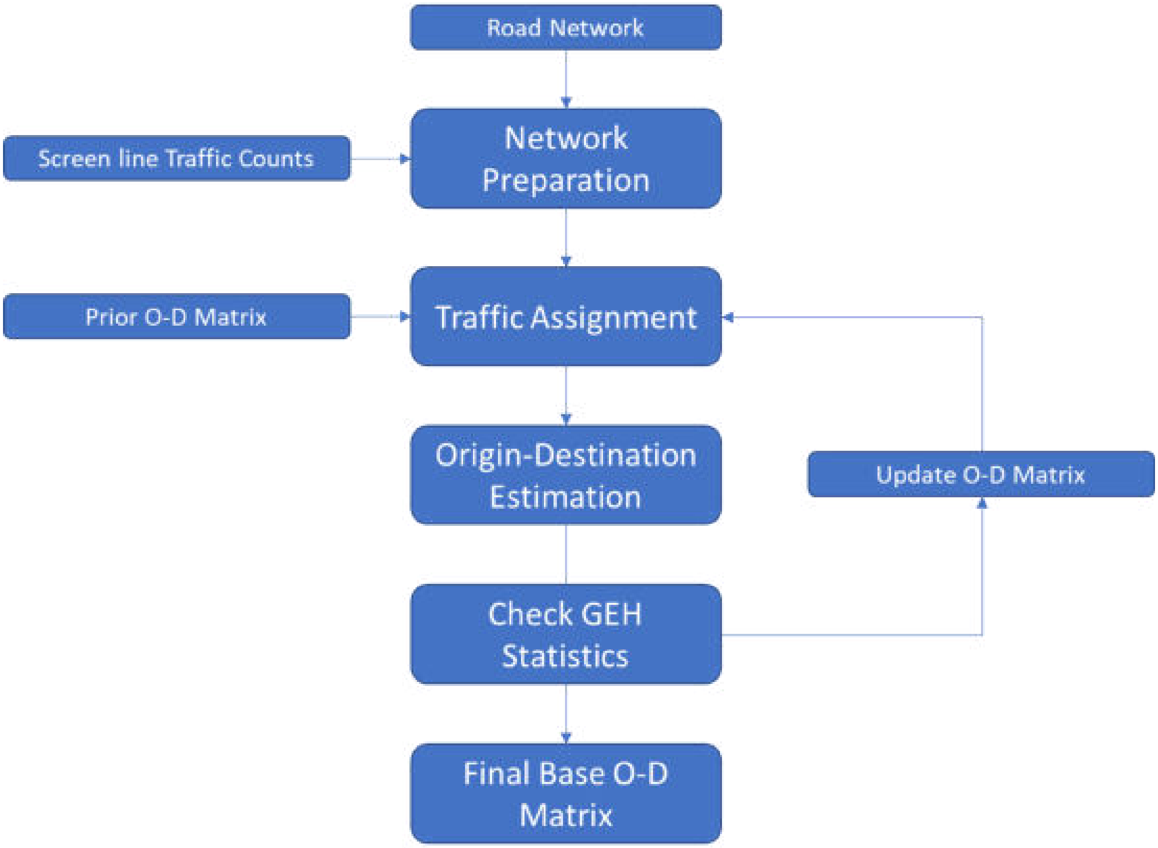
1.1.5 Base Year Origin-Destination (OD) Matrix Calibration

An important step incorporated in the travel demand model is the calibration of the base year OD matrix. In CUBE, the OD Matrix Calibration Application manages the matrix estimation process in order to calibrate or update the base year OD matrix using existing traffic counts.

In reference to the recalibration structure of the traffic demand model (refer to Exhibit 1-2), it utilizes the capability of the analyst drive program within CUBE Voyager during the OD Matrix Optimization Phase. This provides a combined process for the trip generation, distribution and modal split by using the traffic counts and prior OD which are considered as reliable data.

This is done by re-estimating the OD matrix until results converge, that is the traffic volume count matches the latest screen line traffic volume counts through several iterations in determining the best possible OD combinations. The figure below presents the flowchart on how the present OD is estimated given the traffic counts and the partial OD from the survey.

Exhibit 1-20: Base-Year OD Matrix Estimation Process



The method of estimating the OD matrix is through using a bi-level iteration scheme by optimizing a set of OD flows using a fixed trip proportion matrix.

In this optimization solver, the route choice probability matrix is estimated in the initial OD matrix by measuring the simulated volumes given by the observed counterpart as inputted from the traffic volume survey data. The estimation equation is provided below:

$$\begin{aligned} \boldsymbol{J}(\boldsymbol{X}) \quad &= [\boldsymbol{b_c}(\boldsymbol{AX}-\boldsymbol{b})]^T[\boldsymbol{b_c}(\boldsymbol{AX}-\boldsymbol{b})] && \text{(Simulated volume)} \\ &+\boldsymbol{\omega}[\boldsymbol{X_c}(\boldsymbol{X}-\boldsymbol{X_o})]^T[\boldsymbol{X_c}(\boldsymbol{X}-\boldsymbol{X_o})] && \text{(Prior Matrix Term)} \\ &+\boldsymbol{\tau_I}[\boldsymbol{T_{ic}}(\boldsymbol{TE_I}-\boldsymbol{XE_I})^T[\boldsymbol{T_{ic}}\boldsymbol{TE_I}-\boldsymbol{XE_I}] && \text{(Trip End I Term)} \\ &+\boldsymbol{\tau_J}[\boldsymbol{T_{jc}}(\boldsymbol{TE_J}-\boldsymbol{XE_J})^T[\boldsymbol{T_{jc}}\boldsymbol{TE_J}-\boldsymbol{XE_J}] && \text{(Trip End J Term)} \end{aligned}$$

$$subject\ to\ X_{lower} \leq X \leq X_{upper}$$

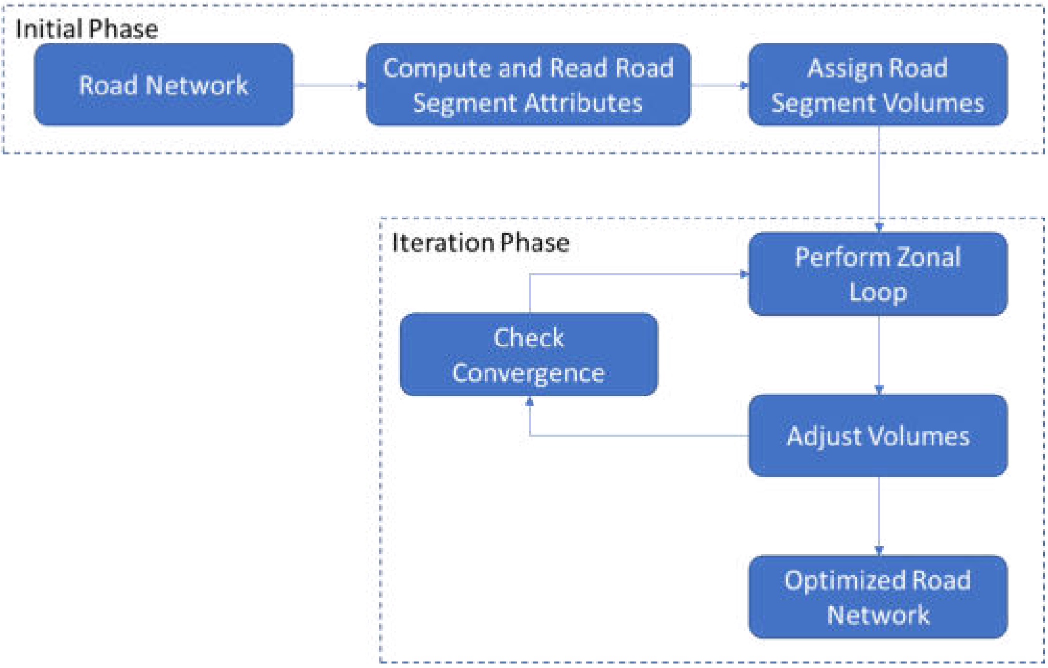
Where;

I = Origin zone
J = Destination zone
T = Arrival time interval
TE = Trip ends
XE = Trip end totals
A = route choice probability
X = variable OD matrix to be estimated
b = vector of observed counts
b_c = diagonal matrix for observed count confidence values
T_{ic} and T_{jc} = diagonal matrices for trip end confidence values
ω, τ_I and τ_J = weighting factors

The iteration stops when simulated values converge close to the observed data (traffic count data). The GEH statistic with values of less than five is usually achieved with this method.

After trip patterns have been estimated, referencing back to Exhibit 1-2 Travel Demand Model Recalibration Structure as the Trip Assignment phase, these trips are converted to traffic flows on network links. The model assigns trips based on the stochastic user equilibrium method, i.e., users choose routes which minimize the impedance measured in travel distance, time, or cost. This is an iterative convergent process that when complete, no traveler can improve their path by changing links. The flowchart of the traffic assignment model is presented in the figure below.

Exhibit 1-21: Highway Assignment Process



1.1.6 Traffic Growth Rate

The same traffic growth rates from the FS are applied to the disaggregated traffic to determine the future volume within the study area. The level of service (LOS) for every road facility (main bridge, ramps, interchanges, and adjacent road network) is determined for each design year. From the evaluation of several alternatives, the best option was selected.

For traffic growth rates, those from the FS as well as those generated using the DPWH formula based on elasticity and per capita income were considered. The calculated DPWH growth rates resulted in very high growth rates compared with the FS as shown in the tables below.

Exhibit 1-22: Average Traffic Growth Rate (Values Based on DPWH Traffic Growth Rate Formula)

Year		Traffic Growth Rates (TGR)		
		Public	Private	Goods
2015	2020	7.9%	8.8%	6.5%
2021	2025	8.1%	9.1%	6.7%

Year		Traffic Growth Rates (TGR)		
		Public	Private	Goods
2026	2030	8.4%	9.4%	6.9%
2031	2035	8.6%	9.6%	7.1%
2036	2040	8.7%	9.8%	7.2%
2041	2045	8.9%	10.0%	7.4%

Exhibit 1-23: Average Traffic Growth Rate (Feasibility Study values)

	MC	Car	Jeepney	Bus	Truck
Average Growth Rate	2.8%	6.0%	2.9%	3.8%	5.0%

It should be noted that the DPWH calculation is only dependent on the data on population and income from the Philippine Statistics Authority (PSA). The growth rates from the FS, on the other hand, are more realistic given that these are based on calibrated traffic before the pandemic. With the expectation of things getting back to the way they were before, these rates would be acceptable for normal traffic conditions. These growth rates were revalidated in the FS stage using population growth for private and public trips, and GDP growth for truck trips. The FS growth rate values are utilized.

1.1.7 Disaggregation of Vehicle Classification

The disaggregation of truck traffic was not done in the FS, but which is critical in the proper design of the road facility, and mainly utilized in the determination of the cumulative equivalent axle load. The disaggregation of truck traffic is included in the highway assignment phase wherein composition trucks from previous DPWH data were utilized.

The composition of truck traffic is presented in the tables below for both Cavite and Bataan.

Exhibit 1-24: Truck Composition - Volume (DPWH 2019 AADT Data)

Area	Rigid Truck 2 Axles	Rigid Truck 3+ Axles	Truck Semi-Trailer 3 & 4 Axles	Truck Semi-Trailer 5+ Axles	Truck Trailers 4 Axles	Truck Trailers 5+ Axles
Cavite	231	203	223	81	129	66
Bataan	102	126	215	123	50	37

Exhibit 1-25: Percentage of Truck Composition (DPWH 2019 AADT Data)

Area	Rigid Truck 2 Axles	Rigid Truck 3+ Axles	Truck Semi-Trailer 3 & 4 Axles	Truck Semi-Trailer 5+ Axles	Truck Trailers 4 Axles	Truck Trailers 5+ Axles
Cavite	20%	20%	29%	8%	16%	7%
Bataan	16%	19%	36%	17%	7%	5%

1.1.8 Traffic Volume

Based on the forecasted volume in terms of Annual Average Daily Traffic (AADT) from the feasibility study, in the opening year 2025, around 12,890 vehicles are expected along the eastbound direction of BCIB; while 12,227 vehicles are expected along the westbound direction.

In the year 2035, traffic is expected to increase to 19,090 vehicles and 18,323 vehicles for the eastbound direction and westbound direction, respectively. The table below presents the volume of traffic by each vehicle class for forecast years 2025 and 2035 along BCIB.

Exhibit 1-26: Traffic Volume in AADT (2025 and 2035), Main Bridge

Year	Direction	MC	Car	PUJ	Bus	Truck	Total
2025	BCIB Eastbound	5,333	4,800	1,067	450	1,240	12,890
	BCIB Westbound	5,200	4,800	467	600	1,160	12,227
2035	BCIB Eastbound	6,800	8,600	600	850	2,240	19,090
	BCIB Westbound	6,800	8,900	333	850	1,440	18,323

Alternatively presented in the table below, the number of vehicles by class during the morning peak hour was utilized as the critical volume for the analysis and design of the bridge.

Exhibit 1-27: Peak Hour Traffic Volume (2025 and 2035), Main Bridge

Year	Direction	MC	Car	PUJ	Bus	Truck	Total
2025	BCIB Eastbound	480	440	93	45	44	1,102
	BCIB Westbound	507	570	40	55	68	1,240
2035	BCIB Eastbound	760	830	47	80	140	1,857
	BCIB Westbound	853	1,020	40	80	84	2,077

To further analyze the level of service discussed in the succeeding sections, the vehicle traffic needs to be converted to passenger car units (PCU). The conversion is done by directly multiplying the factor to the vehicle volume by class. The passenger car equivalent factor (PCEF) by vehicle class utilized in this study, which is still based on the FS, is presented in the table below.

Exhibit 1-28: Passenger Car Equivalent Factor by Vehicle Class

Vehicle Class	MC	Car	PUJ	Bus	Truck
PCEF	0.75	1.0	1.5	2.0	2.5

The peak hour traffic volume in Passenger Car Units (PCU) along the BCIB is presented in the tables below. The forecast is based on the TDM forecast considering an opening year in 2030 and extended to year 2075.

Exhibit 1-29: Peak Hour Traffic Volume Forecast in PCU (2030-2075), Main Bridge

Direction	2030	2031	2032	2033	2034	2035	2036	2037	2038
BCIB Eastbound	1560	1644	1728	1812	1896	1980	2001	2023	2044
BCIB Westbound	1690	1770	1850	1930	2010	2090	2112	2134	2156

Direction	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048
BCIB Eastbound	2066	2087	2109	2130	2152	2173	2195	2219	2244	2269
BCIB Westbound	2178	2200	2222	2244	2266	2288	2310	2336	2362	2388

Direction	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058
BCIB Eastbound	2293	2318	2343	2367	2392	2417	2442	2471	2500	2530
BCIB Westbound	2414	2440	2466	2492	2518	2544	2570	2601	2632	2663

Direction	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068
BCIB Eastbound	2559	2589	2618	2648	2677	2707	2736	2770	2804	2839
BCIB Westbound	2694	2725	2756	2787	2818	2849	2880	2916	2952	2988

Direction	2069	2070	2071	2072	2073	2074	2075
BCIB Eastbound	2873	2907	2941	2975	3010	3044	3078
BCIB Westbound	3024	3060	3096	3132	3168	3204	3240

The traffic demand forecast for the ramps are shown in the succeeding exhibits. The forecast volume in PCU is also presented for the year 2030 up to the year 2075.

Exhibit 1-30: Reference Direction, Cavite Off- and On-Ramps

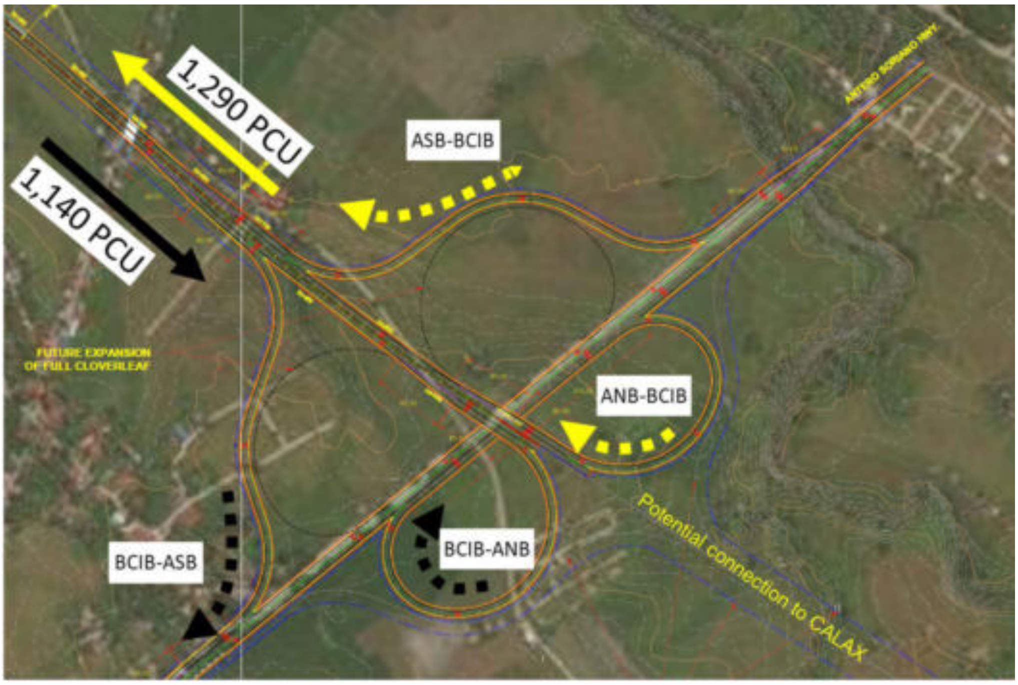


Exhibit 1-31: Peak Hour Traffic Volume Forecast in PCU (2030-2075), Cavite Off- and On-Ramps

Direction	2030	2031	2032	2033	2034	2035	2036	2037	2038
Ramp (ASB-BCIB)	1,014	1,062	1,110	1,158	1,206	1,254	1,267	1,280	1,294
Ramp (ANB-BCIB)	676	708	740	772	804	836	845	854	862
Ramp (BCIB-ANB)	936	986	1,037	1,087	1,138	1,188	1,201	1,214	1,227
Ramp (BCIB-ASB)	624	658	691	725	758	792	801	809	818

Direction	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048
Ramp (ASB-BCIB)	1,307	1,320	1,333	1,346	1,360	1,373	1,386	1,402	1,417	1,433
Ramp (ANB-BCIB)	871	880	889	898	906	915	924	934	945	955
Ramp (BCIB-ANB)	1,239	1,252	1,265	1,278	1,291	1,304	1,317	1,332	1,346	1,361
Ramp (BCIB-ASB)	826	835	843	852	861	869	878	888	898	907

Direction	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058
Ramp (ASB-BCIB)	1,448	1,464	1,480	1,495	1,511	1,526	1,542	1,561	1,579	1,598
Ramp (ANB-BCIB)	966	976	986	997	1,007	1,018	1,028	1,040	1,053	1,065
Ramp (BCIB-ANB)	1,376	1,391	1,406	1,420	1,435	1,450	1,465	1,483	1,500	1,518
Ramp (BCIB-ASB)	917	927	937	947	957	967	977	988	1,000	1,012

Direction	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068
Ramp (ASB-BCIB)	1,616	1,635	1,654	1,672	1,691	1,709	1,728	1,750	1,771	1,793
Ramp (ANB-BCIB)	1,078	1,090	1,102	1,115	1,127	1,140	1,152	1,166	1,181	1,195
Ramp (BCIB-ANB)	1,536	1,553	1,571	1,589	1,606	1,624	1,642	1,662	1,683	1,703
Ramp (BCIB-ASB)	1,024	1,036	1,047	1,059	1,071	1,083	1,094	1,108	1,122	1,135

Direction	2069	2070	2071	2072	2073	2074	2075
Ramp (ASB-BCIB)	1,814	1,836	1,858	1,879	1,901	1,922	1,944
Ramp (ANB-BCIB)	1,210	1,224	1,238	1,253	1,267	1,282	1,296
Ramp (BCIB-ANB)	1,724	1,744	1,765	1,785	1,806	1,826	1,847
Ramp (BCIB-ASB)	1,149	1,163	1,176	1,190	1,204	1,218	1,231

Exhibit 1-32: Reference Direction, Bataan Off- and On-Ramps

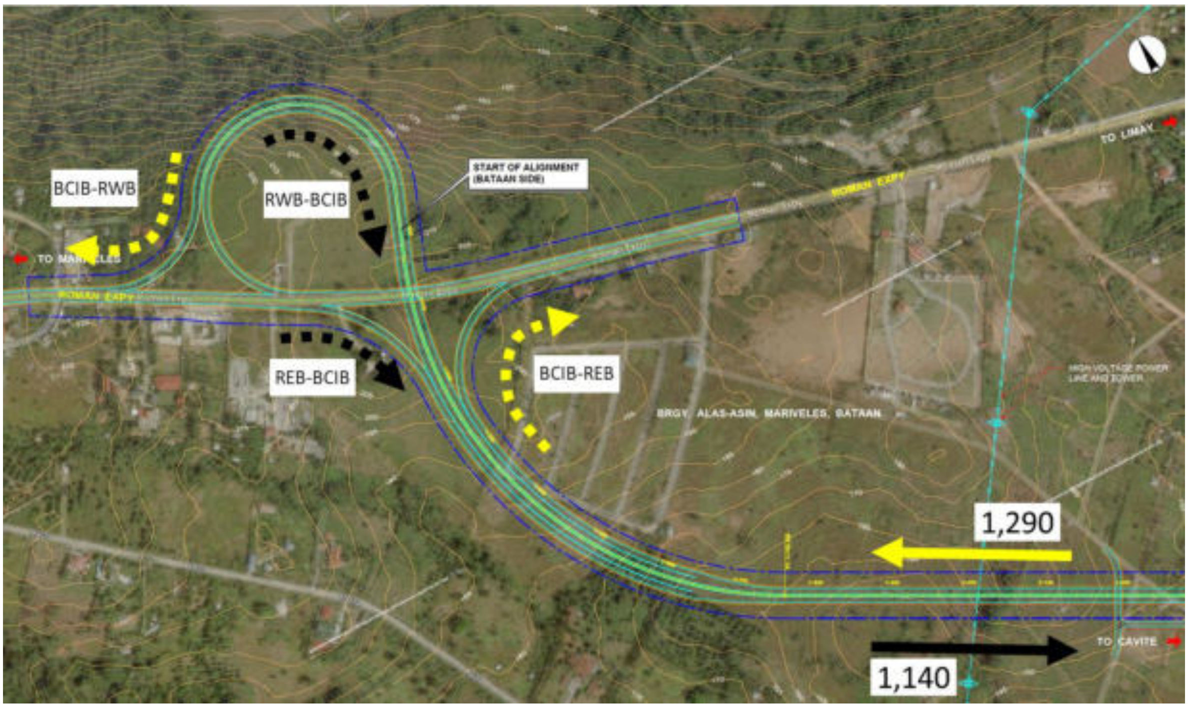


Exhibit 1-33: Peak Hour Traffic Volume Forecast in PCU (2030-2075), Bataan Off- and On-Ramps

Direction	2030	2031	2032	2033	2034	2035	2036	2037	2038
Ramp (BCIB-REB)	930	974	1,018	1,062	1,106	1,150	1,162	1,174	1,186
Ramp (BCIB-RWB)	761	797	833	869	905	941	950	960	970
Ramp (RWB-BCIB)	858	904	950	997	1,043	1,089	1,101	1,113	1,124
Ramp (REB-BCIB)	702	740	778	815	853	891	901	910	920

Direction	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048
Ramp (BCIB-REB)	1,198	1,210	1,222	1,234	1,246	1,258	1,271	1,285	1,299	1,313
Ramp (BCIB-RWB)	980	990	1,000	1,010	1,020	1,030	1,040	1,051	1,063	1,075
Ramp (RWB-BCIB)	1,136	1,148	1,160	1,172	1,183	1,195	1,207	1,221	1,234	1,248
Ramp (REB-BCIB)	930	939	949	959	968	978	988	999	1,010	1,021

Direction	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058
Ramp (BCIB-REB)	1,328	1,342	1,356	1,371	1,385	1,399	1,414	1,431	1,448	1,465
Ramp (BCIB-RWB)	1,086	1,098	1,110	1,121	1,133	1,145	1,157	1,170	1,184	1,198
Ramp (RWB-BCIB)	1,261	1,275	1,288	1,302	1,316	1,329	1,343	1,359	1,375	1,391
Ramp (REB-BCIB)	1,032	1,043	1,054	1,065	1,076	1,088	1,099	1,112	1,125	1,138

Direction	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068
Ramp (BCIB-REB)	1,482	1,499	1,516	1,533	1,550	1,567	1,584	1,604	1,624	1,643
Ramp (BCIB-RWB)	1,212	1,226	1,240	1,254	1,268	1,282	1,296	1,312	1,328	1,345
Ramp (RWB-BCIB)	1,408	1,424	1,440	1,456	1,472	1,489	1,505	1,524	1,542	1,561
Ramp (REB-BCIB)	1,152	1,165	1,178	1,191	1,205	1,218	1,231	1,247	1,262	1,277

Direction	2069	2070	2071	2072	2073	2074	2075
Ramp (BCIB-REB)	1,663	1,683	1,703	1,723	1,742	1,762	1,782
Ramp (BCIB-RWB)	1,361	1,377	1,393	1,409	1,426	1,442	1,458
Ramp (RWB-BCIB)	1,580	1,599	1,618	1,636	1,655	1,674	1,693
Ramp (REB-BCIB)	1,293	1,308	1,324	1,339	1,354	1,370	1,385

1.1.9 Truck Traffic Volume

The truck traffic volume forecast is presented in the exhibit below starting at the opening year in 2030 to 2059.

Exhibit 1-34: Truck Traffic Volume Forecast for Years 2030-2059

Direction	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039
Both Directions	3,132	3,284	3,436	3,589	3,741	3,893	4,044	4,192	4,337	4,480

Direction	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049
Both Directions	4,621	4,760	4,896	5,030	5,162	5,292	5,419	5,545	5,668	5,790

Direction	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059
Both Directions	5,909	6,026	6,142	6,255	6,367	6,477	6,585	6,692	6,796	6,902

Moreover, considering a 100-year design life of the bridge structure, the truck traffic volume forecast is extended until the year 2129 using a linear growth at a rate of 1.56% starting from year 2059. The truck traffic volume along the BCIB is estimated to be 20,441 trucks in year 2129. The Average Daily Truck Traffic (ADTT) considering the 100-year period is calculated at 10,342 trucks along the BCIB.

1.2 Design Requirements and Considerations

As determined in the feasibility study, the design requirements were validated in terms of the number of lanes, the type of interchange and the computed Cumulative Equivalent Single Axle Load (CESAL). Capacity assessment and performance analysis of these design requirements are discussed in the following sections.

1.2.1 Lane Requirements

According to the DPWH Department Order No. 22 Series of 2013, road widening shall be primarily considered along road sections with volume capacity ratio (VCR) of more than or equal to 0.60. Since this is a new facility, it is recommended that the facility be designed in line with the DPWH Department Order wherein consideration on the required number of lanes for the main bridge and ramps shall also have more or less a VCR of 0.60 over a forecast period of 20 years. The subsequent sections present the required number of lanes for the bridge and the ramps while the capacity assessment is described in Section 1.3.

1.2.1.1 Main Bridge

The BCIB project requires two (2) lanes per direction of standard width to accommodate the traffic demand. The same lane configuration is adopted as determined from the traffic forecast.

1.2.1.2 Ramp

The feasibility study does not state the lane requirement for the on and off ramps. The minimum lane requirement was determine using the directional traffic demand based on the directional distribution ratio from historical data and directional traffic along Antero Soriano Highway and Roman Highway.

A single lane is enough to accommodate the directional traffic demand. The proposed single lane ramp has adequate shoulder widths in case expansion to a 2-lane ramp will be necessary. The level of service of the single-lane ramp is presented in Section 1.3.3.

1.2.2 Interchange

A cloverleaf interchange was recommended in the feasibility study at the Cavite side if BCIB is to be connected to the future CALAX. Since it is expected that the BCIB will be connected to another future road facility, making the affected portion a 4-legged intersection, the recommendation based on the assessment of several scenarios as discussed in Section 1.3.2 is the partial cloverleaf which can definitely be upgraded to a full cloverleaf when the other road facility is connected to BCIB and the demand arises.

For Bataan side of BICB, the feasibility study recommended a trumpet interchange. With three (3) intersecting legs, a trumpet interchange will be the choice among the selections especially when right of way is not an issue.

1.2.3 Cumulative Equivalent Single Axle Load (CESAL)

The computed CESAL in the feasibility study was determined using the aggregated bus and truck volumes in relation to a Load Equivalent Factor of 4.6 (large bus) and 6.44 (3 or more axle rigid truck), respectively. The CESAL was recomputed using the disaggregated truck volume as determined in the validation of the traffic demand forecast while also using the relative LEF for each disaggregated truck classification. The computation of the new CESAL value is discussed in the Main Report's Pavement Design Chapter and its Annexes.

1.3 Capacity Assessment and Performance Analysis

The infrastructure facilities were assessed in terms of Volume-Capacity Ratio (VCR) and the equivalent Level of Service (LOS). Both volume and capacity are expressed in terms of passenger car unit (PCU) per hour. The LOS criteria based on DPWH (2013) is presented below.

Exhibit 1-35: Level of Service Criteria

LOS	V/C Ratio	Description
A	Less than 0.20	Free flowing traffic
B	0.21 – 0.50	Relatively free flowing traffic
C	0.51 – 0.70	Moderate traffic
D	0.71 – 0.85	Moderate/ Heavy traffic
E	0.86 – 1.00	Heavy traffic
F	Greater than 1.0	Forced flow, Stop and go

Source: DPWH Department Order No. 22 Series of 2013

To compute for the VCR using the table below, the equivalent lane capacity is 2,000 PCU per lane per hour for a carriageway width of 6.7m.

Exhibit 1-36: Road Capacity

Carriageway Width	Hourly PCU	
	Rural	Urban
Single: < 4 meters	600	600
4.0 - 5.0 meters	1200	1200
5.1 - 6.0 meters	1900	1600
6.1 - 6.7 meters	2000	1700
6.8 - 7.3 meters	2400	1800
2x6.7 or 2x7.3 meters	7200	6700

Source: DPWH Department Order No. 22 Series of 2013

To determine the VCR and LOS for the ramps, the ramp roadway capacity figures below are utilized which are based on the Highway Capacity Manual (HCM) of the Transportation Research Board (TRB)(2000). It should be noted that the DPWH has criteria only for main road segments that also reference the Highway Capacity Manual (HCM) of the TRB. Therefore, it follows that capacity values of the HCM may be utilized.

Exhibit 1-37: Ramp Roadway Capacity

Free-Flow Speed of Ramp	Hourly PCU	
	Single-Lane Ramps	Two-Lane Ramps
>50 mph (80 kph)	2200	4400
>40 mph (60 kph) – 50 mph (80 kph)	2100	4100
>30 mph (40 kph) – 40 mph (60 kph)	2000	3800
>20 mph (30 kph) – 30 mph (40 kph)	1900	3500
<20 mph (30 kph)	1800	3200

Source: Highway Capacity Manual, Transportation Research Board, 2000

1.3.1 Main Bridge

The eastbound direction of BCIB is forecasted to have an LOS B from years 2030 to 2036 while the westbound direction will be from years 2030 to 2034. LOS C starts at year 2037 until 2067 for the eastbound while the westbound is from year 2035 until 2063. Both directions will be able to maintain an LOS D at year 2075.

Exhibit 1-38: Level of Service at Main Bridge

Direction	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039
BCIB Eastbound	0.39	0.41	0.43	0.45	0.47	0.50	0.50	0.51	0.51	0.52
BCIB Westbound	0.42	0.44	0.46	0.48	0.50	0.52	0.53	0.53	0.54	0.54

Direction	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049
BCIB Eastbound	0.52	0.53	0.53	0.54	0.54	0.55	0.55	0.56	0.57	0.57
BCIB Westbound	0.55	0.56	0.56	0.57	0.57	0.58	0.58	0.59	0.60	0.60

Direction	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059
BCIB Eastbound	0.58	0.59	0.59	0.60	0.60	0.61	0.62	0.63	0.63	0.64
BCIB Westbound	0.61	0.62	0.62	0.63	0.64	0.64	0.65	0.66	0.67	0.67

Direction	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069
BCIB Eastbound	0.65	0.65	0.66	0.67	0.68	0.68	0.69	0.70	0.71	0.72
BCIB Westbound	0.68	0.69	0.70	0.70	0.71	0.72	0.73	0.74	0.75	0.76

Direction	2070	2071	2072	2073	2074	2075
BCIB Eastbound	0.73	0.74	0.74	0.75	0.76	0.77
BCIB Westbound	0.77	0.77	0.78	0.79	0.80	0.81

1.3.2 Interchange

Although the Feasibility Study recommended a directional-T intersection for Cavite, the engineering drawing shows an at-grade channelized T-intersection. A traffic analysis was done utilizing this configuration, and results show that at the opening year of 2025 in the FS, the Cavite end would already be operating at LOS F (VCR 1.63).

The resultant imbalance is an LOS B (VCR 0.35) at the trumpet interchange at Bataan, and an LOS F (VCR 1.63) at Cavite which is not acceptable. Drivers may experience uninterrupted flow at the trumpet interchange and all throughout the bridge, only to slow down to a stop-and-go condition as congestion increases at the Cavite side with the channelized T-intersection.

The table below presents the initial evaluation of the traffic performance of the various interchanges under study. It can be deduced that changing the interchange to a partial cloverleaf would be a better balance for the trumpet interchange in Bataan.

Exhibit 1-39: Initial Comparison of Traffic Performance of Interchange Types at Cavite and Bataan

Criteria	Cavite Interchange Channelized T		Directional T		Partial Cloverleaf		Bataan Trumpet
	Indicator	**Rating**	**Indicator**	**Rating**	**Indicator**	**Rating**	**Indicator**
Volume Capacity Ratio (based on FHWA Capacity Analysis, lower is better)	1.63	3	0.58	2	0.38	1	0.35
Conflict Points / Traffic Safety	9	3	6	2	6	2	6
Rating (Lower is better)		3		2		1.5	

However, during the course of the design, the viability of the partial cloverleaf interchange was further evaluated by comparing the interchange to roundabouts which at that time may require lesser right of way. A microsimulation using Synchro was then developed to determine the performance of the alternative facilities. The Exhibits 1-40 and 1-41 below present the comparison of the traffic performance between the partial cloverleaf and a roundabout at the Cavite Interchange, and the performance of the trumpet interchange at Bataan, respectively.

Exhibit 1-40: Interchange Performance of Alternative Facilities at Cavite

Criteria	Roundabout (Circular)		Roundabout (Oval)		Partial Cloverleaf	
	Towards Exit	**At Ramp**	**Towards Exit**	**At Ramp**	**Towards Exit**	**At Ramp**
Average Delay per vehicle	27.2 sec	None	14.9 sec	None	4.1 sec	None
Average Travel Speed	11 kph	31 kph	18 kph	39 kph	23 kph	40 kph
Average Queue Length	121.6 m	None	87.3 m	None	<25 m	None
Average Network Speed	16 kph		32 kph		32 kph	
Weaving Length	50 m		120 m		152 m	

Exhibit 1-41: Interchange Performance at Bataan

Criteria	Towards Exit	At Ramp
Average Delay per vehicle	3.8 sec	None
Average Travel Speed	24 kph	40 kph
Average Queue Length	<10 m	None
Average Speed for the Network	35 kph	
Weaving Length	60 m	

Considering the demand at the proposed facilities, minimal delay will be experienced and should achieve a considerable safe speed while traveling towards Antero Soriano Highway for all facilities. Nevertheless, the best option is the partial cloverleaf, ticking all the criteria. The partial cloverleaf at Cavite Interchange complements also the traffic performance at

Bataan Interchange which also results to minimal delay and likewise achieves a considerable safe speed while traveling towards Roman Highway.

DQ No. 22 which details the discussion regarding the request for change of type of interchange at the Cavite end from directional T-intersection to partial cloverleaf was accepted by the DPWH Bureau of Design in their letter dated 26 June 2021 with BOD Ref No. 009335.

1.3.3 Ramps

At the Cavite Interchange, the LOS for each ramp for the years 2030-2075 is presented below. The ramp that will experience the earliest LOS C is the ASB-BCIB ramp, which may occur in the year 2030. LOS D is expected to be experienced in year 2047 and LOS E is expected to occur in year 2065. The rest of the ramps are expected to have better LOS. The results justify the single-lane ramp considering that the 0.60 VCR (LOS C) may be expected during or after the 20-year design period except for ramp ASB-BCIB which is expected to have an LOS D by year 2047. Even if this is the case, the critical portion that should be address is the receiving lane along BCIB westbound and as presented earlier is expected to have a good LOS C in year 2048.

Exhibit 1-42: Level of Service at Ramps – Cavite Interchange

Direction	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039
ASB-BCIB	0.51	0.53	0.56	0.58	0.60	0.63	0.63	0.64	0.65	0.65
ANB-BCIB	0.34	0.35	0.37	0.39	0.40	0.42	0.42	0.43	0.43	0.44
BCIB-ANB	0.47	0.49	0.52	0.54	0.57	0.59	0.60	0.61	0.61	0.62
BCIB-ASB	0.31	0.33	0.35	0.36	0.38	0.40	0.40	0.40	0.41	0.41
Direction	**2040**	**2041**	**2042**	**2043**	**2044**	**2045**	**2046**	**2047**	**2048**	**2049**
ASB-BCIB	0.66	0.67	0.67	0.68	0.69	0.69	0.70	0.71	0.72	0.72
ANB-BCIB	0.44	0.44	0.45	0.45	0.46	0.46	0.47	0.47	0.48	0.48
BCIB-ANB	0.63	0.63	0.64	0.65	0.65	0.66	0.67	0.67	0.68	0.69
BCIB-ASB	0.42	0.42	0.43	0.43	0.43	0.44	0.44	0.45	0.45	0.46

Direction	2050	2051	2052	2053	2054	2055	2056	2057	2058	2058
ASB-BCIB	0.73	0.74	0.75	0.76	0.76	0.77	0.78	0.79	0.80	0.80
ANB-BCIB	0.49	0.49	0.50	0.50	0.51	0.51	0.52	0.53	0.53	0.53
BCIB-ANB	0.70	0.70	0.71	0.72	0.73	0.73	0.74	0.75	0.76	0.76
BCIB-ASB	0.46	0.47	0.47	0.48	0.48	0.49	0.49	0.50	0.51	0.51

Direction	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069
ASB-BCIB	0.82	0.83	0.84	0.85	0.85	0.86	0.87	0.89	0.90	0.91
ANB-BCIB	0.55	0.55	0.56	0.56	0.57	0.58	0.58	0.59	0.60	0.60
BCIB-ANB	0.78	0.79	0.79	0.80	0.81	0.82	0.83	0.84	0.85	0.86
BCIB-ASB	0.52	0.52	0.53	0.54	0.54	0.55	0.55	0.56	0.57	0.57

Direction	2070	2071	2072	2073	2074	2075
ASB-BCIB	0.92	0.93	0.94	0.95	0.96	0.97
ANB-BCIB	0.61	0.62	0.63	0.63	0.64	0.65
BCIB-ANB	0.87	0.88	0.89	0.90	0.91	0.92

Direction	2070	2071	2072	2073	2074	2075
BCIB-ASB	0.58	0.59	0.60	0.60	0.61	0.62

On the other hand, the LOS for each ramp at the Bataan Interchange for the years 2030-2075 is presented below. The ramp that will experience the earliest LOS C is the BCIB-REB ramp which is expected to happen in year 2032. LOS D is expected to occur in year 2055 and LOS E is expected to occur in year 2072. The rest of the ramps are expected to have better LOS. The results still justify the single-lane ramp considering that the 0.60 VCR (LOS C) may be expected during or after the 20-year design period.

Exhibit 1-43: Level of Service at Ramps – Bataan Interchange

Direction	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039
BCIB-REB	0.46	0.49	0.51	0.53	0.55	0.57	0.58	0.59	0.59	0.60
BCIB-RWB	0.38	0.40	0.42	0.43	0.45	0.47	0.48	0.48	0.49	0.49
RWB-BCIB	0.43	0.45	0.48	0.50	0.52	0.54	0.55	0.56	0.56	0.57
REB-BCIB	0.35	0.37	0.39	0.41	0.43	0.45	0.45	0.46	0.46	0.46

Direction	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049
BCIB-REB	0.61	0.61	0.62	0.62	0.63	0.64	0.64	0.65	0.66	0.66
BCIB-RWB	0.50	0.50	0.50	0.51	0.51	0.52	0.53	0.53	0.54	0.54
RWB-BCIB	0.57	0.58	0.59	0.59	0.60	0.60	0.61	0.62	0.62	0.63
REB-BCIB	0.47	0.47	0.48	0.48	0.49	0.49	0.50	0.50	0.51	0.52

Direction	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059
BCIB-REB	0.67	0.68	0.69	0.69	0.70	0.71	0.72	0.72	0.73	0.74
BCIB-RWB	0.55	0.55	0.56	0.57	0.57	0.58	0.59	0.59	0.60	0.61
RWB-BCIB	0.64	0.64	0.65	0.66	0.66	0.67	0.68	0.69	0.70	0.70
REB-BCIB	0.52	0.53	0.53	0.54	0.54	0.55	0.56	0.56	0.57	0.58

Direction	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069
BCIB-REB	0.75	0.76	0.77	0.77	0.78	0.79	0.80	0.81	0.82	0.83
BCIB-RWB	0.61	0.62	0.63	0.63	0.64	0.65	0.66	0.66	0.67	0.68
RWB-BCIB	0.71	0.72	0.73	0.74	0.74	0.75	0.76	0.77	0.78	0.79
REB-BCIB	0.58	0.59	0.60	0.60	0.61	0.62	0.62	0.63	0.64	0.65

Direction	2070	2071	2072	2073	2074	2075
BCIB-REB	0.84	0.85	0.86	0.87	0.88	0.89
BCIB-RWB	0.69	0.70	0.70	0.71	0.72	0.73
RWB-BCIB	0.80	0.81	0.82	0.83	0.84	0.85
REB-BCIB	0.65	0.66	0.67	0.68	0.68	0.69

1.4 Traffic Survey Revalidation

1.4.1 Background and Objectives

Part of the DED is to update the Travel Demand Model (TDM) developed by Arup during the Feasibility Study (FS) which in essence should validate the results of the FS model and provide a less conservative and more precise traffic forecast. However, due to the challenges in the gathering of primary data brought about by the pandemic in 2020 and 2021, a TDM model was redeveloped though Cube Voyager using the inputs from the MUCEP Study (JICA, 2015). This TDM focused on providing a working template for the BCIB project to run the necessary scenarios in the updating of the economic model. The TDM developed in this DED stage should provide similar forecasts to the FS TDM but with refinements to the origin-destination matrices as well as provide disaggregation for the truck classification.

To proceed with validation activities for the TDM, traffic surveys have been conducted in November 2022 and this chapter provides the discussion of the validation process and analysis of the results.

1.4.1.1 Objectives of Traffic Survey Revalidation

The purpose of this travel demand model validation is to determine the accuracy of the forecast and changes in travel volume considering the pandemic's impact. Specifically, this report should address the following objectives:

- To check the TDM forecast versus the observed data,
- To determine the normalcy of traffic that was greatly affected by the pandemic, and
- To recalibrate the base year model if necessary.

1.4.1.2 Validation Process

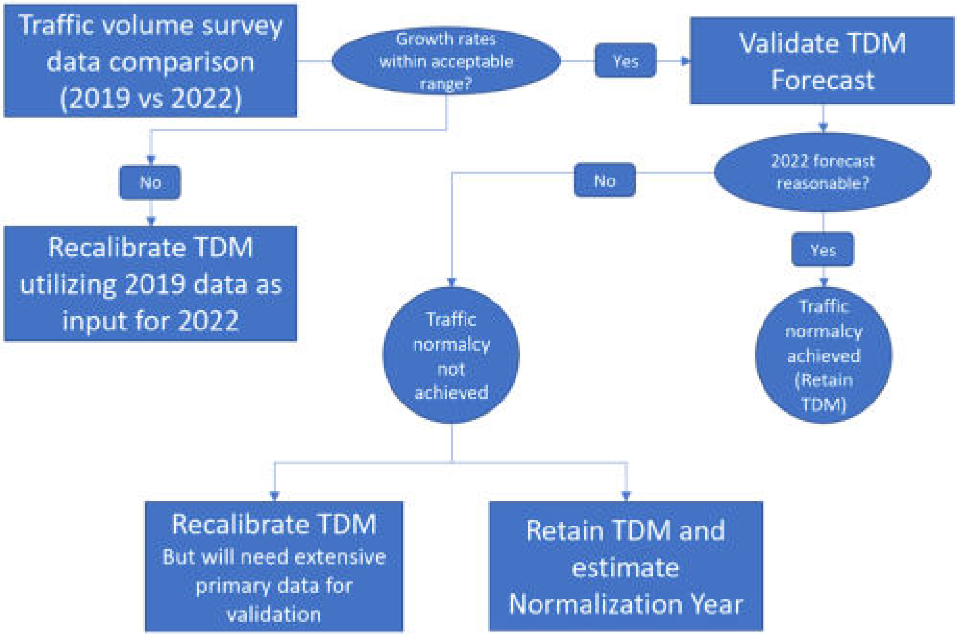
To systematically conduct the validation, the following elements were considered:

- Collection and assessment of traffic data
- Validation of traffic forecast
- Analysis and documentation

One of the first few steps in validation is the collection of data to be utilized for counterchecking the model results. This was done through the traffic surveys conducted in November 2022 at strategic locations.

Since the TDM was developed for the base year 2019 using traffic data from a multitude of surveys conducted during the FS, forecast for the same year 2022 needs to reasonably reproduce the observed traffic volume from the recently conducted data gathering. The forecast validation process is presented in the figure below.

Exhibit 1-44: TDM Validation Process



1.4.2 Traffic Volume Count Survey

This chapter provides a summary of the traffic volume count surveys undertaken for the Bataan-Cavite Interlink Bridge (BCIB) Project conducted by University of the Philippines - National Center for Transportation Studies Foundation Inc. (UP-NCTSFI).

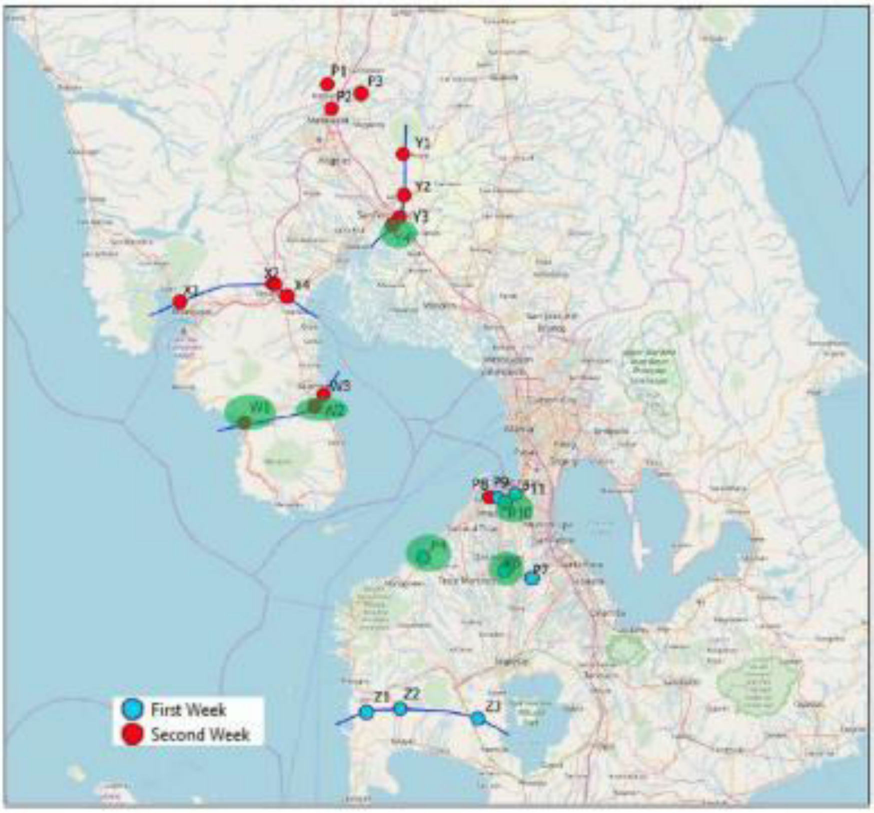
These traffic volume count surveys were proposed to check the changes in travel volume at selected stations similar to the Traffic Survey Stations conducted in 2019 for the BCIB project and validate the travel demand model. Hence, traffic volume count surveys were conducted for 24 hours November 03 and 08 2022 to determine hourly variations and check the normalcy of the travel volume.

The table below presents the details of the survey while the succeeding map shows the original traffic survey stations conducted in 2019 and the highlighted stations in green for the validation survey. Out of the original 25 survey stations, 6 survey stations were selected as a minimum based on the proximity to the BCIB project and most likely where the traffic captured will also utilize the BCIB.

Exhibit 1-45: Traffic Volume Count Survey Stations

No.	Survey Station	Duration (hours)	No. of Days	Traffic Movements	Survey Date
P4	Antero Soriano Highway, Naic, Cavite	24	1	2	Nov 3, 2022
P6	Governor's Drive, Dasmarinas, Cavite	24	1	2	Nov 3, 2022
P10	Aguinaldo Highway, Bacoor, Cavite	24	1	2	Nov 3, 2022
W1	Aguinaldo Street, Bagac, Bataan	24	1	2	Nov 8, 2022
W2	Roman Superhighway, Pilar, Bataan	24	1	2	Nov 8, 2022
Y4	McArthur Highway, San Matias-Sto Tomas, Pampanga	24	1	2	Nov 8, 2022

Exhibit 1-46: Location of Traffic Volume Count Survey



1.4.2.1 Vehicle Classification

The vehicle volume count survey covered 13 vehicle classifications similar to those used and prescribed by the DPWH in the conduct of traffic surveys plus 1 non-motorized transport (bicycles). The counting of bicycles was included in the survey for the purpose of determining the non-motorized users which may become useful in analysis outside of this report.

These vehicles are grouped and described as follows:

1. Motorcycle
2. Tricycle
3. Passenger car (taxi, owner jeep, SUV)
4. Passenger Utility (jeepneys, HOV taxi, FX, megataxi, garage service, shuttle, etc.)
5. Goods Utility (Pick-up, Vans, Cargo Jeepney or AUV, Utility vehicles)
6. Mini-Bus, Coasters (passenger or private)
7. Large Bus (commuter, private, school, or tourist)
8. Rigid Truck 2 axles
9. Rigid Truck 3+ axles
10. Truck Semi-Trailer 3 and 4 axles
11. Truck Semi-Trailer 5 axles or more
12. Truck Trailer 4 axles
13. Truck Trailer 5 axles or more
14. Bicycles

The following are the results of the survey which were utilized in the validation of the travel demand forecasts. The results are presented in a bar graph to show the hourly variation of traffic for each vehicle classification.

Exhibit 1-47: Traffic Volume, P4 - Antero Soriano Highway, Naic, Cavite

Traffic Volume Count Survey (Hourly Summary)		
Traffic Survey for the Bataan-Cavite Interchange Bridge Project		
U.P. National Center for Transportation Studies Foundation Inc. for TYLin-PEC JV		
Location		Date
P4: Antero Soriano Highway, Naic, Cavite		03 November 2022
Traffic Movement		(Thursday)
Two (2) Movements (Northbound and Southbound)		Survey Period
Weather		0:00 AM - 12:00 MN

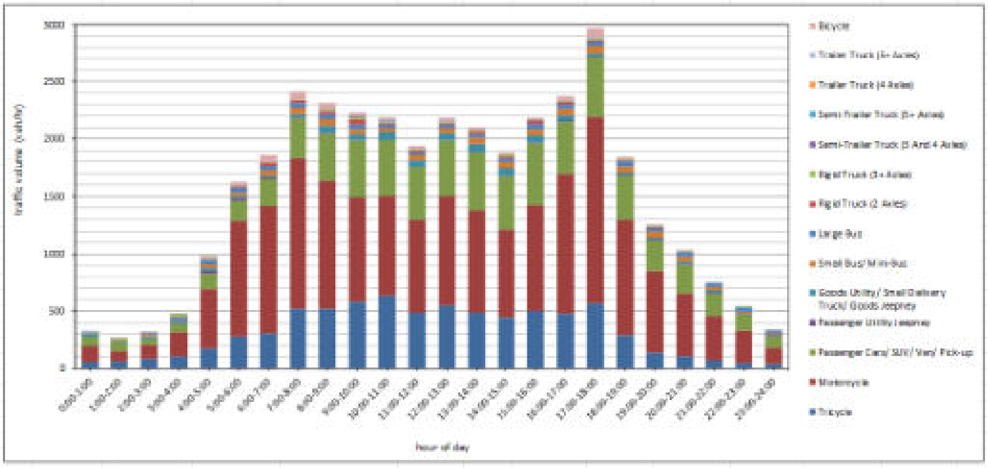


Exhibit 1-48: Traffic Volume, P6 - Governor's Drive, Dasmarinas, Cavite

Traffic Volume Count Survey (Hourly Summary)		
Traffic Survey for the Bataan-Cavite Interchange Bridge Project		
U.P. National Center for Transportation Studies Foundation Inc. for TYLin-PEC JV		
Location		Date
P6: Governor's Drive, Dasmarinas City, Cavite		03 November 2022
Traffic Movement		(Thursday)
Two (2) Movements (Eastbound and Westbound)		Survey Period
Weather		0:00 AM - 12:00 MN

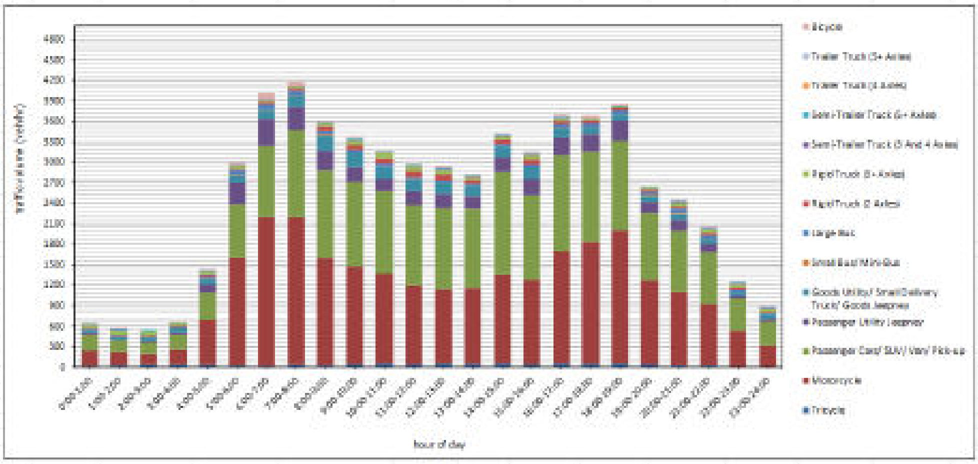


Exhibit 1-49: Traffic Volume, P10 - Aguinaldo Highway, Bacoor, Cavite

Traffic Volume Count Survey (Hourly Summary)		
Traffic Survey for the Bataan-Cavite Interchange Bridge Project		
U.P. National Center for Transportation Studies Foundation Inc. for TYLin-PEC JV		
Location		Date
P10: Aguinaldo Highway, Bacoor City, Cavite		03 November 2022
Traffic Movement		(Thursday)
Two (2) Movements (Northbound and Southbound)		Survey Period
Weather: Fair (12AM-1 PM - Fair; 3-4 PM - Cloudy; 4-6 PM - Rainy; 7 PM-12 MN - Fair)		0:00 AM - 12:00 MN

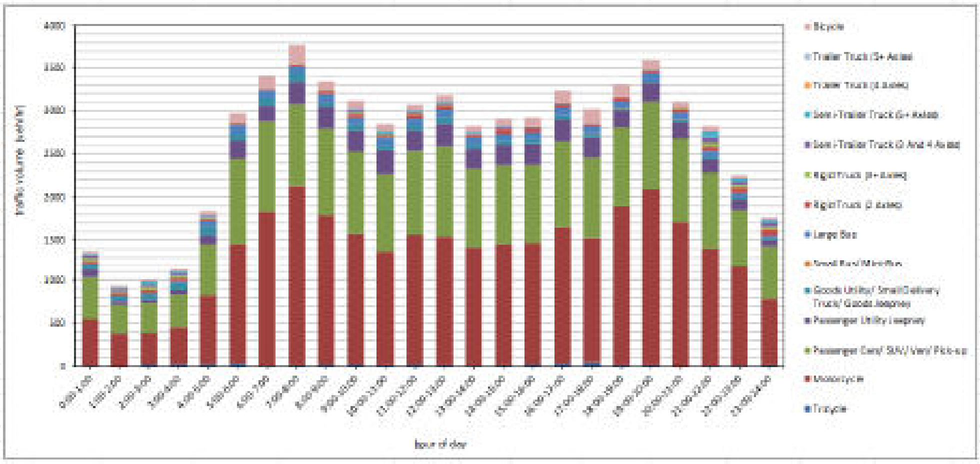


Exhibit 1-50: Traffic Volume, W1 - Aguinaldo Street, Bagac, Bataan

Traffic Volume Count Survey (Hourly Summary)		
Traffic Survey for the Bataan-Cavite Interchange Bridge Project		
U.P. National Center for Transportation Studies Foundation Inc. for TYLin-PEC JV		
Location		Date
W1: Aguinaldo Street, Bagac, Bataan		08 November 2022
Traffic Movement		(Tuesday)
Two (2) Movements (Northbound and Southbound)		Survey Period
Weather: Fair/Sunny (Partly Cloudy in Some Hours in the Morning and Afternoon)		0:00 AM - 12:00 MN

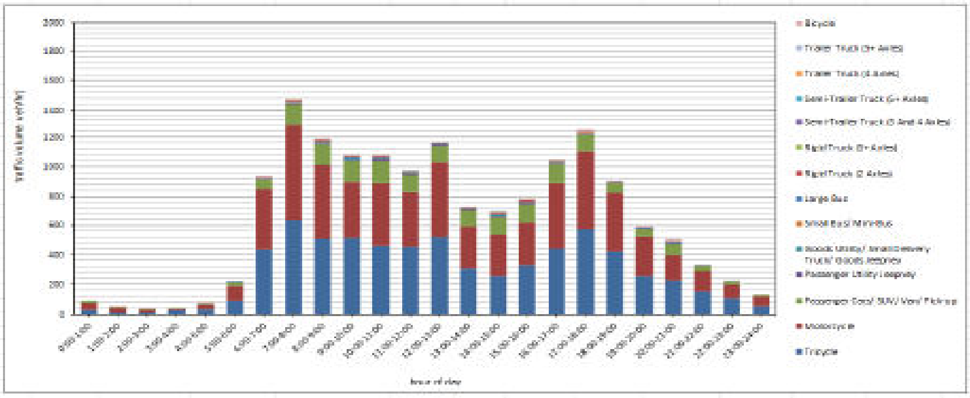


Exhibit 1-51: Traffic Volume, W2 - Roman Superhighway, Pilar, Bataan

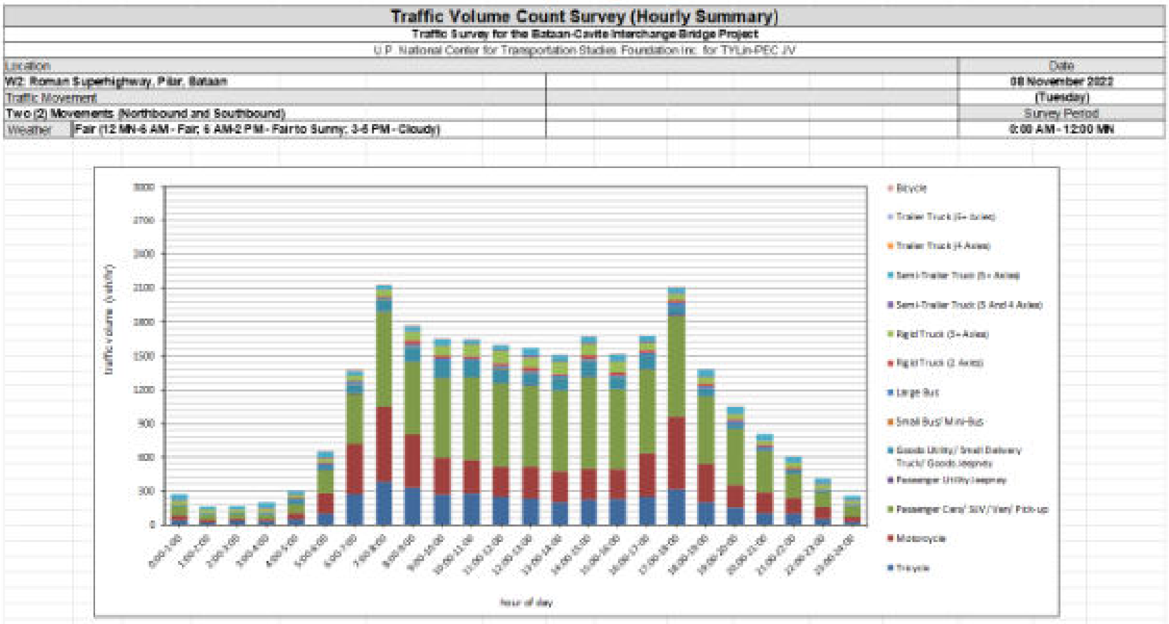
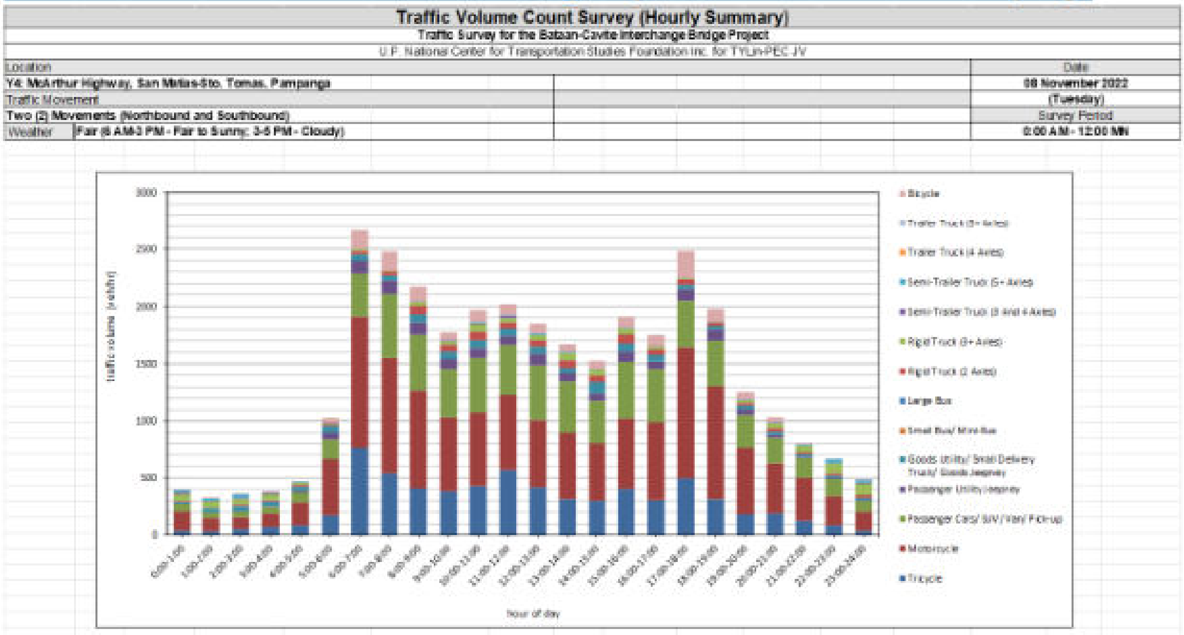


Exhibit 1-52: Traffic Volume, Y4 - McArthur Highway, San Matias-Sto Tomas, Pampanga



1.4.3 Forecast Validation

1.4.3.1 Comparison of 2019 and 2022 Survey Data

The table below presents a comparison of the 2019 traffic volume count survey data at the selected 6 stations versus the recently conducted traffic volume count survey data.

Exhibit 1-53: Traffic Volume Count Survey Data Comparison, 2019 vs 2022

No.	Survey Station	2019	2022	% Difference	Annual Growth Rate
P4	Antero Soriano Highway, Naic, Cavite	32,035	35,814	11.80%	3.79%
P6	Governor's Drive, Dasmarinas, Cavite	50,086	60,469	20.73%	6.48%

No.	Survey Station	2019	2022	% Difference	Annual Growth Rate
P10	Aguinaldo Highway, Bacoor, Cavite	55,813	63,581	13.92%	4.44%
W1	Aguinaldo Street, Bagac, Bataan	13,923	15,515	11.43%	3.67%
W2	Roman Superhighway, Pilar, Bataan	19,376	26,401	36.26%	10.86%
Y4	McArthur Highway, San Matias-Sto Tomas, Pampanga	29,240	31,780	8.69%	2.82%

This is the first step in the validation process as presented earlier. This step is a mere verification on whether there is indeed a significant growth since 2019 considering that the pandemic greatly impacted the trip patterns hence reducing the traffic volume.

Based on the hourly variation of the traffic volume in the previous chapter, it can be observed that peaks still happen during the usual morning peak (6-9) and afternoon peak (4-7) with also the usual dips during off-peak hours. Trip patterns are therefore almost back to normal as the trends in the hourly variation follow the typical traffic patterns.

On the other hand, the traffic growth rates can be compared to determine the significant change. A positive change is observed between the 2019 and the 2022 traffic data. The FS average annual traffic growth rate is around 4.10%. Moreover, the growth rate using the DPWH traffic growth rate formula estimates an average traffic growth rate of 7.97% for the period 2021-2025. The average annual traffic growth rate, as presented in Exhibit 1-53, for the period 2019-2022 is 4.90% in the Cavite area while the average annual growth rate in the Bataan and Pampanga area is 5.78%. These rates are within the estimated growth rates. Therefore, it can be deduced that there is indeed a significant growth in traffic and that traffic is nearing its normalcy.

From the validation process, it can be said that growth rates are within the acceptable ranges and that the TDM need not necessarily be recalibrated using the 2019 data as inputs for the year 2022. The forecasts of the TDM may be utilized and be validated to check the reasonableness of the estimates.

1.4.3.2 Forecast Validation

The next step in the validation process is the forecast validation wherein the 2022 estimates are compared with the current traffic volume count data. This check should ensure that the established travel demand model forecasts will reasonably reproduce the observed traffic volume counts. Otherwise, a recalibration needs to be done to the TDM.

Since the traffic volume are being validated, the specific step in the TDM to be verified is the Traffic Assignment. This also becomes a primary basis for the validation of the entirety of TDM.

To ensure the reasonability of the forecasts, a GEH statistic is employed. GEH Statistic is an empirical formula that has proven useful for a variety of traffic analysis purposes. The use of GEH as an acceptance criterion for travel demand forecasting models is recognized in the UK Highways Agency's Design Manual for Roads and Bridges, the Wisconsin microsimulation modeling guidelines, the Transport for London Traffic Modelling Guidelines and other references. The formula is presented as follows.

$$GEH = \sqrt{\frac{2(M-C)^2}{M+C}}$$

Where: M = modeled volume
C = observed volume

A GEH value of less than 5 is considered a good fit and should comprise 85% of the total observed volume. A GEH value between 5 and 10 may warrant investigation while a value of more than 10 should require a recalibration or a more understanding on the results of the forecast and the discrepancies especially in cases of extraordinary events that may have occurred before the validation year.

Exhibit 1-54 presents the GEH values at the specified locations. The value of 0.06 is achieved at the W1 station. 3 stations at the Cavite area have GEH values between 5 and 10 while W2 and Y4 stations have GEH values greater than 10.

Exhibit 1-54: 2022 Traffic Volume Comparison, Observed vs Modeled

No.	Survey Station	Observed	Modeled	GEH	% Difference
P4	Antero Soriano Highway, Naic, Cavite	35,814	37,736	10.02	5.37%
P6	Governor's Drive, Dasmarinas, Cavite	60,469	58,844	6.66	-2.69%
P10	Aguinaldo Highway, Bacoor, Cavite	63,581	66,027	9.61	3.85%
W1	Aguinaldo Street, Bagac, Bataan	15,515	15,508	0.06	-0.05%
W2	Roman Superhighway, Pilar, Bataan	26,401	24,162	14.08	-8.48%
Y4	McArthur Highway, San Matias-Sto Tomas, Pampanga	31,780	36,153	23.72	13.76%

Although the GEH values should be 10 or below to be considered as an acceptable forecast, it must be noted that due to the pandemic, traffic normalcy may not have been achieved yet but should be transitioning towards it. Also, there are only 6 volume links to compare and some of the links may contribute to the lower GEH values.

On the other hand, the % difference indicate positive values in some area as well as negative values in other area. The area with negative values may be considered to have achieved traffic normalcy since difference is below a 10% discrepancy.

Furthermore, traffic volume related checks when compared on a link-by-link basis can be done using the Root Mean Square Error (RMSE) and Percent RMSE using the following formulae:

$$RMSE = \sqrt{\frac{\sum_{i=1}^{N}(Count_i - Model_i)^2}{N}}$$

and

$$\%RMSE = \frac{RMSE}{\left(\frac{\sum_{i=1}^{N} Count_i}{N}\right)} x100$$

RMSE and %RMSE are both measures of accuracy of the traffic assignment measuring the average error between the observed and modeled traffic volumes on links with traffic counts. Based on an areawide %RMSE guideline from the Federal Highway Administration, a %RMSE value of 45% is acceptable while a 35% is preferable.

The computed %RMSE for this study area is 6.28%. This means that the forecasts are able to replicate the observed counts and that the TDM is accurate enough to estimate reliable traffic forecasts.

1.4.3.3 Perceived Traffic Normalcy

Based on the previously submitted BCIB Traffic Position Paper in April 2022, traffic is said to have dipped by 40% in EDSA and has almost reached the normal level in March 2022 by around 96%.

It was also concluded in the same Position Paper that traffic surveys are used to calibrate traffic models and validate forecast results in an ideal or normal environment. However, if the traffic surveys are undertaken during an abnormal period and situation, the forecast is prone to aberrations and distortions. In light of the still ongoing abnormal traffic patterns and volume, the Consultant therefore progressed into utilizing the existing 2019 traffic data in the FS as the basis for the tasks outlined in the TOR and to forego additional traffic surveys as originally planned and stated in the Inception report since the data collected in 2019 provide the most accurate and realistic basis for any forecasts at this point moving forward. The traffic engineers of the Design Consultants will then revise the traffic survey design to meet that objective of supporting the normalization hypothesis.

Moving forward, traffic volume count surveys were then decided to be conducted to verify the normalization hypothesis and aid in the TDM validation. Thus, this travel demand model validation exercise supports the traffic normalization phenomenon through the results presented earlier utilizing various traffic growth rate comparison as well as the determination of measures of accuracy using the GEH Statistic and the % RMSE.

The succeeding graphs below present the traffic trends for each station/location. Since the observed volume are almost the same as the forecast, it can be inferred that the year 2022 transitions to the normalization of traffic and by end of year 2023, traffic may be perceived as normal.nre

Exhibit 1-55: Traffic Forecast (orange) vs Normalization Phenomenon (blue), Station P4

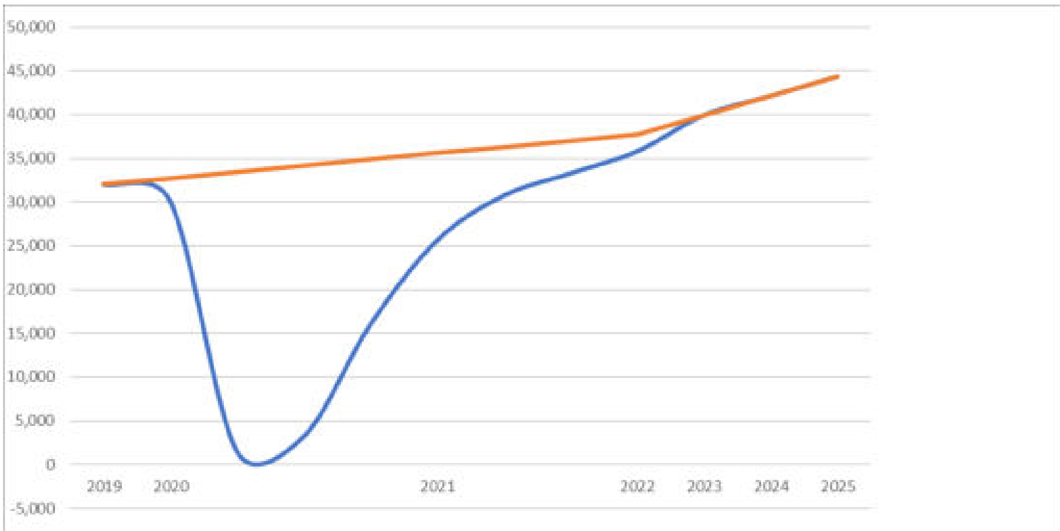


Exhibit 1-56: Traffic Forecast (orange) vs Normalization Phenomenon (blue), Station P6

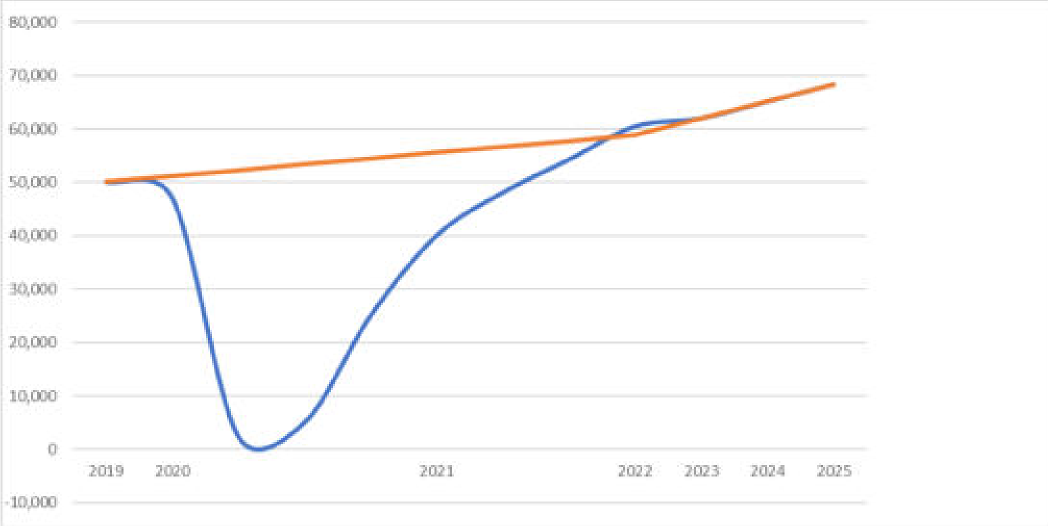


Exhibit 1-57: Traffic Forecast (orange) vs Normalization Phenomenon (blue), Station P10

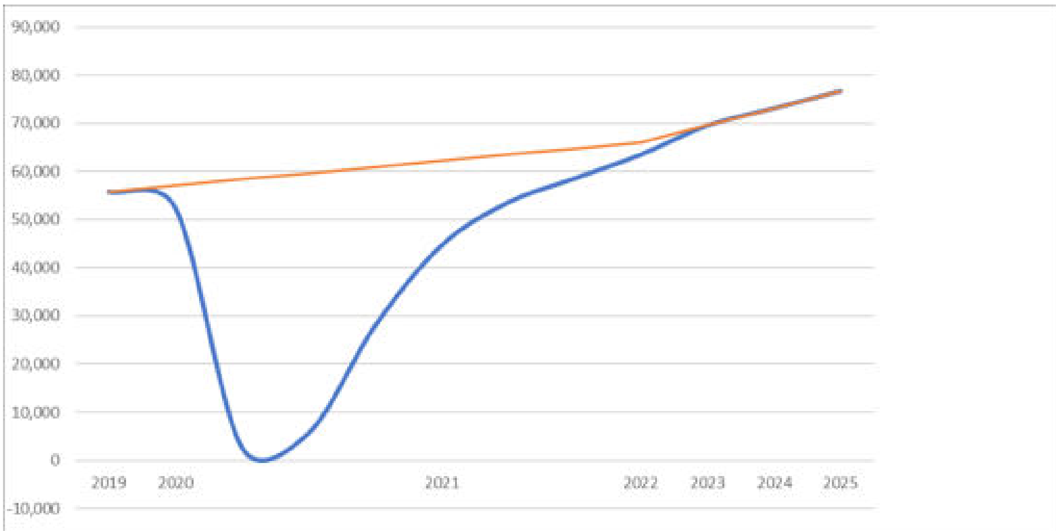


Exhibit 1-58: Traffic Forecast (orange) vs Normalization Phenomenon (blue), Station W1

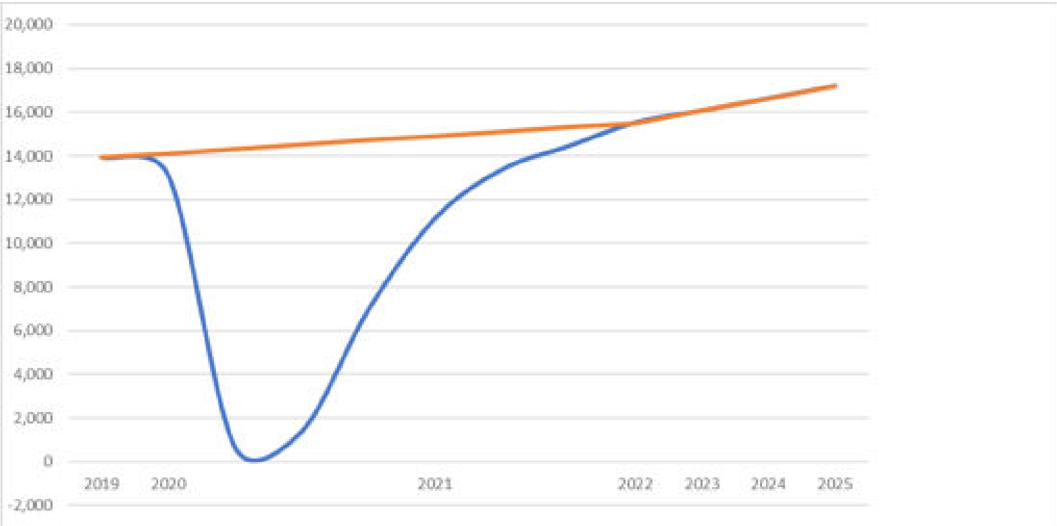


Exhibit 1-59: Traffic Forecast (orange) vs Normalization Phenomenon (blue), Station W2

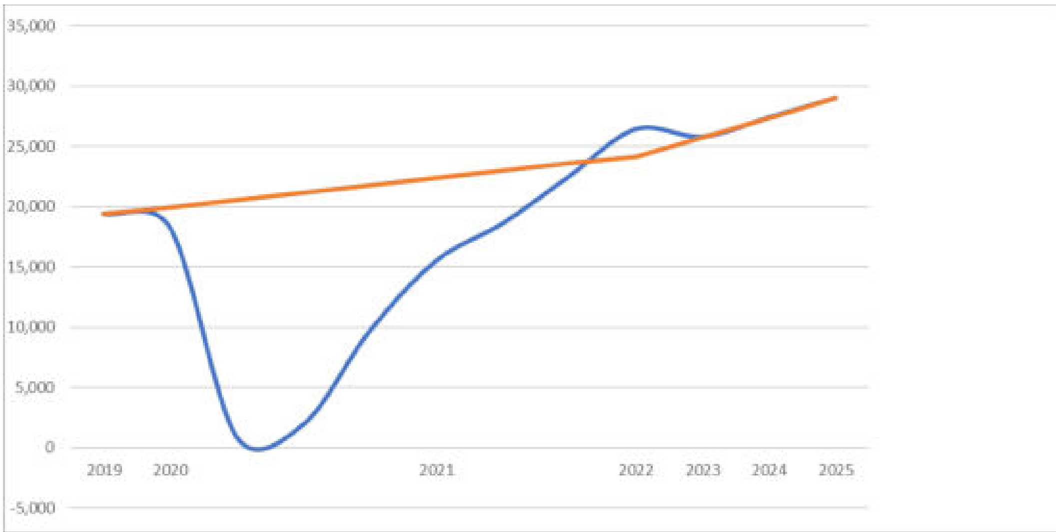
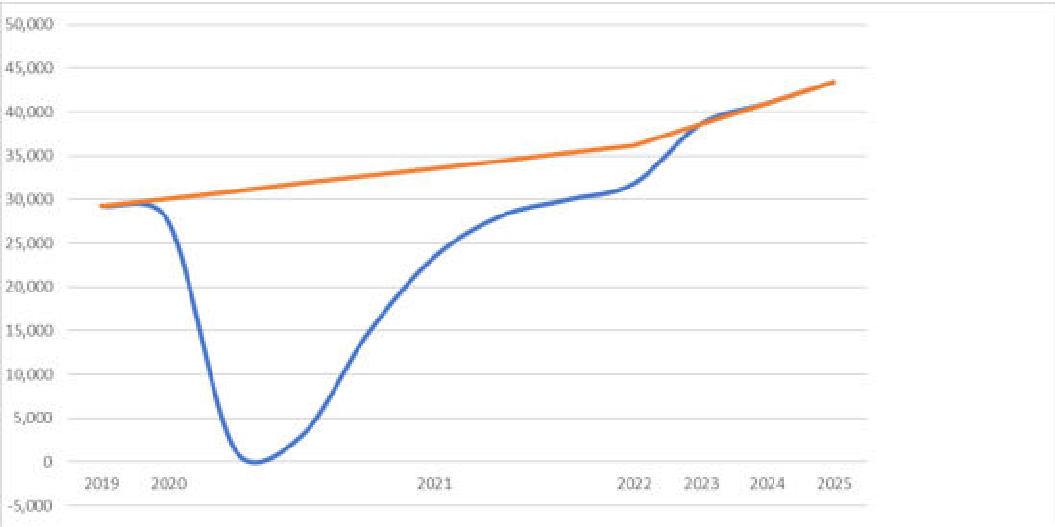


Exhibit 1-60: Traffic Forecast (orange) vs Normalization Phenomenon (blue), Station Y4



1.4.4 Conclusion and Recommendation for the Traffic Survey Revalidation

Based on the %RMSE value of 6.28%, it can be concluded that the travel demand model reasonably reflects the observed traffic volume for the year 2022. The model is reliable enough to produce accurate estimates for the rest of the forecast years.

It is also concluded that traffic normalcy may be achieved as early as year 2023 based on the validation exercise conducted.

However, it is still recommended that periodic validation be conducted to update the travel demand model. After all, forecasting is just an estimation and needs a continuous refinement to produce accurate results especially when changes are introduced that may significantly affect travel patterns and traffic volume.

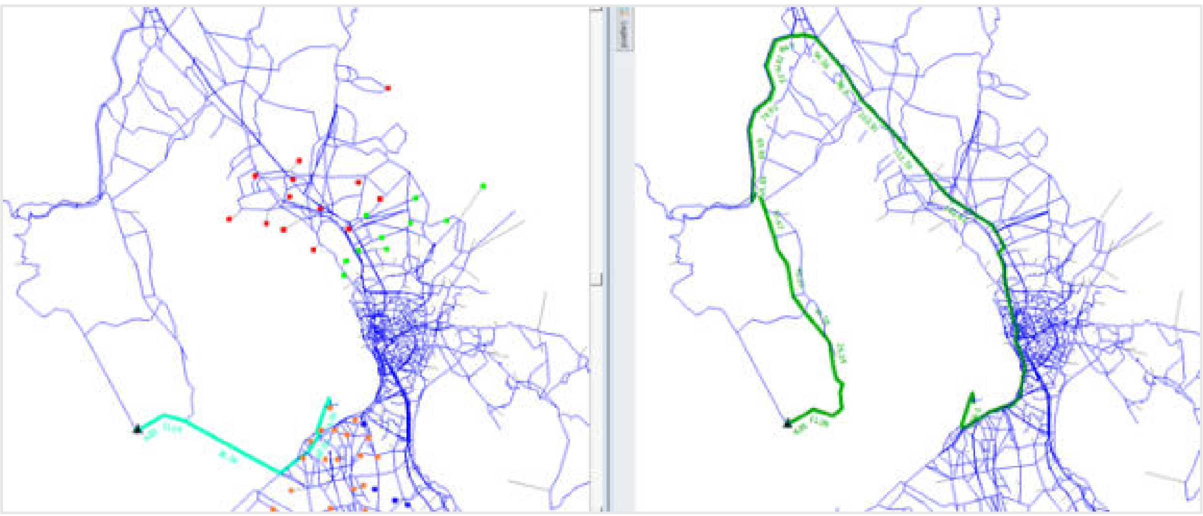
ANNEX

This section is provided as guidance in the interpretation of results out of the traffic modeling exercises for the Bataan-Cavite Interlink Bridge (BCIB) Project. This section of the report was updated based on the proceedings of the Fact-Finding Mission by the Asian Development Bank on from June 16, 2023 to July 05, 2023.

The fabric of road comprising the transport network for the BCIB is not limited to the direct impact areas in the Provinces of Bataan and Cavite. The impact is regional, to say the least, with the major arterials serving the Grater National Capital Region as the biggest beneficiary. The major arterials are defined as the SCTEX, NLEX, EDSA/Skyway Stage 3, SLEX, CALAX, and Cavitex. However, there is no direct measure of traffic diversion from these arterials to the BCIB since the urban setting possesses high demand for mobility. Hence, any road space freed up due to the BCIB is easily replaced by other sets of traffic from secondary arterials. Therefore, the optimum process to measure the impact of the BCIB on major arterials is presented in the following figures and tables. This measure is through person kilometers and person minutes to account for the differences in average travel distance and time due to the aggregation of the Traffic Analysis Zones (TAZ). Overall, the BCIB will generate new set of traffic (called latent demand) due to changes in land uses and indirect diversion from other arterials. Despite the potential to unlock latent traffic demand, the following tables and charts illustrate the overall improvement in travel time and speed generally in the macro-simulation area.

Exhibit 1-61 presents the travel route from a particular TAZ in Bataan towards Cavite through the BCIB (left network) compared to the usual route through NLEX-Metro Manila-Antero Soriano Highway (right map). This represents the main travel time benefit brought about by the BCIB, having a shorter travel distance.

Exhibit 1-61: Bataan-Cavite Travel Route Comparison with and without BCIB



However, in analyzing trip distances for other areas due to the aggregation of zones patterned from the economic model, this equates to weighted average distances as presented in Exhibit 1-62. It may seem that the route traveled between Bataan and Pampanga for without BCIB produce shorter distances than with the BCIB. This should not be interpreted as lesser traveled distance but should be considered as computational averaging when overall vehicle kilometers are divided by the respective total trips. Therefore, from the finer zoning analysis, similar trip distances between OD pairs not utilizing the BCIB should still be maintained for with and without the BCIB in place.

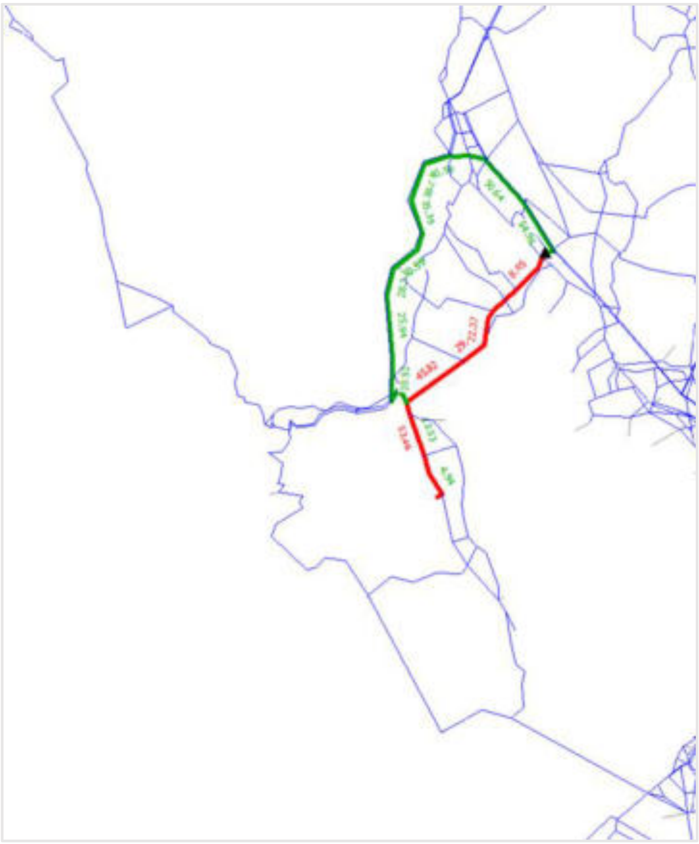
Exhibit 1-62: Average Distance Comparison between Fine and Aggregated TAZ

with project			
Bataan to	Pampanga		
	carkm	cars	distance
409	95,933.96	775.60	123.69
433	8,837.87	94.10	93.92
434	49,622.55	729.10	68.06
436	48,708.04	517.40	94.14
437	10,032.94	94.10	106.62
438	39,710.45	517.40	76.75
Aggregated	252,845.81	2,727.70	92.70

without project			
Bataan to	Pampanga		
	carkm	cars	distance
409	49,455.96	399.84	123.69
433	8,835.99	94.08	93.92
434	49,623.64	729.12	68.06
436	48,711.52	517.44	94.14
437	10,030.81	94.08	106.62
438	39,713.29	517.44	76.75
Aggregated	206,371.21	2,352.00	87.74

Furthermore, as presented in Exhibit 1-63, there may be instances where directional routes taken between OD pairs vary. Depending on the congestion level in the iteration during the assignment phase for a particular time period, the path from NLEX and SCTEX may be better towards Bataan while from Bataan towards NLEX, the non-toll road may be preferred.

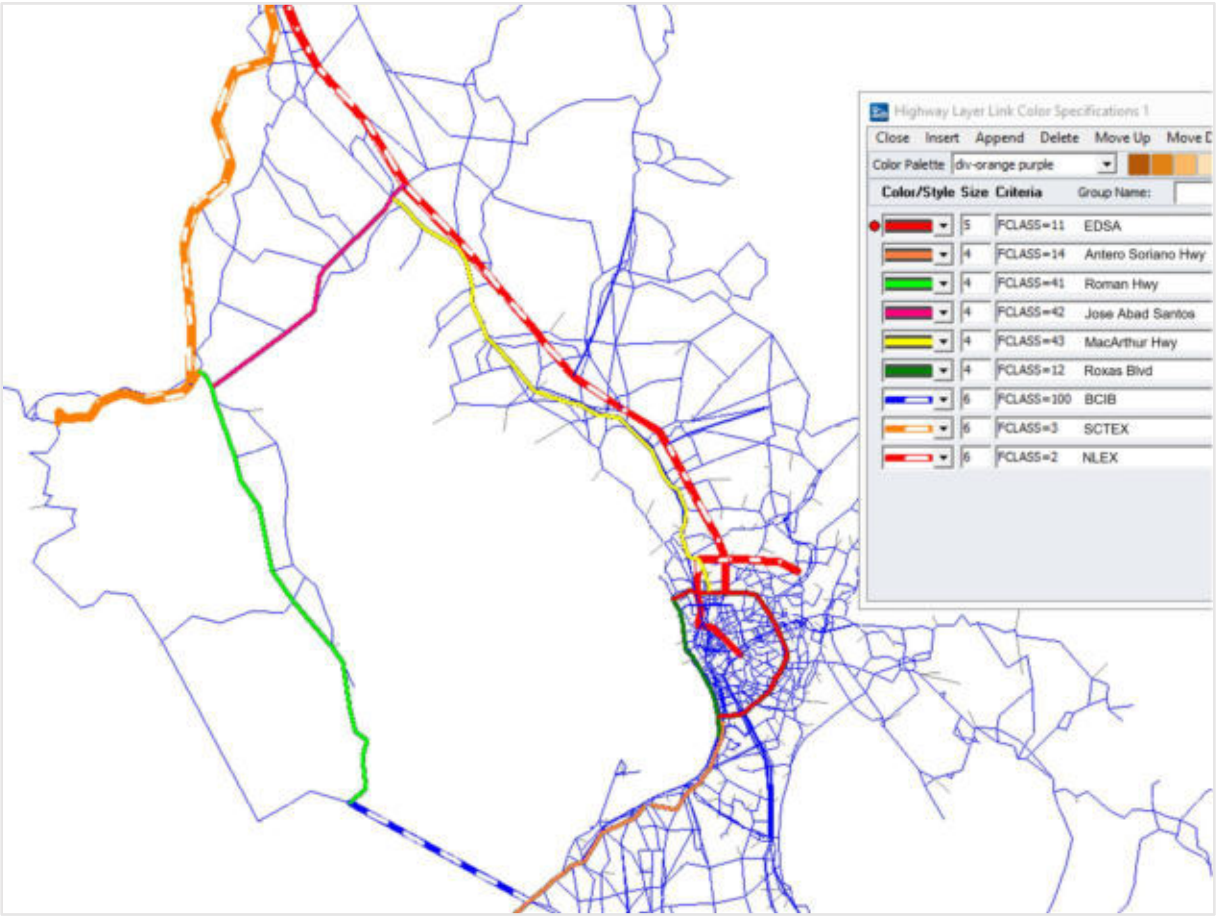
Exhibit 1-63: OD Pair Directional Distance Variation



1.1 Transport Network Update

In the evaluation of the transport network, several projects were integrated. The road network of the model consists of nodes and links. These link attributes are important and critical in the highway assignment later in the simulation process. Highlighted in the figure below are the main road links to and from Cavite to Bataan, with the striped blue and white representing the BCIB. The solid orange, yellow, red and green links are the non-toll roads while the striped red and striped orange links are expressways. Highlighted also in red is EDSA. However, the model forecast specifically analyzed the proposed Bataan-Cavite link bridge as an individual project, separate from other highway projects.

Exhibit 1-64: Updated 2035 Model Network



1.2 Transport Model Scenarios[1]

Similar to the model scenarios in the feasibility study, the peak hour forecast was adopted to allow peak hour traffic analysis of Base Case. With BCIB in place, the change of traffic along the relevant existing corridors of Bataan and Cavite traffic were analyzed.

[1] Derived from the Bataan - Cavite Interlink Bridge (BCIB) Project B10 Final Feasibility Study Report

To analyze the traffic patterns during peak hours in the Base Case, the peak hour forecast was utilized. The presence of the Bataan-Cavite link bridge (BCIB) prompted an examination of the traffic changes along the relevant existing corridors of Bataan and Cavite.

A series of scenarios were carried out to assess the traffic demand for the proposed BCIB and the performance of key roads under the Base Case. These scenarios encompassed the following:

- Year 2025 without the project (excluding BCIB)
- Year 2025 with the project (including BCIB)
- Year 2035 without the project (excluding BCIB)
- Year 2035 with the project (including BCIB)

By comparing the model forecast between the "without project" and "with project" scenarios, the impact of BCIB on traffic was evaluated.

Exhibit 1-65: Network Traffic Comparison (With project - Without Project) for 2025 AM

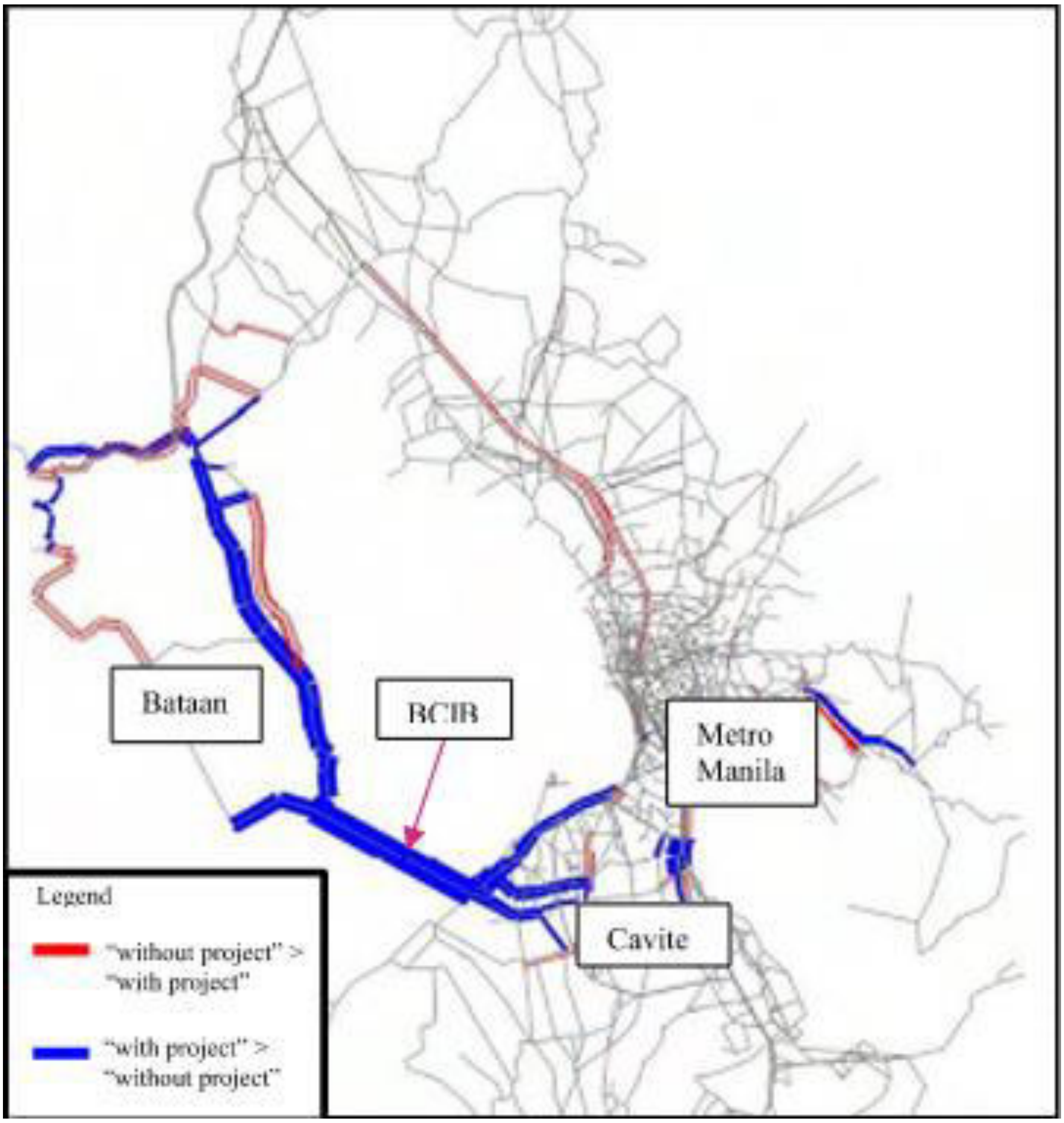
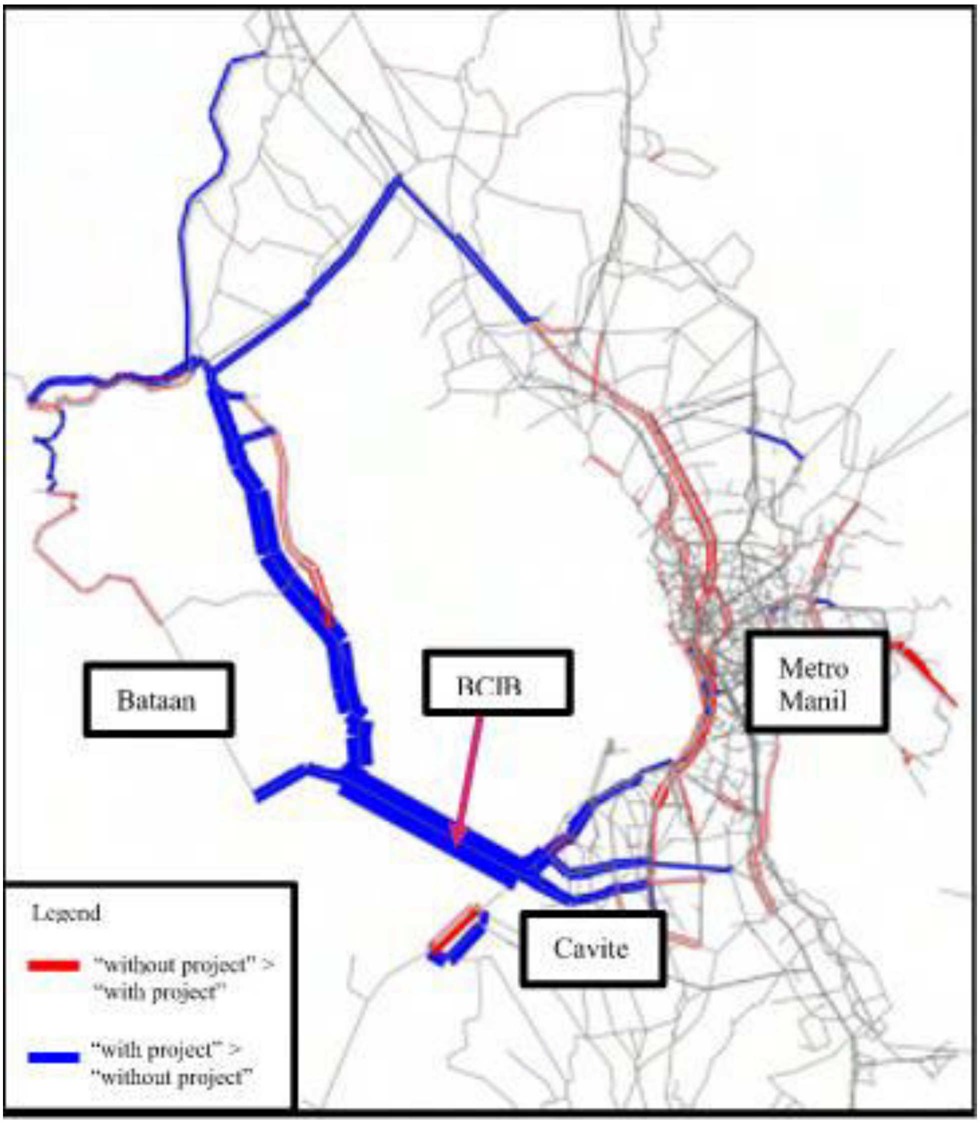


Exhibit 1-66: Network Traffic Comparison (With Project - Without Project) for 2035 AM



In general, the findings suggest that the implementation of BCIB will not lead to significant changes in the traffic pattern within the modeled area. BCIB primarily improves the connectivity between Bataan and Cavite, with minimal impact on traffic movements between other provinces.

The network comparison reveals that a considerable portion of BCIB traffic will be directed towards Cavite, while the remaining traffic on the Cavite side will be dispersed among Antero Soriano Highway (Road R-1) and across other existing and new roads in the north-south and east-west direction. On the Bataan side, the BCIB traffic will predominantly flow into the Bataan area. This traffic distribution pattern remains consistent during both the 2025 and 2035 AM peak hours.

The road network on both the Bataan and Cavite sides will experience increased traffic with the implementation of the project. To assess the road performance in terms of volume/capacity ratio during the 2025 and 2035 AM peak hours, comparisons were made between the "without project" and "with project" cases. The findings and analysis of these assessments are presented in Exhibit 1-67 to Exhibit 1-70.

Exhibit 1-67: Network Performance in V/C ratio for 2025 AM "without project" case

Exhibit 1-68: Network Performance in V/C ratio for 2025 AM "with project" case

Exhibit 1-69: Network Performance in V/C ration for 2035 AM "without project" case

Exhibit 1-70: Network Performance in V/C ration for 2035 AM "with project" case

In the "without project" scenario, Roman Superhighway (Road R301) on the Bataan side is expected to maintain a volume/capacity (V/C) ratio of 1.0 in both 2025 and 2035. On the Cavite side, Road R-1 generally operates within a V/C ratio of 1.0 in 2025 and 2035, although certain localized sections may exceed 1.2. The V/C ratio for Road R-1 is calculated considering only one effective traffic lane, as the nearside lane is typically occupied due to various street activities observed on-site.

With the direct connection of BCIB to Road R-1 on the Cavite side, it is anticipated that two traffic lanes in each direction along Road R-1 should be maintained to accommodate the BCIB traffic. Similarly, for the BCIB connection on the Bataan side, two traffic lanes in each direction along Road R301 (Bataan Provincial Highway) should be allowed to handle the BCIB traffic.

The assessment of the V/C ratio in the "with project" scenario indicates that during the 2025 AM peak hour, the main roads on the Bataan and Cavite sides will generally operate below a V/C ratio of 0.7. Assuming two effective traffic lanes are in operation on Road R-1 when BCIB is implemented (with no street activities occupying the nearside lane), the road capacity at the immediate sections connecting to BCIB would be enhanced. As a result, the V/C ratio of Road R-1 would decrease from over 1.2 in the "without project" scenario to below 1.0 in the "with project" scenario. Overall, the traffic on the main roads would be effectively manageable.

In the 2035 AM peak hour of the "with project" scenario, the road network is expected to experience increased traffic. However, the main roads in Bataan and Cavite would generally operate with a V/C ratio below 1.0, indicating manageable traffic conditions. It is anticipated that a short section at the landing point of BCIB, despite having two effective traffic lanes on Road R-1, would still operate at a V/C ratio exceeding 1.2, resulting in significant congestion. Similarly, Road R301 in northern Bataan would also have a V/C ratio below 1.2, leading to some traffic delays.

Comparing the "with project" scenario to the "without project" scenario, it can be observed that the V/C ratio in Cavite remains similar, indicating that the project does not contribute to increased traffic congestion. However, for both scenarios, it is necessary for relevant authorities to consider and develop further road improvement measures along Road R-1 in the long term. In Bataan, the implementation of the project would lead to increased traffic volume, necessitating additional road improvement measures along Road R301 to support economic development. These measures should be considered and developed by the appropriate authorities in the future.

ANNEX 9: NOISE IMPACT ASSESSMENT (NOVEMBER 2023)

Republic of the Philippines
Department of Public Works and Highways

ADB ASIAN DEVELOPMENT BANK

Bataan-Cavite Interlink Bridge Project

Noise Assessment

November 08, 2023

Prepared By:

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Revision: 01

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Date	Description	Revision	Originator	Reviewer	Approver
2023-11-08	Issue for Coordination	00	Charlon Gonzales (Ecosys)	Jodi Ketelsen (TYLI)	Marwan Nader (TYLI/ PEC JV)
2023-11-08	Complete Report submittal	01	Robert Rodland (TYLI)	Jodi Ketelsen (TYLI)	Marwan Nader (TYLI/ PEC JV)

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Table of Contents

List of Tables

List of Figures

1 INTRODUCTION

A noise assessment was conducted to identify the potential for impacts from the proposed Bataan-Cavite Interlink Bridge (BCIB) located in the provinces of Bataan and Cavite during construction and operation phases. The noise assessment was prepared in accordance with the International Finance Corporation's Environmental, Health, and Safety (EHS) Guidelines on Noise Management and consistent the Federal Transit Administration's (FTA) Transit Noise and Vibration Impact Assessment. Soundplan version 8.2 was the noise model utilized in the study following the Transit Noise Model 2.5/3.0 standards.

This assessment utilizes the noise baseline measurements conducted in 2020 and 2021. Ground elevation, projected traffic, and construction activities and equipment were taken from the feasibility study and preliminary engineering designs to generate noise modelling scenarios and evaluate potential mitigation measures. The assessment criteria adopted the ADB requirement of no net increase in ambient noise levels of more than 3dB(A) at nearest sensitive sites because of the project (equally applicable to areas with ambient noise levels exceeding the relevant noise standard at pre-project stage).

2 NOISE ASSESSMENT

This section provides key features of relevant environmental laws and regulations, and international guide values that were used as criteria values in this noise assessment. A more detailed and comprehensive description particularly on the domestic standards are provided in Chapter 2 (Policy, Legal, and Administrative Framework) of the EIA.

2.1 National Laws, Regulations, and Guidelines

Presidential Decree (PD) 984 the Pollution Control Law (1976) defined pollution while PD 1152, the Philippine Environmental Code (1977) required the establishment of community noise and noise-producing equipment standards and for standards for noise-producing equipment. The 1978 implementing rules and regulations of PD 984 and provided the national noise standards.

- In 1980, the government amended the noise regulation and further qualified the standards and required: i) noise sources to be no greater than the ambient noise, ii) noise levels should not cause adverse effect to the public, iii) ambient noise level limit may be increased by 5 dB(A) in areas directly fronting or facing a four-lane road, or by 10 dB(A) on wider roads, and redefined Categories B, C, and D as areas zoned or reserved for commercial, light industrial, and heavy industrial uses.

Table 1: Environmental Quality Standards for Noise in General Areas (NPC 1980)

Category	Maximum Allowable Noise (dBA) by time periods		
	Daytime (9:00AM-6:00PM)	Morning/Evening (5:00AM-9:00AM/ 6:00PM-10:00PM)	Nighttime (10:00PM-6:00AM)
AA	50	45	40
A	55	50	45
B	65	60	55
C	70	65	60
D	75	70	65
Noise Standards for Areas Directly Fronting or Facing a Four-Lane or Wider Road			
AA	60	55	50
A	65	60	55
B	75	70	65
C	80	75	70
D	85	80	75

- *Class AA - a section of contiguous area which requires quietness, such as areas within 100 meters from school site, nursery schools, and special house for the elderly.*
- *Class A - a section of contiguous area which is primarily used for residential area.*

- *Class B - a section of contiguous area which is primarily a commercial area.*
- *Class C – a section of contiguous area reserved as light industrial area.*
- *Class D – a section which is primarily reserved for heavy industrial area.*

2.1.1 Occupational Noise Standards

The Philippine Department of Labor and Employment's prescribed noise limits for construction workers is provided in Table 2. Table 2 provides information on the averaging times of 0.25-8 hours and noise levels during the duration provided that the peak noise levels will not exceed 140 dB(A). Refer to Section 8.2.2 of the EIA for additional information.

Table 2: Permissible Noise Level, Department of Labor and Employment

Duration per day, hours	Sound levels, slow response
8	90
6	92
4	95
3	97
2	100
1.5	102
1	105
0.5	110
0.25	115

2.1.2 Noise as Nuisance

Noise as nuisance is defined in two national statues namely, the Civil Code and The Local Government Code. The Civil Code of the Philippines, Republic Act 386 (1949), Art. 682 provide that … "Every building or piece of land is subject to the easement which prohibits the proprietor or possessor from committing nuisance through noise, jarring, offensive odor, smoke, heat, dust, water, glare and other causes." While the Local Government Code, RA 7160 (1991) empowered barangay officials to "enforce laws and regulations relating to pollution control and protection of the environment" and "promote the general welfare of the barangay" through ordinances, zoning restrictions and local licensing requirements.

2.1.3 World Bank Group's Environmental, Health, and Safety Guideline on Noise Management

The ADB's Safeguard Policy Statement (2009) requires that all projects supported by ADB must apply pollution prevention and control technologies and practices consistent with international good practices as reflected in internationally recognized standards such as the IFC's Environmental, Health and Safety Guidelines on Noise Management (IFC EHS Guidelines 2007).

The IFC EHS Guidelines prescribe that noise prevention and mitigation measures should be applied where predicted or measured noise impacts from a project facility or operations exceed the applicable noise level guidelines at the most sensitive point of reception. The IFC EHS Guidelines further stipulate that noise impacts should not exceed the levels presented in Table 3 or result in a maximum increase in background levels of 3 dB at the nearest receptor location off-site. The IFC EHS Guidelines values are for noise levels measured out of doors, and are based on Guidelines for Community Noise, World Health Organization (WHO), 1999.

Table 3: IFC EHS (Noise Level) Guidelines

Receptor	One Hour Leq dB(A)	
	Daytime, 07:00-22:00	Nighttime, 22:00-07:00
Residential; institutional; educational	55	45
Industrial; commercial	70	70

2.2 Noise Levels

2.2.1 Ambient Noise Level

Section 7.1.4, Ambient Noise and Vibration, of the EIA provides the ambient noise measurements in the project area which were conducted in February 2020 and November 2021 approximating the dry and wet seasons characterization as required by national EIA regulations. Key findings from the ambient baseline measurements are as follow:

- In 2020, 11 measurements were done (5 in Mariveles and 6 in Naic). This was supplemented in November 2021 when 6 additional measurements were made with 3 each in Mariveles and Naic.
- Noise measurement was carried out using Lutron Sound Level Meter instead of a dosimeter, equivalent noise levels (Leq) were calculated in 4 time slices; 0500-0900 (Morning), 0900-1800 (Daytime), 1800-2200 (Evening), and 2200-0500 (Nighttime) to allow comparison with national standards.
- Measured ambient noise were compared to the national standards[1] and international guide values[2]. Ambient noise as measured in Bataan is generally not within the

[1] National Pollution Control Commission (NPCC) Memorandum Circular No. 002 Series of 1980, Section 78 – Ambient Noise Quality and Emission Standards for Noise.
[2] IFC EHS Guidelines – Noise Management (2007)

guideline values. Out of 32 sampled noise periods, exceedances were found in 26 periods, with 20 of these sampling periods involving exceedances of both the national and IFC guideline values. Exceedances of the relevant national guideline value averaged 7.7 dBA. Similarly in Cavite, ambient noise as measured is generally not within the guideline values. Out of 36 sampled periods, exceedances were documented in 32 periods, 24 of the sampled periods exceeded both the NPCC and IFC guideline values. Exceedances of the relevant NPCC guideline value averaged 8.0 dBA.

3 NOISE IMPACT ASSESSMENT

Noise Basics. According to the FTA (2018), sound is defined as small changes in air pressure above and below the standard atmospheric pressure and noise is usually considered to be unwanted sounds. The three parameters that define noise include:

- **Level**: The level of sound is the magnitude of air pressure change above and below atmospheric pressure and is expressed in decibels (dB). Typical sounds fall within a range between 0 dB (the lower limits of human hearing) and 120 dB (the highest sound levels experienced in the environment). A 3-dB change in sound level is perceived as a barely noticeable change outdoors. A change by 5 dB(A) are clearly noticeable and a 10-dB change in sound level is perceived as a doubling (or halving) of the sound level.

- **Frequency**: The frequency (pitch or tone) of sound is the rate of air pressure changes and is expressed in cycles per second, or Hertz (Hz). Human ears can detect a wide range of frequencies from around 20 Hz to 20,000 Hz; however, human hearing is not effective at high and low frequencies, and the A-weighting system (dBA) is used to correlate with human response to noise. The A-weighted sound level has been widely adopted by acousticians as the most appropriate descriptor for environmental noise.

- **Time Pattern**: Because environmental noise is constantly changing, it is common to condense all this information into a single number, called the "equivalent" sound level (Leq). The Leq represents the changing sound level over a period, representing a typical 1-hour period.

The succeeding noise assessment followed the procedure described in Section 4 of US FTA Transit Noise and Vibration Impact Assessment Manual, except for the criteria standards where the IFC guide values were adopted as provided in the ADB SPS 2009. The assessment was based on the following:

- Assessment criteria adopted is consistent with the IFC's allowable 3 dB increase over the baseline level. The national standards and WBG EHS noise level guidelines were not used as assessment criteria as they provide no guidance in situations where the measured baseline (ambient) already exceeds the prescribed limits. As described in Section 2.2.1, the noise measurements in the project area indicated ambient baseline noise exceeds the national and IFC noise limits at most of the sampled locations.

- The noise impacts are exclusively from the project and noise from the Roman and Antero Sorianos Highways were not assessed and instead considered as part of ambient baseline noise.

- To capture the potential impacts from the project, the screening distance for the noise assessment was conservatively set at 160 m or about 500 feet for operational noise and 100 m or about 325 feet for construction noise.

- Within the screening distance, reckoned from the road centerline, the terrain heights were taken primarily taken from Project's LIDAR survey. There were, however, gaps as illustrated in Figure 1. Interferometric synthetic aperture radar (IFSAR) data obtained from the Philippine National Mapping and Resource Information Authority (NAMRIA), raster files generated from LIDAR data from the UP DREAM LIPAD project (LiPAD - LiDAR Portal for Archiving and Distribution (upd.edu.ph)), and SRTM90 files (Shuttle Radar Topography Mission from Earthdata) were downloaded from the previous PhilGis website and used to fill the gaps.

- Buildings (houses and other structures) were generated from Open Street Map and overlayed in Google Earth. These two sources were overlayed and identified gaps were digitized to ensure a comprehensive accounting of the buildings is considered in the assessment. Building heights were extrapolated from the number of building storey for each structure. The ground floor is assumed to be 3.5 meters high and succeeding floors are 3 meters. For Bataan, 455 buildings were generated from OSM and an additional 91 buildings from Google Earth (total of 546 buildings). For Cavite, OSM buildings were 254 and additional from Google Earth was 41 (total of 295 buildings).

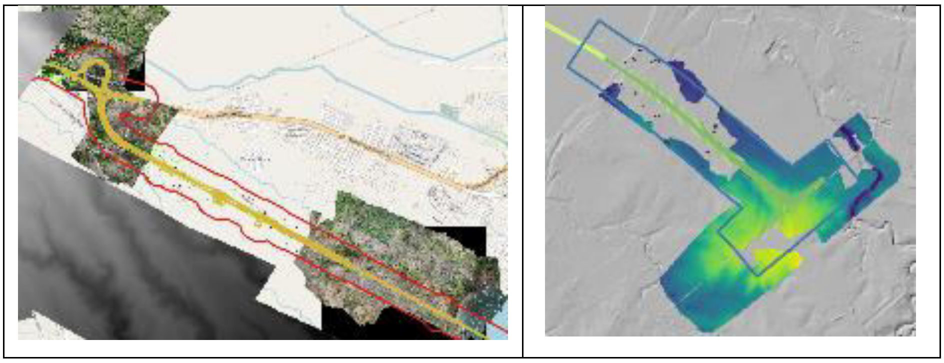
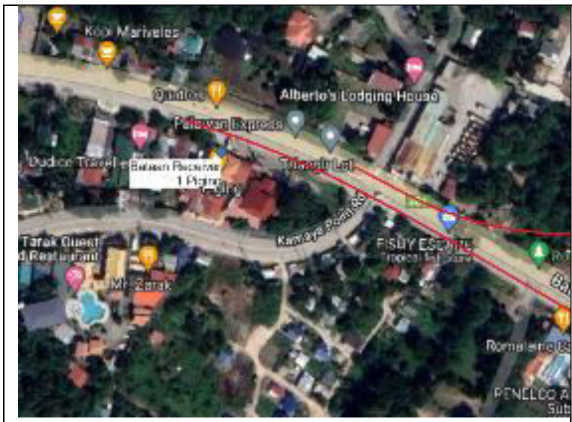


Figure 1: Illustrated Terrain Data Available from the Project Within the Screening Distance

3.1 Noise Sensitive Receiver Identification

Among the buildings circumscribed in the screening distance, noise sensitive receivers were identified based on the following: i) vulnerability based on distance from the project road alignment (i.e. the nearest or a representative of row of buildings using a screening distance of 160 meters); ii) representative of land use type to include high sensitivity that are required to maintain serenity and quiet (examples are theaters, historical landmarks, and recording studios), residential where people usually sleep, and institutional (examples are schools, libraries, churches).

A total of 7 representative noise sensitive receivers were identified in Bataan and 8 in Cavite. These noise sensitive receivers are representative receivers of the area around each of the selected locations. In Bataan, most of the sensitive receivers are located near the western section of the interchange particularly the merge lane between the existing Roman Highway and Ramp 1 (Figure 2). In Cavite, most of the receivers are located along the Project's main line (Figure 3).



Piging Restaurant Near the start of Ramp 1 and Roman Highway

Grace Inn (Hotel) near Ramp 1

Albertos Lodging House and a Residential Noise Sensitive Receptor at the Junction of Roman Highway and Ramp 1

PENELCO Alas-Asin Substation Along the Roman Highway


Residential Receptor near the Bataan Main Line

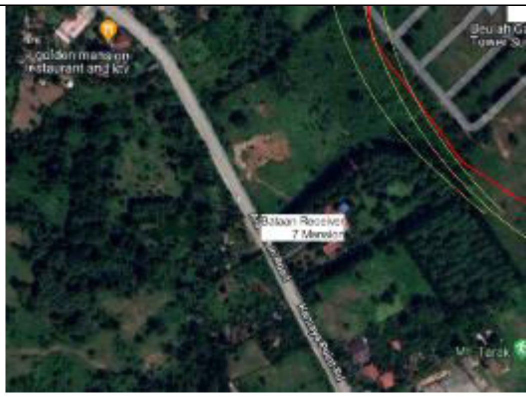
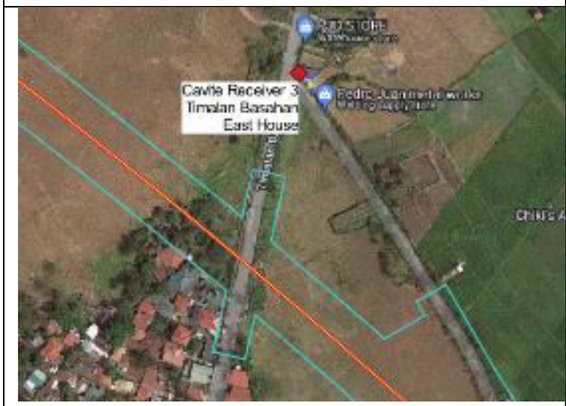

Residential Receptor (Mansion) Located Near the Bataan Main Line

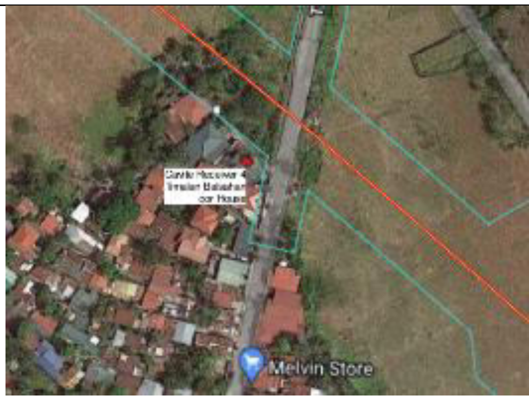
Figure 2: Location of the Representative Noise-Sensitive Receptors on Bataan-Side

Residential Receptor Near the Beach Area Along the Edge of the Construction Limit North Bound Road

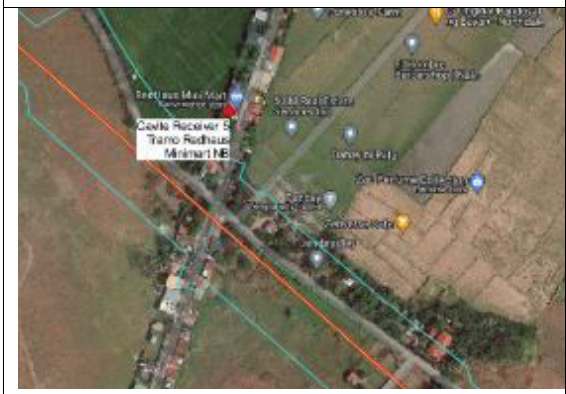
Residential Receptor Represents the Nearest Row of the Houses on the West Near the Beach



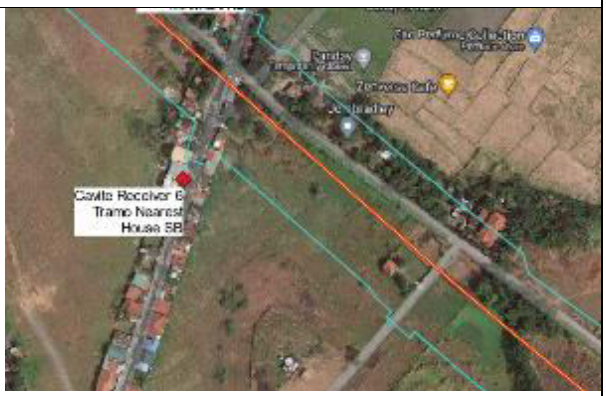
Nearest Residence East of the Alignment Along the Timalan-Basahan Road



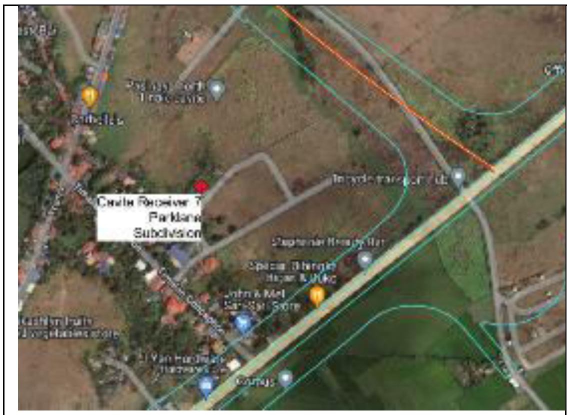
Nearest Residence West of the Alignment Along the Timalan-Basahan Road



Tramo Redhouse the Nearest Residence from the NB Main Road and Tramo Road



Nearest Residence from the SB Main Road and Tramo Road



Parklane Subdivision

LTO Building Near the Interchange

St Claire Homes near the Southern Tip of the Interchange

Timalan Conception Nearest Residence

Figure 3: Location of the Representative Noise-Sensitive Receptors in Cavite-Side

3.2 Noise Source

3.2.1 Construction

A general construction method and process is provided in Section 3.7, Construction, in the Project Description of the EIA. Construction is expected to last 5 years and will be implemented into a series of construction packages for linear sections of the Project and not necessarily following the same construction phasing.

At the time of assessment detailed construction phases and methodology are not available. Instead, the generalized construction phase was referred to infer the land-based construction activity and corresponding equipment that will be used simultaneous that is expected to generate the most severe noise impacts to identified noise-sensitive receivers. The generalized construction phase is discussed in Section 3.7.1, Construction Phasing, in the EIA and highlighted as follows:

- **Pre-Construction**. The nature of the activities during pre-construction phase that mainly pertains to land acquisition, permitting, planning, and consultations will have no to minimal impacts on noise. This activity was excluded in the noise assessment.

- **Mobilization** activities, particularly the land clearing, excavation/land filling, hauling, and earth shaping will require intensive use of heavy equipment and expected to generate significant noise impacts. The casting works in Bataan are also anticipated to generate high noise level. During the construction of the casting yards, typical earth moving and paving equipment will be utilized. During casting yard operation, noise generating sub-activities include batching plant and aggregate storage; casting and storage of footing soffit and cantilever spans. Also, general storage activities for casted materials, rebars, pipe piles, and general warehousing are expected to generate noise. Finally, the gantry cranes operation to load the casted materials to the heavy lift vessel will generate noise impacts.

- **Substructure construction activities**. These activities include installation of pile foundations for the bridges, viaducts, and interchanges. The activities will be located along or near the shore and were considered in the assessment. All construction activities located in the marine area are excluded in the noise assessment.

- **Superstructure construction activities.** The casting of the 40, 23, and 24 m viaduct spans will be done in the casting yards. The casting yard typically involves the following: delivery and storage, concrete batching plant, rebar cage assembly, casting cells, curing, and segment storage. Two areas were identified as casting yards.

- **Roadway and associated fixtures.** This activity involves the construction of roadway, interchange, drainage, and under-crossings among others. Significant noise impacts are anticipated during excavation, grading, and paving activities.

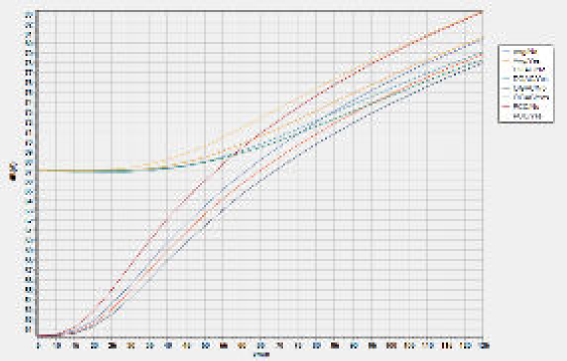
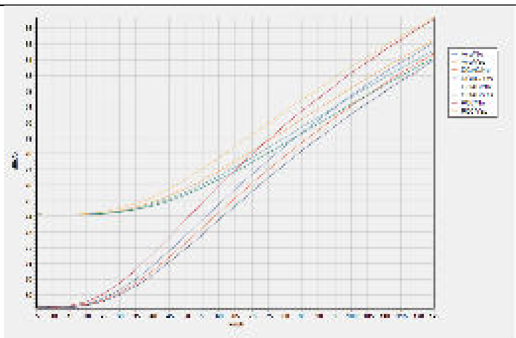
Construction Noise Sources: An initial estimate of construction equipment needed was provided in the EIA Report and from this the following equipment are likely to be used during mobilization phase which is anticipated to the dominant source of noise impacts considering the scale of work, the number of equipment, and proximity to noise sensitive receptors. Table 4 provides information on the construction equipment noise level for equipment that could be used for the project. An important condition that will be limit noise-generating works after 2000 hrs (9:00 pm) to avoid disturbance.

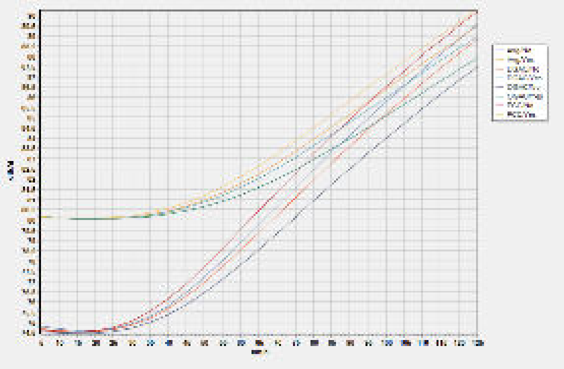
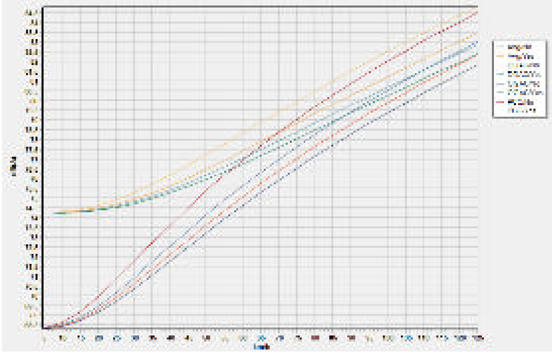
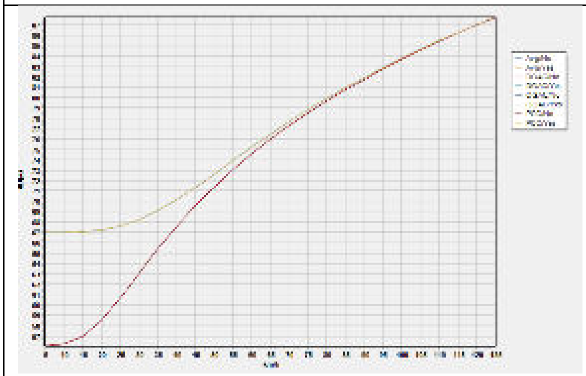
Table 4: Construction Equipment Noise Level (dBA) at 15 meters (50 ft.)

Equipment	Typical Noise Level 15m/50ft from Source, dBA
Truck	84
Air Compressor	80
Backhoe	80
Compactor	82
Concrete Mixer	85

Equipment	Typical Noise Level 15m/50ft from Source, dBA
Concrete Pump	82
Dozer	85
Generator	82
Grader	85
Impact Wrench	85
Jack Hammer	88
Loader	80
Paver	85
Pile-driver (Sonic)	95
Pneumatic Tool	85
Pump	77
Rock Drill	95
Roller	85
Saw	76
Scraper	85
Shovel	82
Source: FTA Transit and Vibration Impact Assessment Manual (2018)	

Operation Noise Sources. Figure 4 presents the speed dependent noise emission for each type of vehicle based on different pavement types. Individual noise-speed curves were developed for different types of pavement types, namely: dense-graded asphaltic concrete (DGAC), open-graded asphaltic concrete (OGAC), and Portland cement concrete (PCC).

	
Automobile	Medium Truck

	
Heavy Truck	Bus
	
Motorcycle	

Source: FTA, Transit Noise Model 2.5

Figure 4: Noise-Speed Curves for Various Types of Pavements

3.2.2 Operation

Road traffic is the principal noise source during the project operation. Peak hour volume of traffic for the day and night times were interpolated at 12% of the average annual daily traffic and 70% and 30% for the respective time slices. Travel speeds were assumed at 80 kph for cars, 60 kph for buses, motorcycles, PUJ, bus, trucks. Table 5 provides information on the projected average annual daily traffic volumes for 2030 and 2050 by roadway sections and Table 6 provides information on the day and night peak hour traffic for 2030 and 2050.

Table 5: Projected Average Annual Daily Traffic

Road Section	Motorcycle	Car	PUJ	Bus	Trucks
2030					
BCIB Eastbound	8,900	6,233	598	666	1,762
BCIB West Bound	8,788	6,341	296	768	1,370

Road Section	Motorcycle	Car	PUJ	Bus	Trucks
Roman Highway East	5,156	4,199	1,100	104	752
Roman Highway West	37,571	20,049	2,626	1,445	6,948
Antero Soriano East	43,311	14,522	9,053		3,226
Antero Soriano West	47,423	19,098	8,228	863	3,794
2050					
BCIB Eastbound	12654	12671	0	1293	3597
BCIB West Bound	12654	13113	0	1293	2312
Roman Highway East	7494	5973	1916	118	1135
Roman Highway West	65,895	36,974	4,521	3,537	14,058
Antero Soriano East	58,553	30,156	16,074	-	7,194
Antero Soriano West	63,769	38,514	2,155	4,011	7,574

Table 6: Estimated Day and Night Peak Hour Traffic by Road Section

Road Section	Motorcycle		Car		PUJ		Bus		Trucks	
	D	N	D	N	D	N	D	N	D	N
2030										
BCIB Eastbound	747.60	320.40	523.57	224.39	50.23	21.53	55.94	23.98	148.01	63.43
BCIB West Bound	738.19	316.37	532.64	228.28	24.86	10.66	64.51	27.65	115.08	49.32
Roman Highway East	433.10	185.62	352.72	151.16	92.40	39.60	8.74	3.74	63.17	27.07
Roman Highway West	3,155.96	1,352.56	1,684.12	721.76	220.58	94.54	121.38	52.02	121.38	250.13
Antero Soriano East	3,638.12	1,559.20	1,219.85	522.79	760.45	325.91	-	-	270.98	116.14

Road Section	Motorcycle		Car		PUJ		Bus		Trucks	
	D	N	D	N	D	N	D	N	D	N
Antero Soriano West	3,983.53	1,707.23	1,604.23	687.53	691.15	296.21	72.49	31.07	318.70	136.58
2050										
BCIB Eastbound	1,062.94	455.54	1,064.36	456.16	0	0	108.61	46.55	302.15	129.49
BCIB West Bound	1,062.94	455.54	1,101.49	472.07	0	0	108.61	46.55	194.21	83.23
Roman Highway East	629.50	269.78	501.73	215.03	160.94	68.98	9.91	4.25	95.34	40.86
Roman Highway West	5,535.18	2,372.22	3,105.82	1,331.06	379.76	162.76	297.11	127.33	1,180.87	506.09
Antero Soriano East	4,918.45	2,107.91	2,533.10	1,085.62	1,350.22	578.66	-	-	604.30	258.98
Antero Soriano West	5,356.60	2,295.68	3,235.18	1,386.50	181.02	77.58	336.92	144.40	636.22	272.66

3.2.3 Noise Model Set Up

Figures 5 to 7 provide information on the Soundplan 8.2 model set-up to assess the construction and operation phases. For the construction noise modeling, the assumed paths for the excavators, graders, wheel front loader, rubber tire rollers, motor grader, and trucks are depicted in pink lines within the construction footprint. Time histogram limits the all noise-emitting activities to occur during the daily working period of 0700-2000Hrs. All construction equipment noise source heights were assumed at 1.0m above the digital ground model (DGM) which were generated from the point elevation described in the earlier section. Generators noise source height was assumed at 2.0 meters above DGM.

1. In case the 3dB allowable noise increase due to the project during construction, the provision of noise walls is the only mitigation measure that was considered in the modeling. Noise barrier heights of 2- and 3-meters were considered in the construction noise analysis.

2. The model set-up to assess operational noise assessment is very similar except on two aspects: i) the noise source elevation during construction was derived from the latest engineering design provided to the team, ii) the noise walls heights that were investigated are 1 meter, 2 meter, and 3 meter, wherein the 1 meter approximates the carriage width parapet walls that are already part of the project design along the landside portions of the BCIB.

3. The assessment considered concrete noise walls will be installed during construction and operational phases to mitigate adverse noise impacts. Concrete is fully reflective material with a 1.0 dB reflection loss, 0.206 absorption coefficient, and 0.794 reflection coefficient.

4. During project construction, the recommended locations of the noise walls were dictated by the result unmitigated noise assessment. These are discussed in the succeeding discussions.

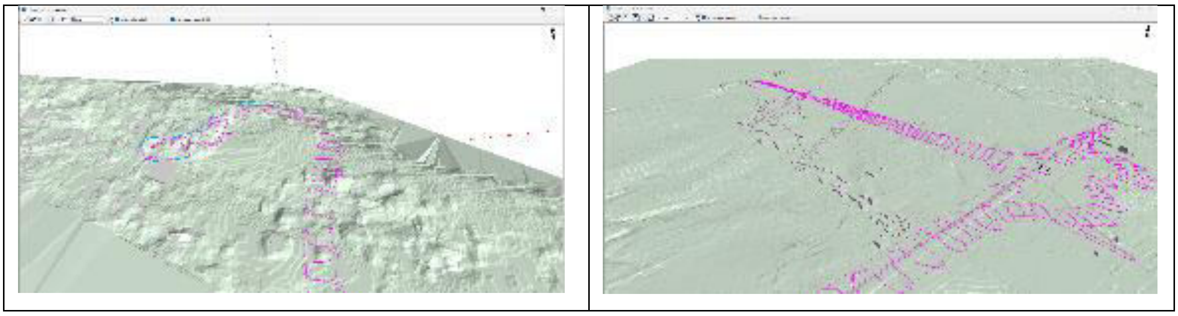


Figure 5: 3D View of the SoundPlan 8.2 Set-up for the Construction Noise Assessment for Bataan and Cavite Sides

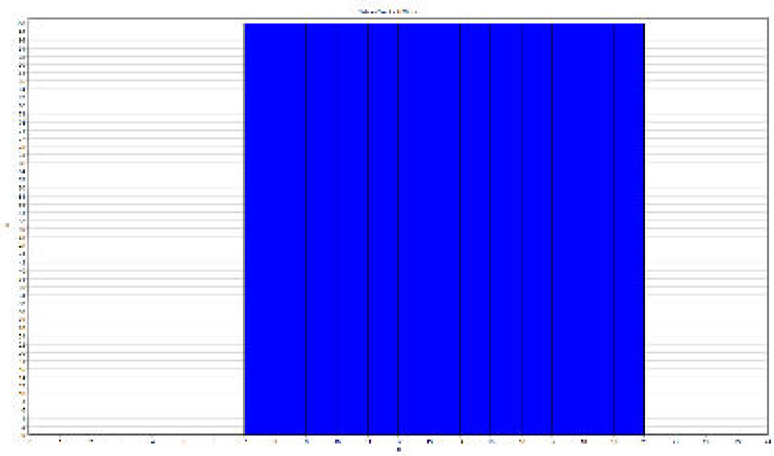


Figure 6: Time Histogram Adopted in the Construction Noise Assessment

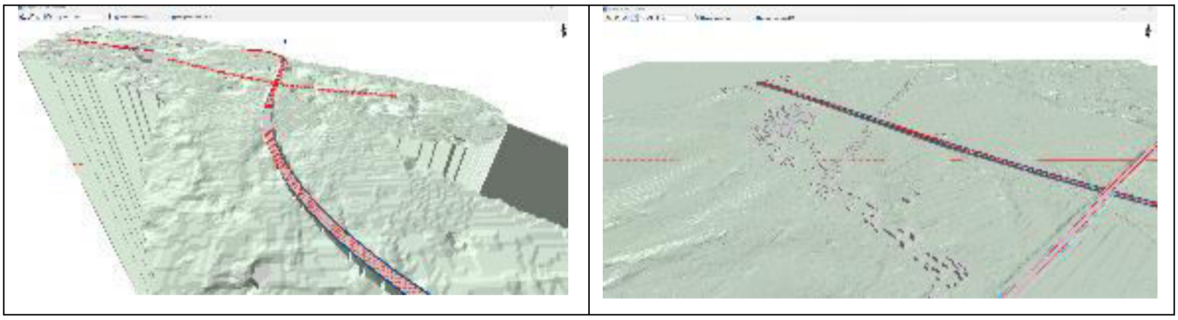


Figure 7: 3D View of the SoundPlan 8.2 Set-up for the Operational Noise Assessment for Bataan and Cavite Sides

3.2.1 Predicted Noise Levels

3.2.1.1 Construction

Tables 7 and 8 presents the predicted unmitigated and mitigated noise level with either a 2- or 3-meter temporary noise barrier for the representative noise sensitive receptors during construction. Figures A1 to A9 provide information on the noise contours for both unmitigated and mitigated in Bataan and Cavite. Since noise is added logarithmically, an increase of 3 dB results to the predicted project attributable noise equal the baseline noise. The following summarizes the information in provided in Tables 7 and 8:

- Most of the noise sensitive receivers on the Bataan side are located along the Ramp 1 approach and where the ambient noise measurement was low. Alberto's Lodging, Penelco Alas-Asin, and Piging Restaurant are located along Ramp 1 of the project while the Mansion is in a quiet zone with ambient baseline noise levels at 49 dB during the daytime and 53 dB at nighttime.

- On the Cavite side, the majority of the representative noise sensitive receivers are the buildings nearest the project alignment along the tip of the main road at the beach area and on either side of the project alignment where Timalan Balsahan and Tramo Roads would travel under the project. The row of houses that bound Antero Soriano Highway and Timalan Conception are located at the very edge of the construction limit.

- On the Bataan side, the first row of buildings, as represented by a mansion, that is nearest the main road with daytime ambient noise level of 49 dB (along the vicinity of A3 measurement) cannot be protected from exposure to construction noise. Noise sensitive receivers in this area would be exposed to noise levels of up to a 20 dB increase in noise levels over the ambient baseline during construction.

- In contrast on the Cavite side, the lowest existing noise level over identified sensitive receivers during the daytime is 55 dB or 6dB higher than in the Bataan side. This factor, in addition to the terrain allows for the effective mitigation of the construction noise impacts within the 3 dB threshold using a temporary 2-meter noise barrier.

- On the Cavite side, the predicted noise levels in the Timalan Basahan and Timalan Conception sensitive receptors still exceeded the allowable 3 dB increase over the ambient baseline as these buildings are located along the limit of construction.

- Increasing the noise barrier from 2 meters to 3 meters will have marginal benefit in terms of noise reduction. A noise barrier with a 2-meter height is optimum to control the construction noise in Bataan and Cavite sides.

- To avoid adverse noise impacts during nighttime (2000-0700) no construction activities that will produce loud noise should be allowed. Limiting construction works and hauling to daylight hours (0600 to 1800) can help reduce the severity of noise impacts. Referring to the Table 1 for Environmental Quality Standards for Noise in General Areas, daytime hours without mitigation allow up to 65 dB and 55 dB for nighttime hours.

- Within the confines of the construction limit, the site workers will be exposed to an equivalent noise level (Laeq1hr) of 71.4 dB.

Table 7: Predicted Project Construction Noise Levels at the Sensitive Receivers in Bataan Side. Unmitigated, with 2-meter and 3-meter Noise Walls

Floor	Name	Usage	Direction	Baseline Noise		Construction Phase					
						Unmitigated		wth 2M Wall		with 3M Wall	
				Day	Night	Leq,d	Leq,n	Leq,d	Leq,n	Leq,d	Leq,n
				[dB(A)]		[dB(A)]					
G	Alberto's Lodging House	PR	SE	64	63	63.2	1.1	61.5	0	60.5	0
F2	Alberto's Lodging House	PR	SE	64	63	66	0.5	64.8	0	63.6	0
G	Grace Inn	PR	SW	64	63	59.1	3	58.5	0	57.7	0
G	Mansion	PR	NE	49	53	71.3	10.3	68.5	10.3	67.7	10.4
F2	Mansion	PR	NE	49	53	71.8	10.6	68.9	10.6	68.1	10.6
F3	Mansion	PR	NE	49	53	72.1	10.7	69.3	10.7	68.5	10.8
G	PENELCO Alas Asin Substation	GI	NE	64	63	77.2	8.3	76.5	0	74.7	0
F2	PENELCO Alas Asin Substation	GI	NE	64	63	77	8.9	77	0	76	0
G	Piging	COM	N	64	63	57.8	0	57.6	0	57	0

Table 8: Predicted Project Construction Noise Levels at the Sensitive Receivers in Cavite Side. Unmitigated, with 2-meter and 3-meter Noise Walls

No.	Floor	Name	Usage	Direction	Baseline		3000 Cavite Construction Noise Assessment					
					Day	Night	Unmitigated		2m		3m	
					dB(A)		Leq,d	Leq,n	Leq,d	Leq,n	Leq,d	Leq,n
1	G	Cavite Houses on west near beach	SCR	NE	55	52	56.5	49.5	55.5	49	54.2	48.4
2	G	House Near Beach NB	PR	SW	55	52	59.2	41.8	54.9	28.7	52.4	28.7
3	G	LTO Building	COM	N	73	77	55.2	45.3	55.2	45.3	55.2	45.3
3	F2	LTO Building	COM	N	73	77	56.2	47.1	56.1	47.1	56.2	47.1
3	F3	LTO Building	COM	N	73	77	57.8	51.2	57.8	51.2	57.8	51.2
3	F4	LTO Building	COM	N	73	77	58.4	51.5	58.4	51.5	58.4	51.5
6	G	Timalan Balsahan cor House	PR	NE	59	57	64.1	43.2	59.7	42.3	56.9	40
7	G	Timalan Concepcion Nearest House	PR	SE	59	57	62	37	59.4	37	56.2	37
7	F2	Timalan Concepcion Nearest House	PR	SE	59	57	62.7	37.1	62.7	37.1	62.6	37.1
8	G	Tmalan Basahan East House	PR	S	59	57	54	44.2	53.3	44	52.6	44
8	F2	Tmalan Basahan East House	PR	S	59	57	54.3	44.4	53.6	44.1	53.1	44
9	G	Tramo Nearest House Southbound	PR	N	59	57	50.5	41	47.7	37.3	47.5	37.3
9	F2	Tramo Nearest House Southbound	PR	N	59	57	52.8	42.7	51.7	42.4	50.9	40.9
10	G	Tramo Redhouse Minimart Northbound	PR	SW	59	57	59.5	53	58	51.9	58.1	51.9

3.2.1.1 Operation

Tables 9 and 10 summarize the noise impact assessments for the Bataan and Cavite sides. The assessment covered two scenarios: 1) unmitigated noise and 2) mitigation with noise barriers with heights of 1, 2, and 3 meters. The assessment assumed the ramps and main roads will position noise barriers parallel and along the edges of the carriage width. In the Annex, Figures A10 to A38 provide information on the noise model contours for the two scenarios in Bataan and Cavite.

Table 9: Predicted Project Operational Noise Levels at the Sensitive Receivers in Bataan Side. Unmitigated, with 1-meter, 2-meter, and 3-meter Noise Walls

Floor	Name	Usage	Direction	Baseline Noise		Operational Phase							
						Unmitigated		with 1m Wall		with 2m Wall		with 3M Wall	
				Day	Night	Leq,d	Leq,n	Leq,d	Leq,n	Leq,d	Leq,n	Leq,d	Leq,n
				[dB(A)]		[dB(A)]							
G	Alberto's Lodging House	PR	SE	64	63	75	68	76.2	69	76.2	69.3	74	69.3
F2	Alberto's Lodging House	PR	SE	64	63	77.1	69.3	77.6	70.9	78.4	71	75.9	70.1
G	Grace Inn	PR	SW	64	63	71.6	62.5	71.9	63	72.3	63.6	71.3	63.7
G	Mansion	PR	NE	49	53	65.6	62.3	66.4	63	63.6	60.5	61.8	58.1
F2	Mansion	PR	NE	49	53	68.4	65	67.1	63.7	64	61	62.3	59.1
F3	Mansion	PR	NE	49	53	68.8	65.5	68.5	65.1	64.9	61.7	63.3	60.4
G	PENELCO Alas Asin Substation	GI	NE	64	63	92.9	80.4	92.9	80.5	93	80.5	92.9	80.5
F2	PENELCO Alas Asin Substation	GI	NE	64	63	92.8	80.4	92.8	80.5	92.8	80.5	92.8	80.5
G	Piging	COM	N	64	63	92.8	80.8	92.9	81	92.9	81	92.9	81

Table 10: Predicted Project Operational Noise Levels at the Sensitive Receivers in Cavite Side. Unmitigated, with 1-meter, 2-meter, and 3-meter Noise Walls

No.	Floor	Name	Usage	Direction	Baseline		Operational Noise 2050							
					Day	Night	Unmitigated		1m Prapet		2m Wall		3m Wall	
					dB(A)		Leq,d	Leq,n	Leq,d	Leq,n	Leq,d	Leq,n	Leq,d	Leq,n
1	G	Cavite Houses on west near beach	SCR	NE	55	52	68.5	65.2	61.3	57.8	59	55.6	55.7	52.3
2	G	House Near Beach NB	PR	SW	55	52	71	67.8	57.1	53.8	55.7	52.4	53.1	49.8
3	G	LTO Building	COM	N	73	77	71.8	66.8	68.1	63.2	65.8	60.5	61.8	56.5
3	F2	LTO Building	COM	N	73	77	72.7	67.6	71.6	66.4	67.8	62.5	63.2	57.8
3	F3	LTO Building	COM	N	73	77	74.3	69.2	74.5	69.3	69.8	64.6	66	60.6
3	F4	LTO Building	COM	N	73	77	74.5	69.4	76.5	71.3	73.5	68.3	67.9	62.6
6	G	Timalan Balsahan cor House	PR	NE	59	57	72.9	69.6	64.3	60.9	62.4	59	59.9	56.4
7	G	Timalan Concepcion Nearest House	PR	SE	59	57	76.2	70.9	76.2	70.9	72.8	67.5	70.9	65.7
7	F2	Timalan Concepcion Nearest House	PR	SE	59	57	77	71.8	79.3	74.1	75.6	70.4	75.3	70.3
8	G	Tmalan Basahan East House	PR	S	59	57	64.9	61.5	61.7	58.2	58.3	54.7	57.3	53.7
8	F2	Tmalan Basahan East House	PR	S	59	57	65.8	62.5	63.8	60.4	59.8	56.3	57.7	54.1
9	G	Tramo Nearest House Southbound	PR	N	59	57	59.2	55.6	56.1	52.1	53.6	49.4	51.5	47.4
9	F2	Tramo Nearest House Southbound	PR	N	59	57	62.2	58.7	60.4	56.4	57.3	53	55.5	51
10	G	Tramo Redhouse Minimart Northbound	PR	SW	59	57	67.1	63.7	62	58.5	59.4	55.7	57.9	54.1

The following summarizes findings from the operational assessment:

- The anticipated operational noise levels are higher than the construction noise levels owing to the number of vehicles that are projected to use the bridge by year 2050.
- The projected unmitigated operational noise level increases from the ambient baseline at the representative noise sensitive receivers ranges from an increase of 12-30 dB on the Bataan side to between 2-16 dB on the Cavite side.
- The use of noise barriers on the Cavite side is effective at some of the receivers, but not all of them due to height of buildings and physical limitations, such as ingress and egress access preventing a contiguous noise barrier. Where feasible, a 1-meter parapet wall will be able to mitigate noise within 3dB of the ambient baseline noise for about 10% and 20% of the noise sensitive receivers in the screening area for the day and night-time, respectively. Increasing the noise barrier height to 2 meters increases compliance to 30% and 40% of the noise sensitive receivers, and a 3-meter noise barrier to 60% for both day and night times. In is noteworthy that regardless of the noise barrier height, two of the representative noise sensitive receivers (#1 - Cavite House on West Beach and #7 - Timalan Concepcion - Antero Soriano Nearest House) would still be impacted owing to their proximity to the project. The 2- and 3-m noise barrier is not recommended for the following reasons: enormous visual impact for the entire community, in many contexts the noise wall would be ineffective due to breaks in the wall to preserve access and in other cases the change in noise reduction is minor and does not warrant the investment. Along the Antero Soriano Highway, the assessment considered installing the noise barrier however access to these properties would be eliminated which is unacceptable.
- The operational noise assessment in the Bataan side indicated that even the 3-meter noise barrier is not able to mitigate the noise levels to within 3dB increase of the ambient baseline noise levels. This is mainly due to the relatively low existing noise environment surrounding the project alignment in the areas south of the Roman Highway and the considerable noise increase that will be introduced from new roadway traffic. There are physical limitations from building effective noise barriers due to the topography of the site and access permeations that prevent the wall to be contiguous for sensitive receptors along Roman Highway and therefore ineffective noise barrier. Along the Roman Highway on the Bataan side, the engineering designs indicated no improvements will be taken and numerous buildings are

already located along the edge of the carriageway which discounted the option of installing noise walls. The location of the noise barriers considered in the operational noise assessments are illustrated in the succeeding Figures 8 to 10.

Information on noise contours with either 1-, 2- or 3-meter noise barriers are presented in Figures A10 to A38.

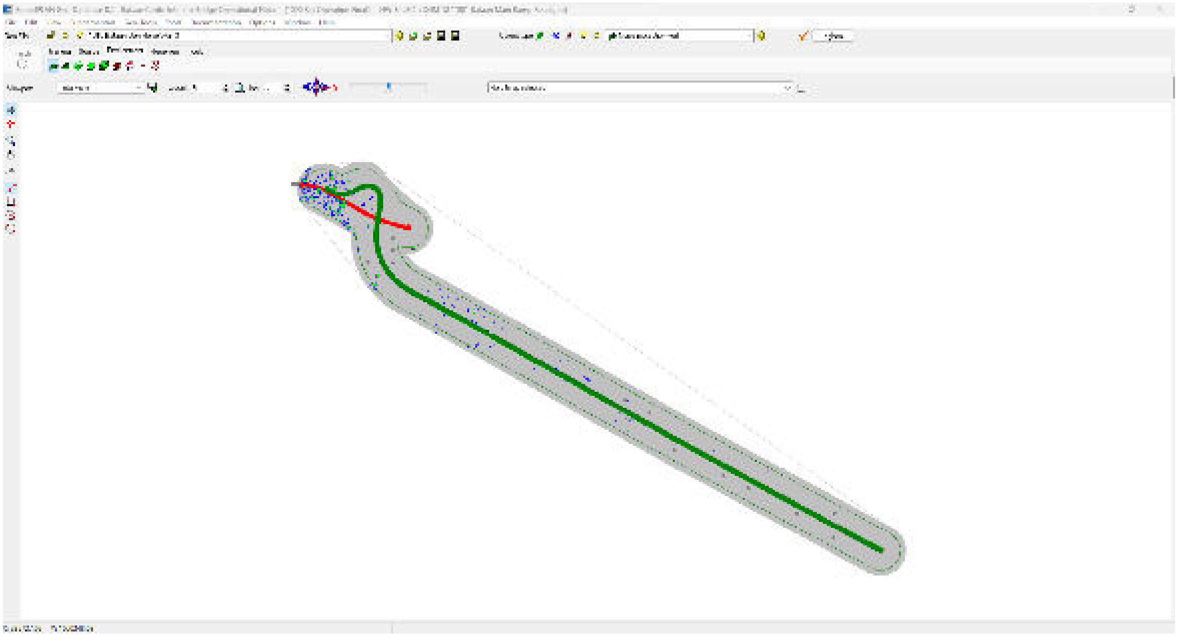


Figure 8: Illustration (Green Color) of the Extent of Noise Walls Considered in the Operational Noise Assessment-Bataan Side

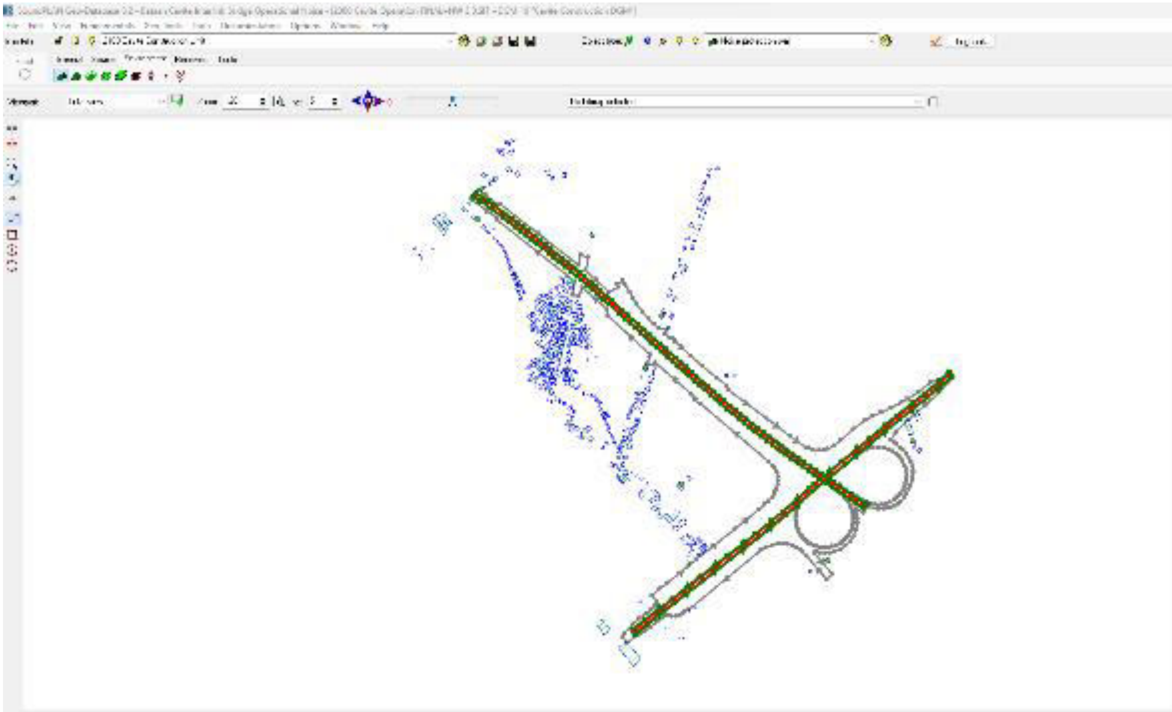


Figure 9: Illustration (Green Color) of the Extent of Noise Walls Considered in the Operational Noise Assessment-Cavite Side

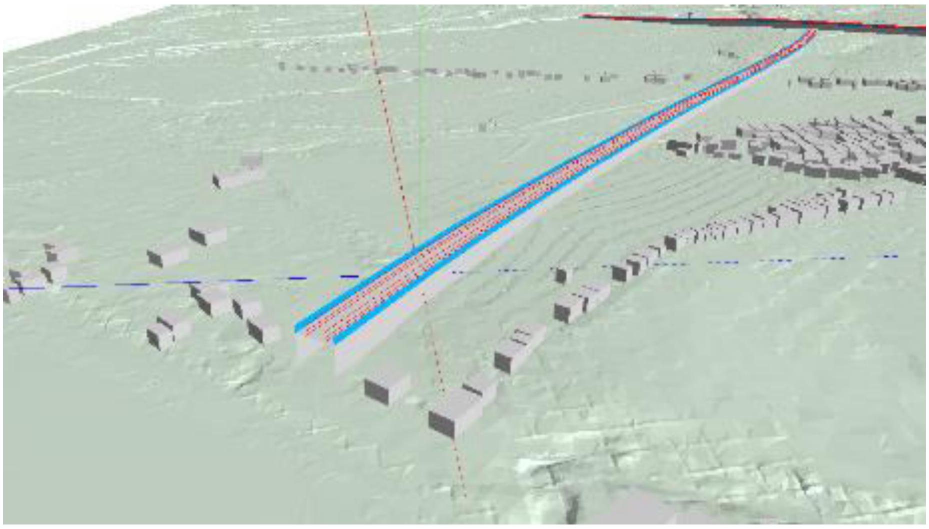


Figure 10: Close-up of the Noise Wall Model Representation in the Cavite Side

The findings from the operational noise assessment should be tempered by the recognition of potential increase in the ambient noise level due to induced urbanization brought by the massive infrastructure and establishment of new access across the Manila Bay. The expected urbanization should be considered in the decision to install noise walls particularly in the Cavite side.

The assessment concluded the noise levels in all scenarios for both Bataan and Cavite sides cannot be totally mitigated within the 3 dB increase guide value. In this regard, it is prudent for the project to limit the noise barriers at the 1-meter height which coincides with the proposed parapet wall already part of the BCIB design. This recommendation will be supported with the following:

- Public Consultation will be addressed through the Multi-Partite Monitoring Team (MMT) and there would be separate MMT's for Bataan and Cavite. The MMTs include representatives of various groups and organization and the MMTs would review the monitoring reports of the Proponent, conduct their own observational verification monitoring, and follow up on grievances submitted by members of the public or entities in the project area. Refer to Section 11.2.1.10 in the EIA for additional information. In addition, if complaints are brought before the Grievance Redress Mechanism, then post construction noise modeling may be needed to determine if additional parapet noise barriers walls are necessary and can be effective (Refer to Chapter 10, Grievance Redress Mechanism, of the EIA for information).

- Sequence the construction operation: i) Schedule noisy construction activities during daytime hours (0600 to 2000)s; ii) Install temporary noise barriers in the early stages of project construction in accordance with the need and effectiveness.

- Source Mitigation: i) use of less noisy equipment and use of well-maintained machinery and vehicles equipped with the lates noise abatement technology; ii) installation of mufflers on all internal combustion engines; iii) installation of noise shields to particular equipment; v) installation of aprons or curtains using absorptive mats; and vii) Equipment operating training.

4 ANNEXES

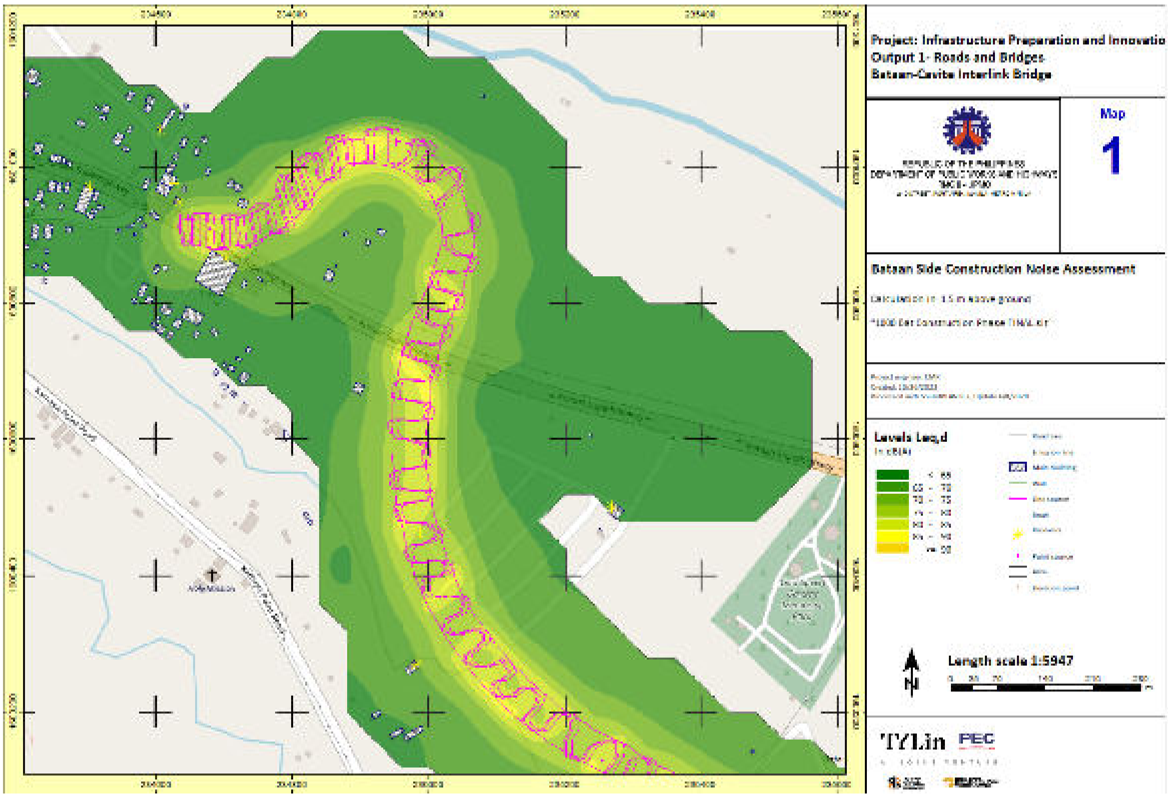


Figure A1. Section 1 Bataan Side Construction Noise Assessment Daytime Unmitigated

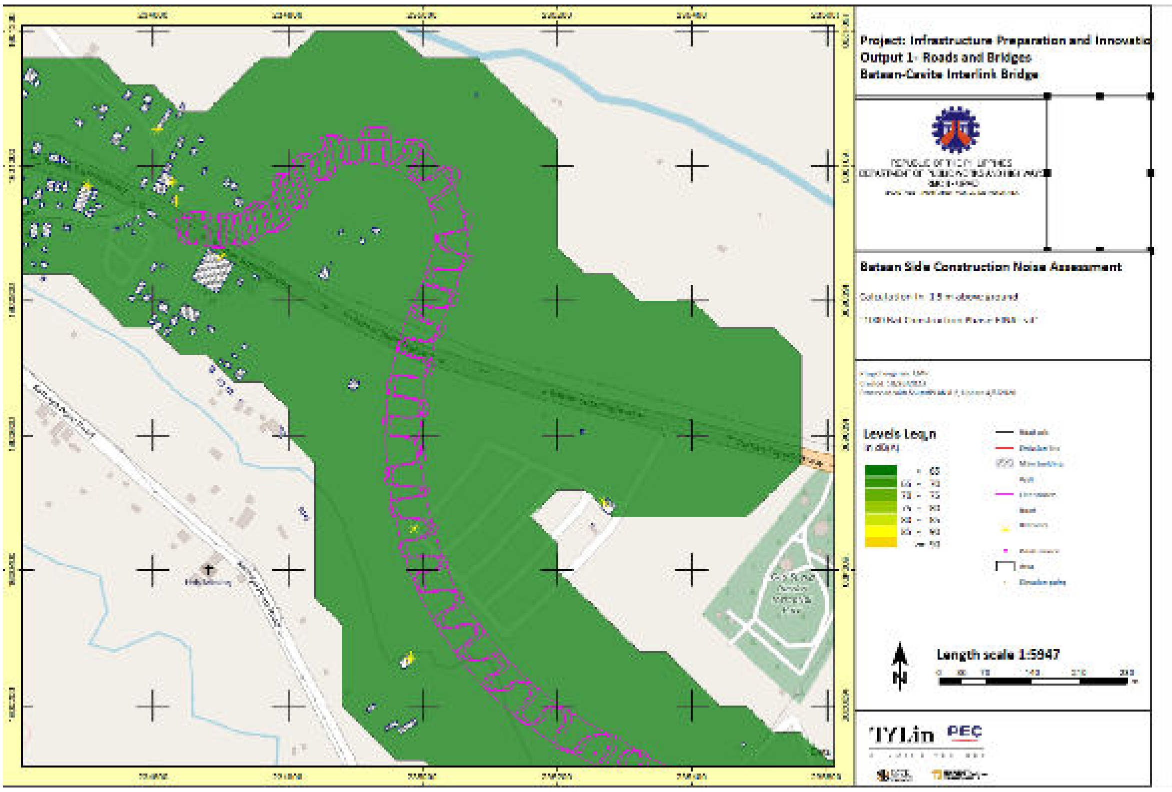


Figure A2. Section 1 Bataan Side Construction Noise Contour Map Nighttime Unmitigated

(Note: Succeeding Noise Contour Maps Nighttime will not be illustrated as no works will be allowed during this 2000 to 0700HRS)

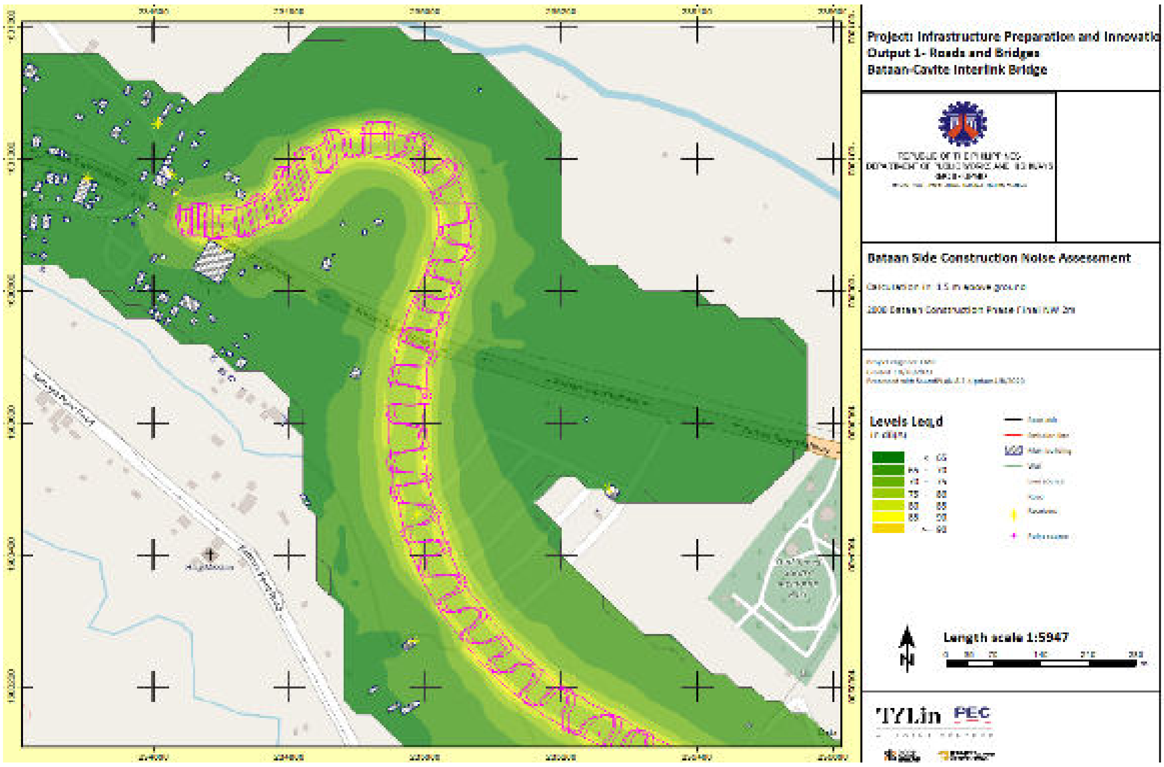


Figure A3. Section 1 Bataan Side Construction Noise Contour Map Daytime with 2m Noise Walls

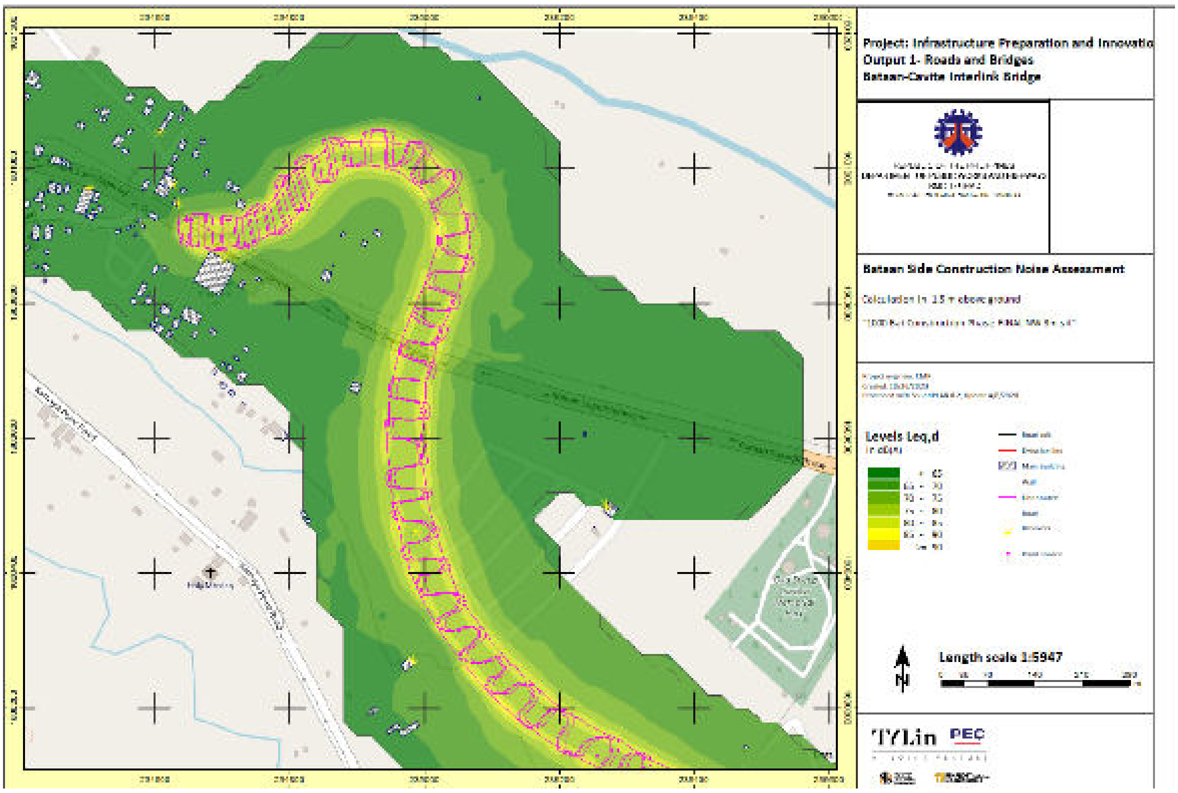


Figure A4. Section 1 Bataan Side Construction Noise Contour Map Daytime with 3m Noise Walls

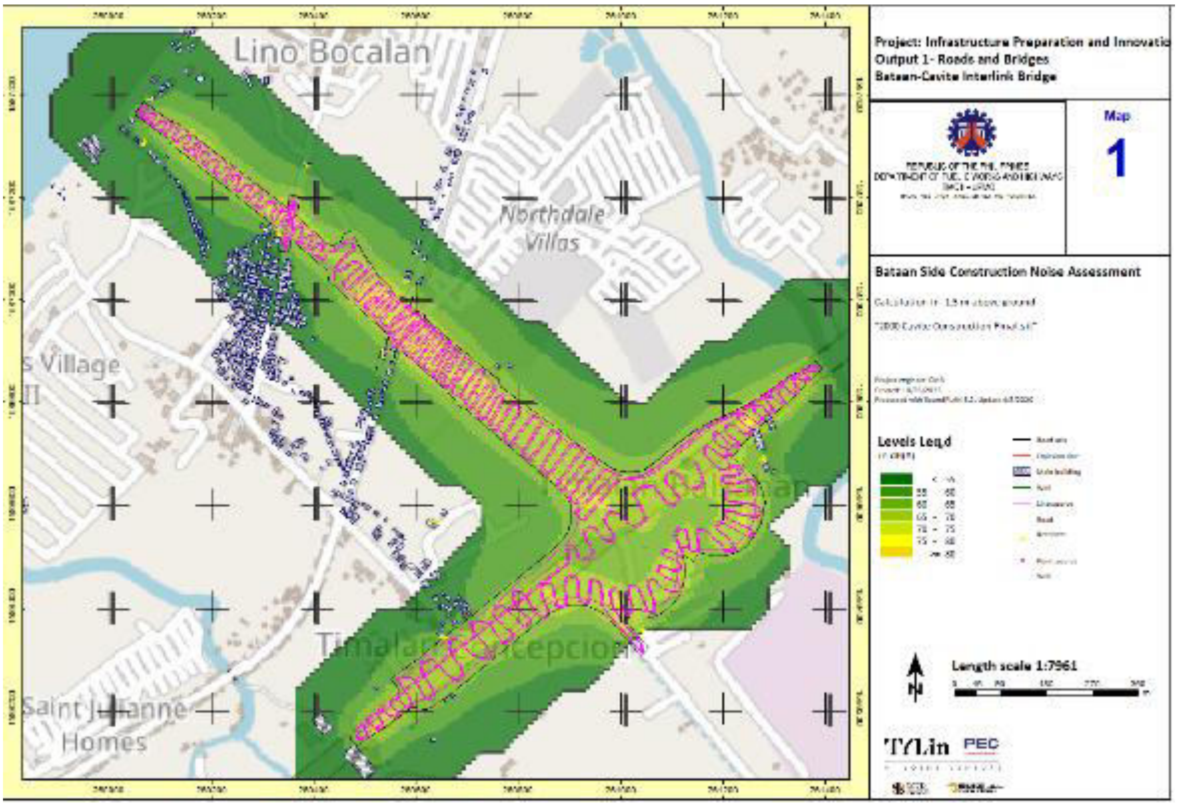


Figure A5. Entire Cavite Side Construction Noise Contour Map Daytime Unmitigated

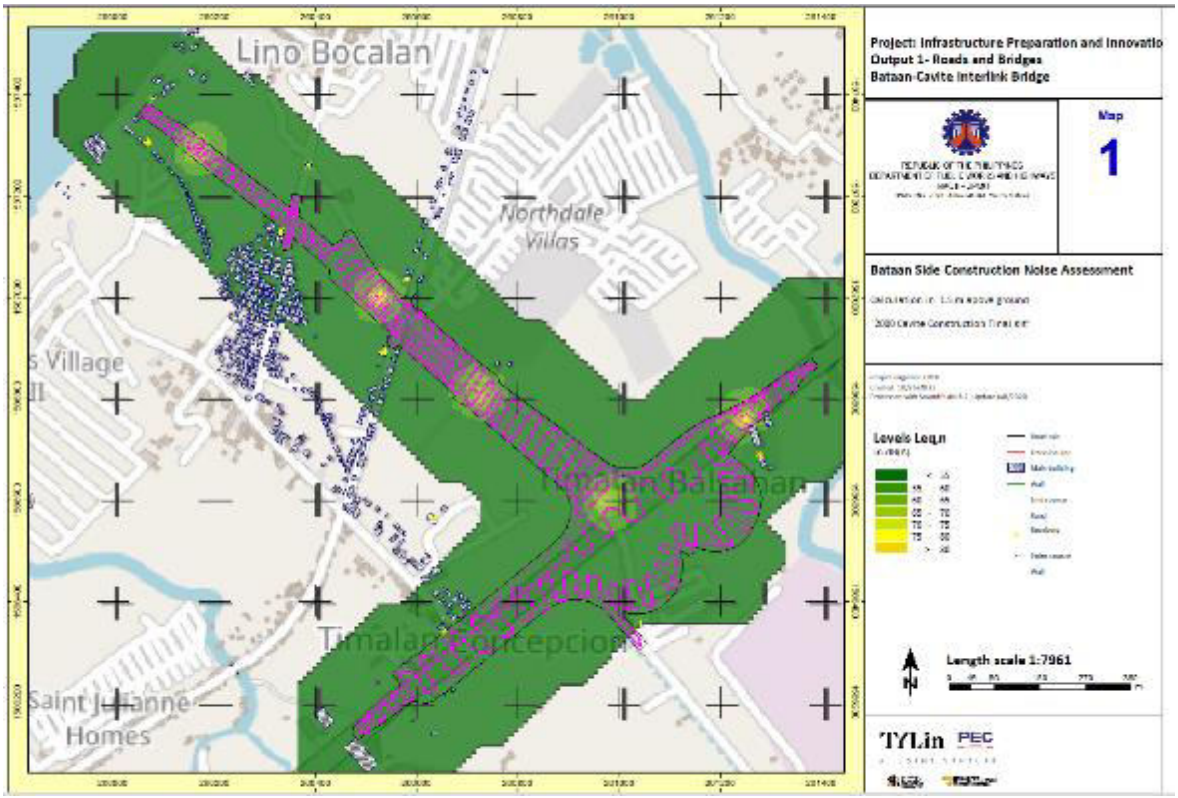


Figure A6. Entire Cavite Side Construction Noise Contour Map Nighttime Unmitigated

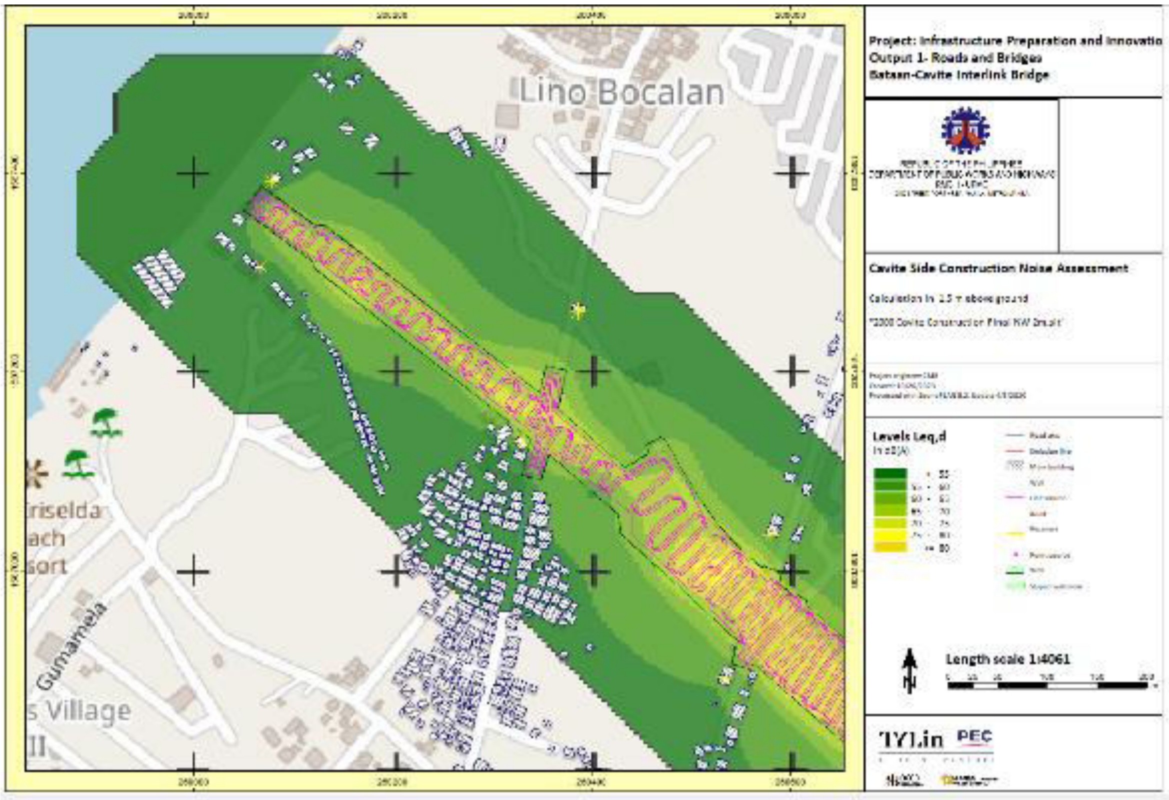


Figure A7. Section 1 Cavite Construction Noise Contour Map Daytime 2m Noise Walls

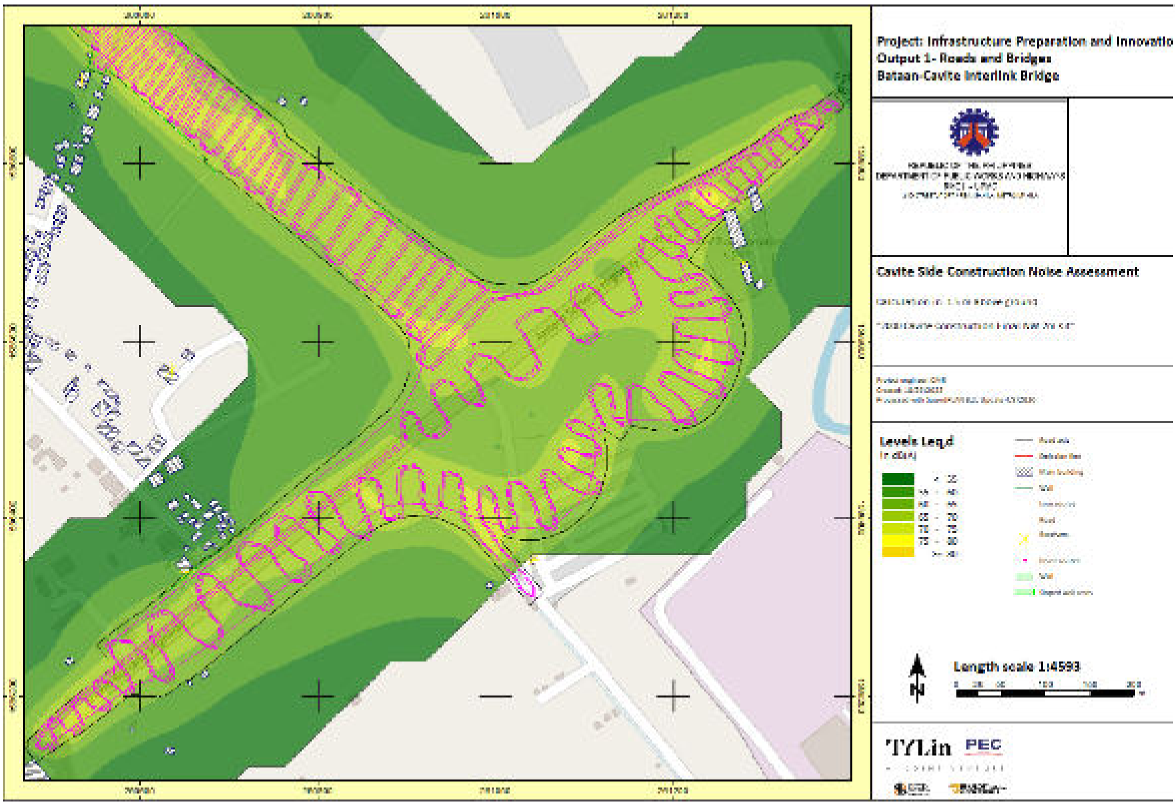


Figure A8. Section 2 Cavite Construction Noise Contour Map Daytime 2m Noise Walls

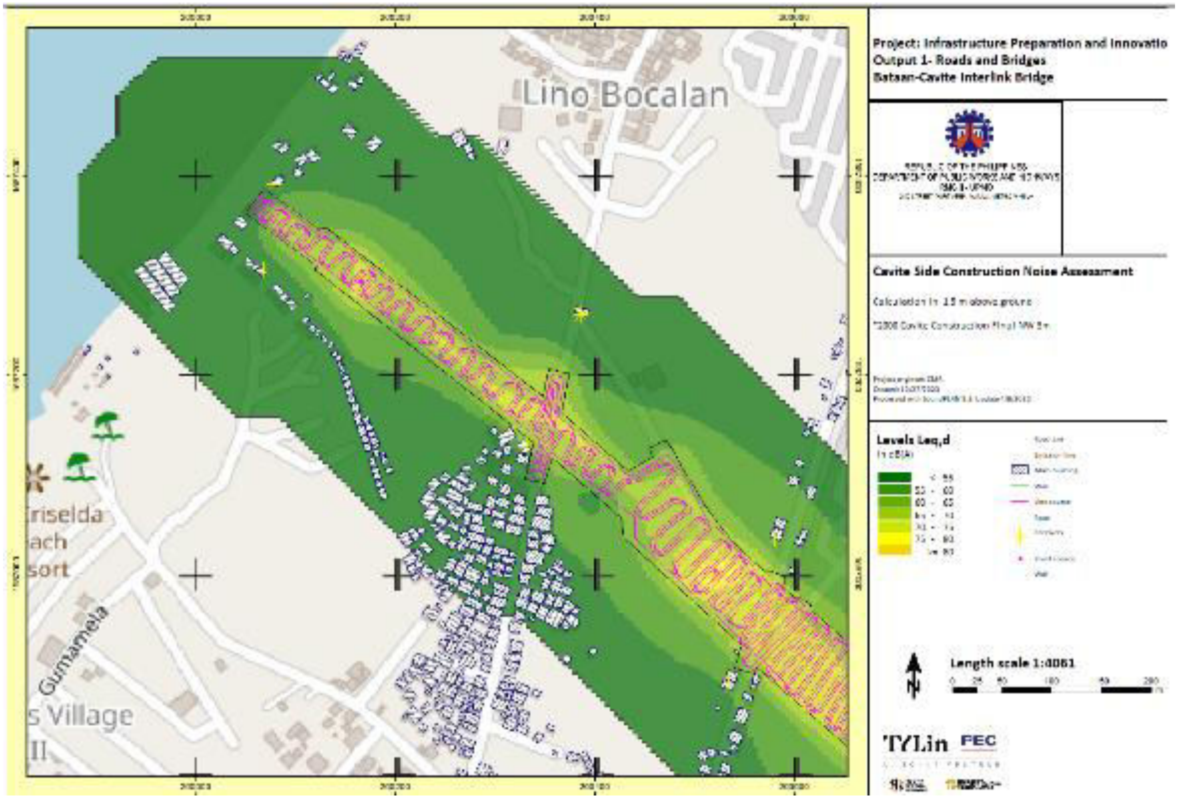


Figure A9. Section 1 Cavite Construction Noise Contour Map Daytime 3m Noise Walls

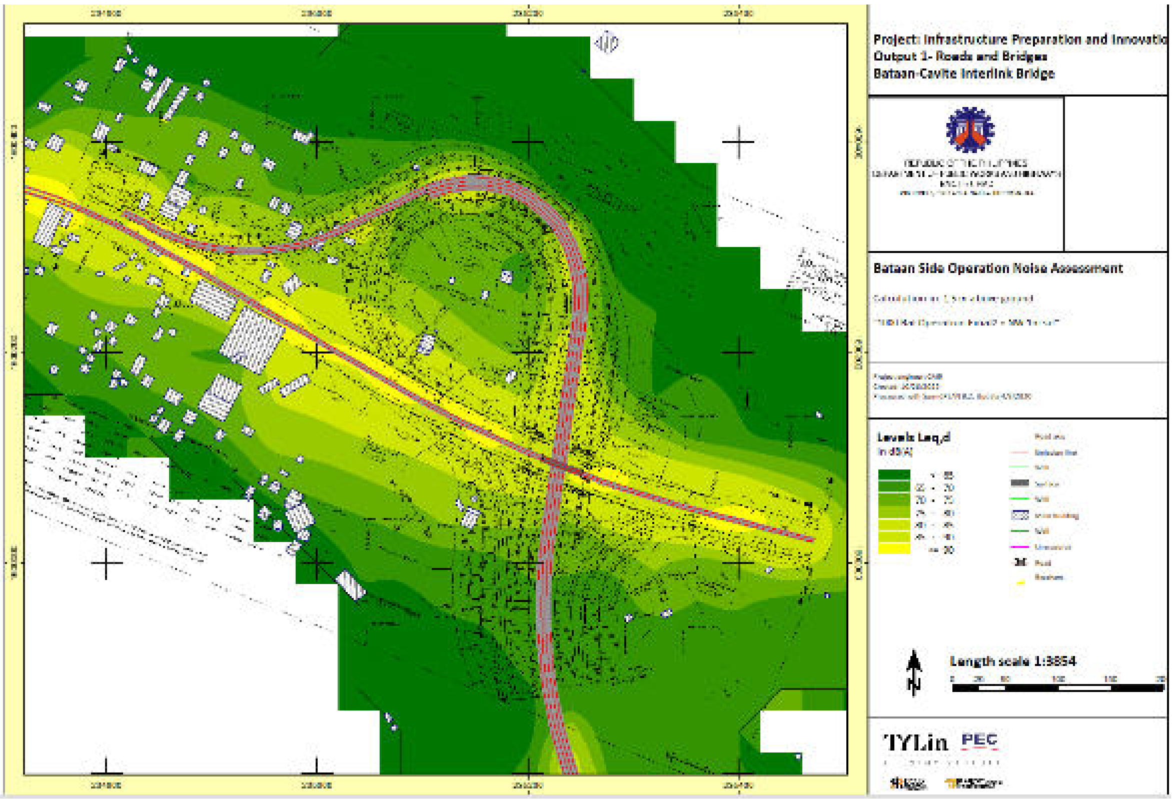


Figure A10. Section 1 Bataan Operational Noise Contour Map Day time 1m Noise Walls

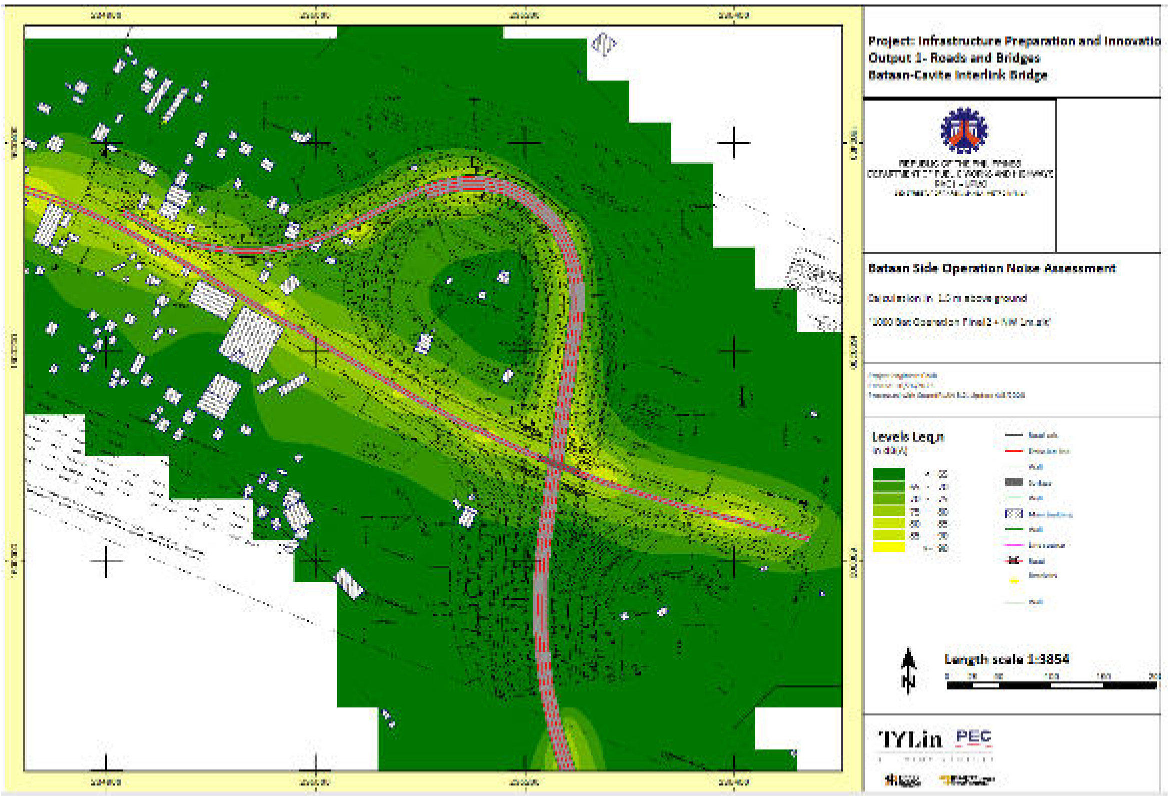


Figure A11. Section 1 Bataan Operational Noise Contour Map Nighttime 1m Noise Walls

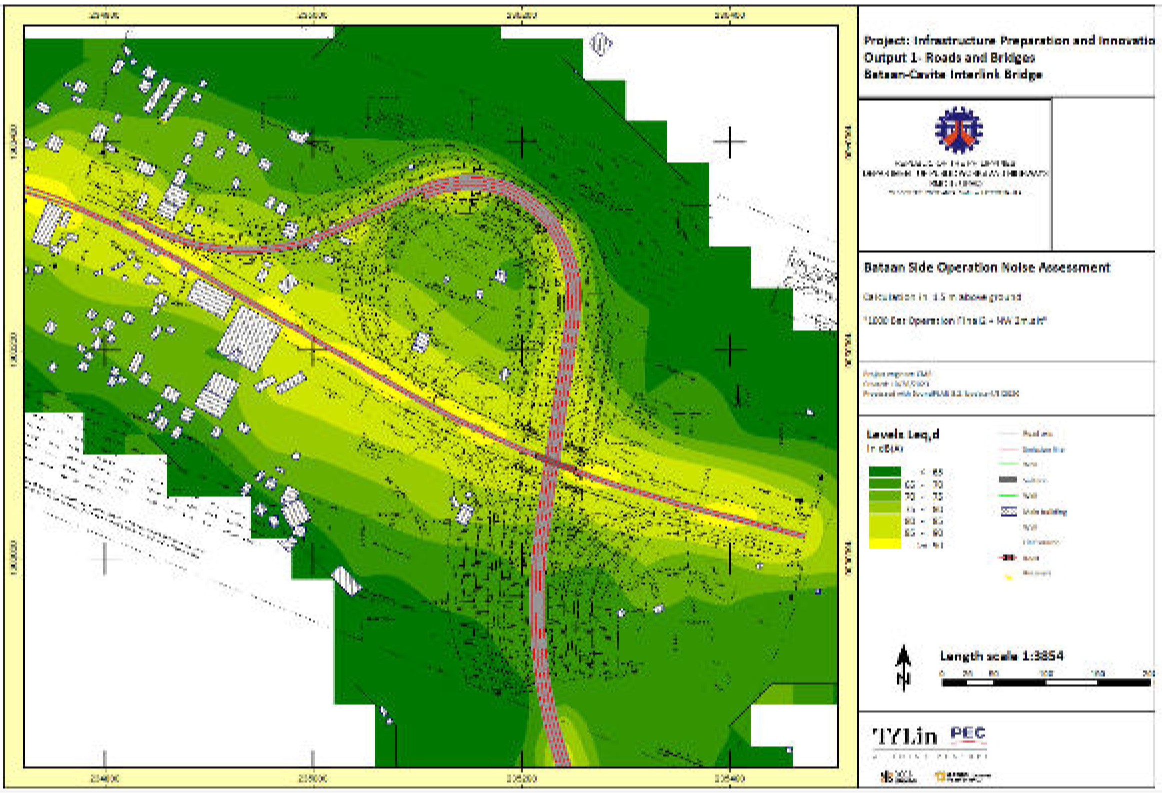


Figure A12. Section 1 Bataan Operational Noise Contour Map Day time 2m Noise Walls

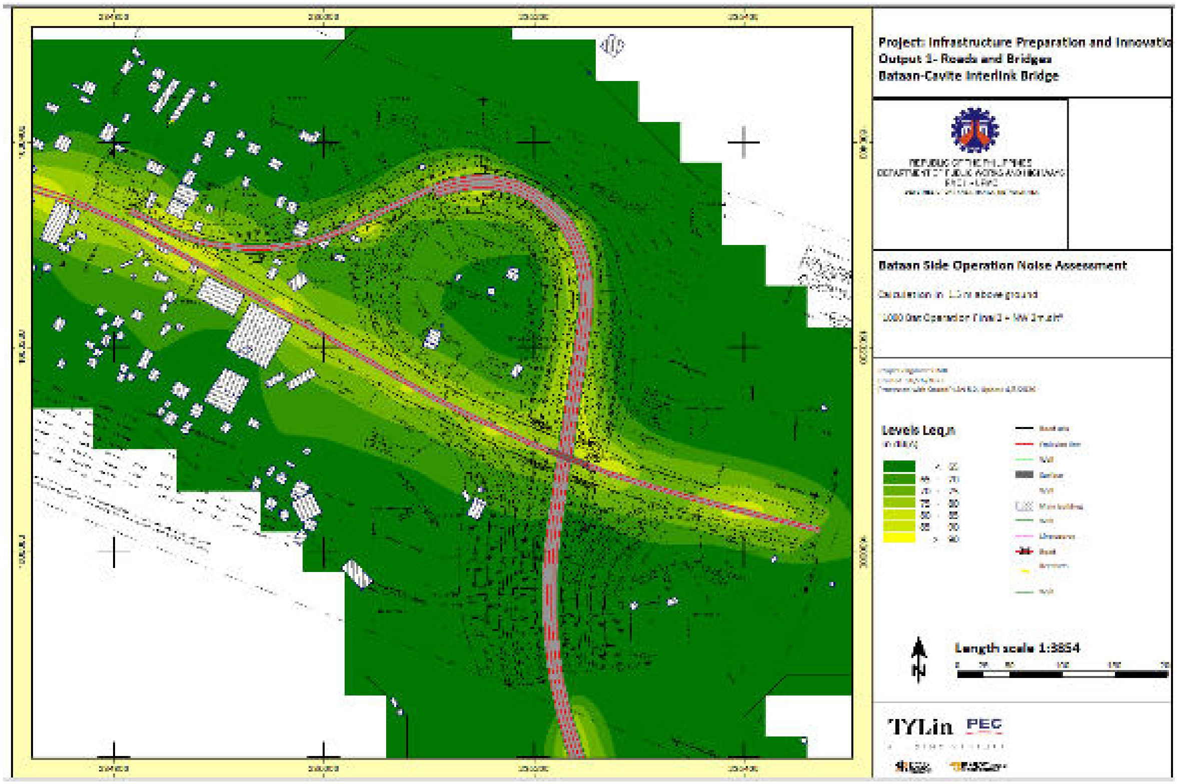


Figure A13. Section 1 Bataan Operational Noise Contour Map Nighttime 2m Noise Walls

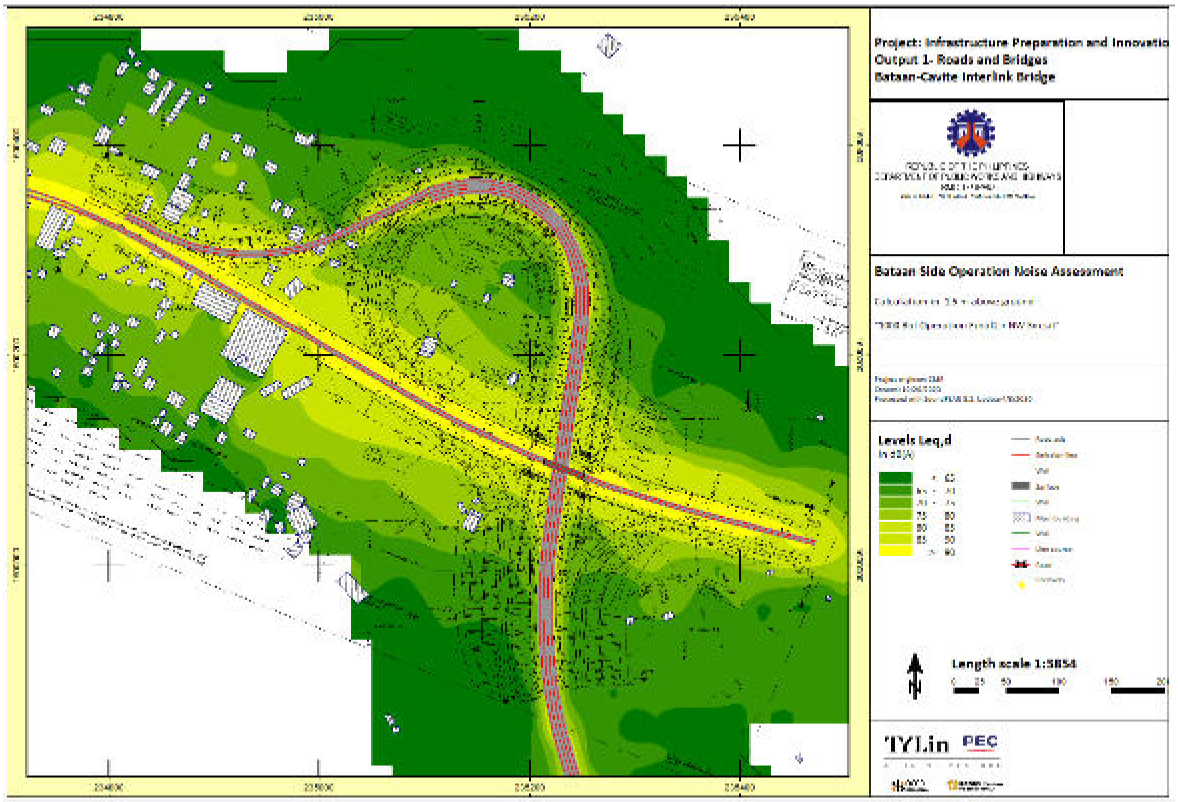


Figure A14. Section 1 Bataan Operational Noise Contour Map Day time 3m Noise Walls

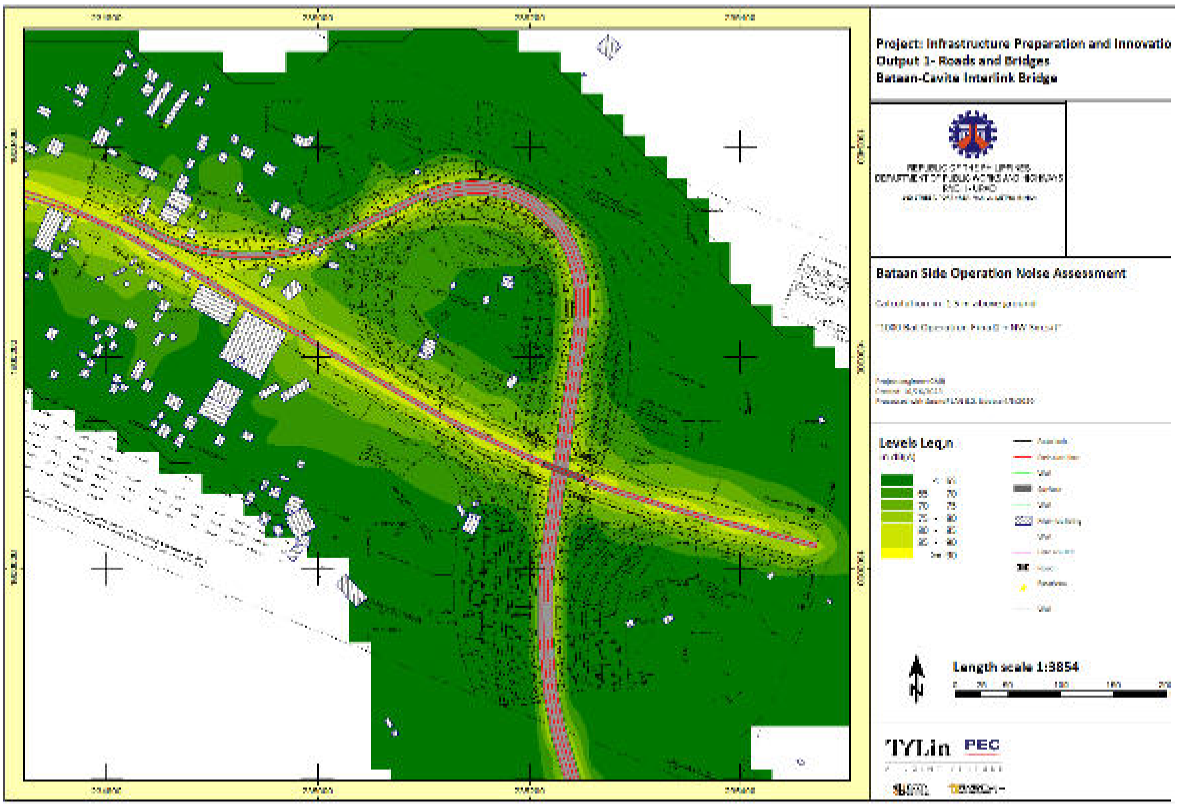


Figure A15. Section 1 Bataan Operational Noise Contour Map Nighttime 3m Noise Walls

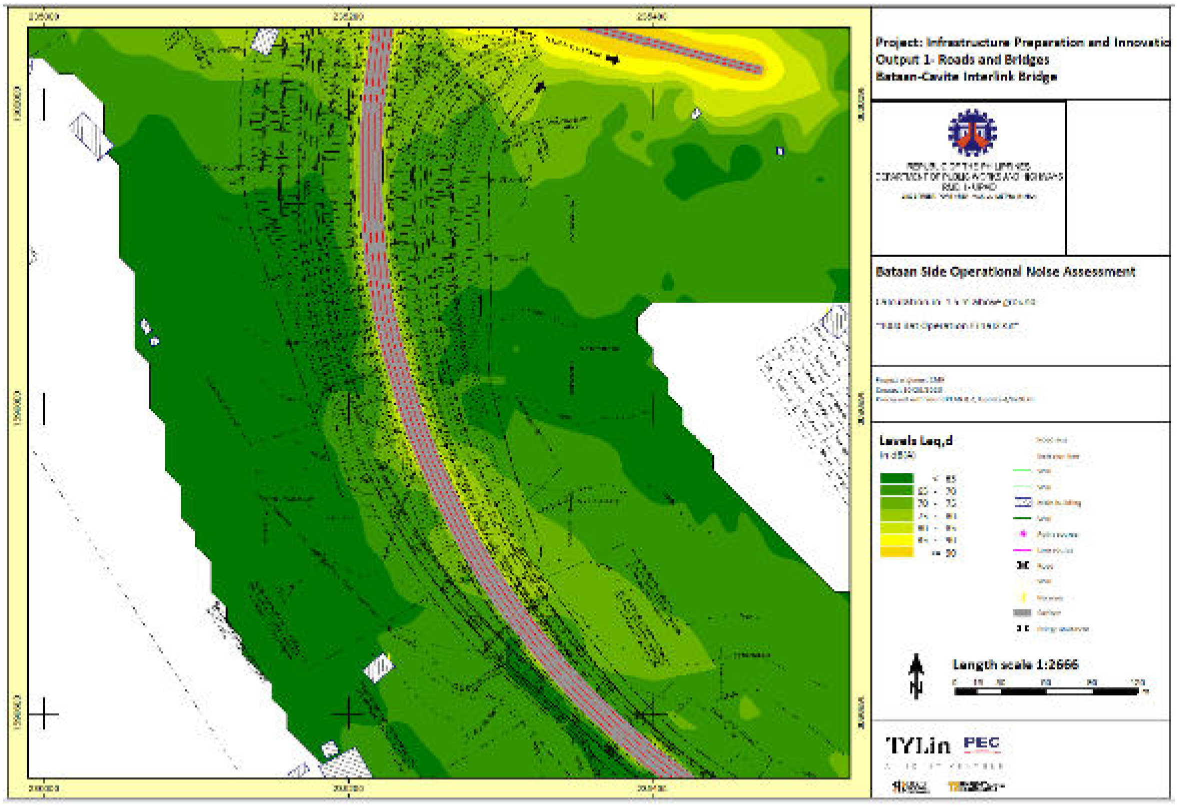


Figure A16. Section 2 Bataan Operational Noise Contour Map Day time Unmitigated

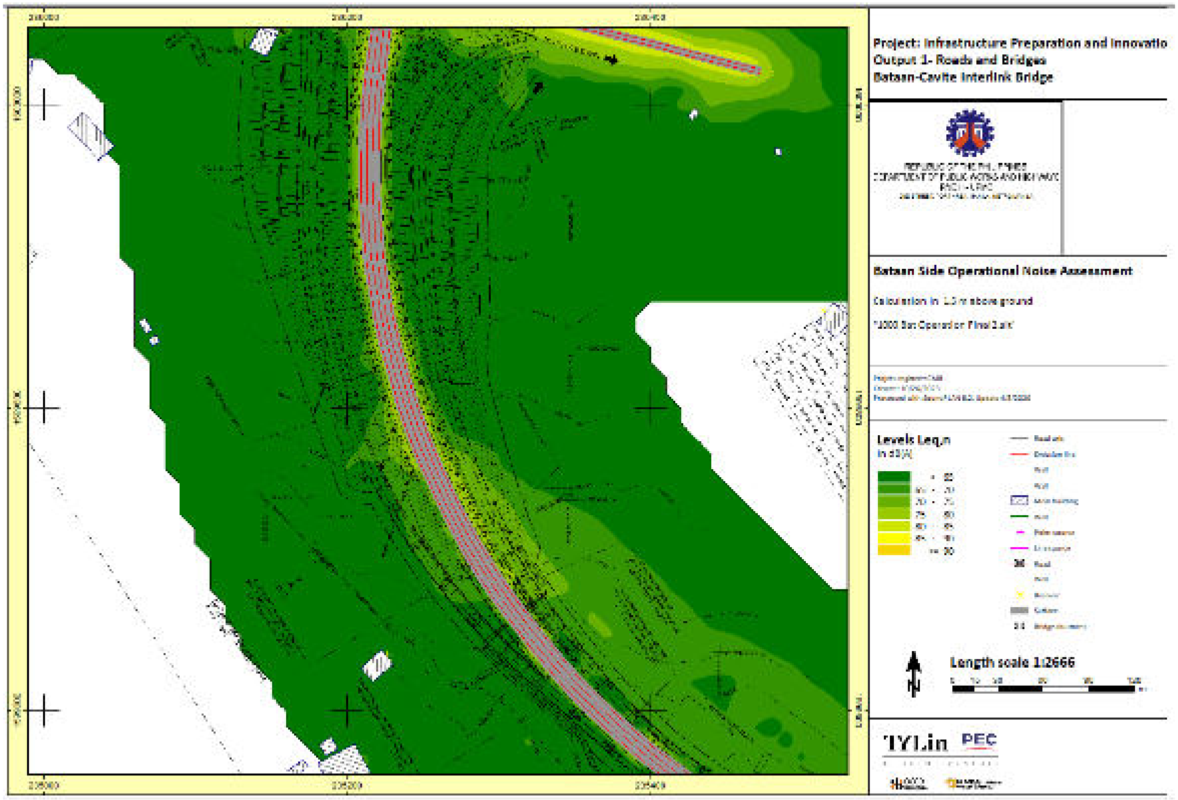


Figure A17. Section 2 Bataan Operational Noise Contour Map Nighttime Unmitigated

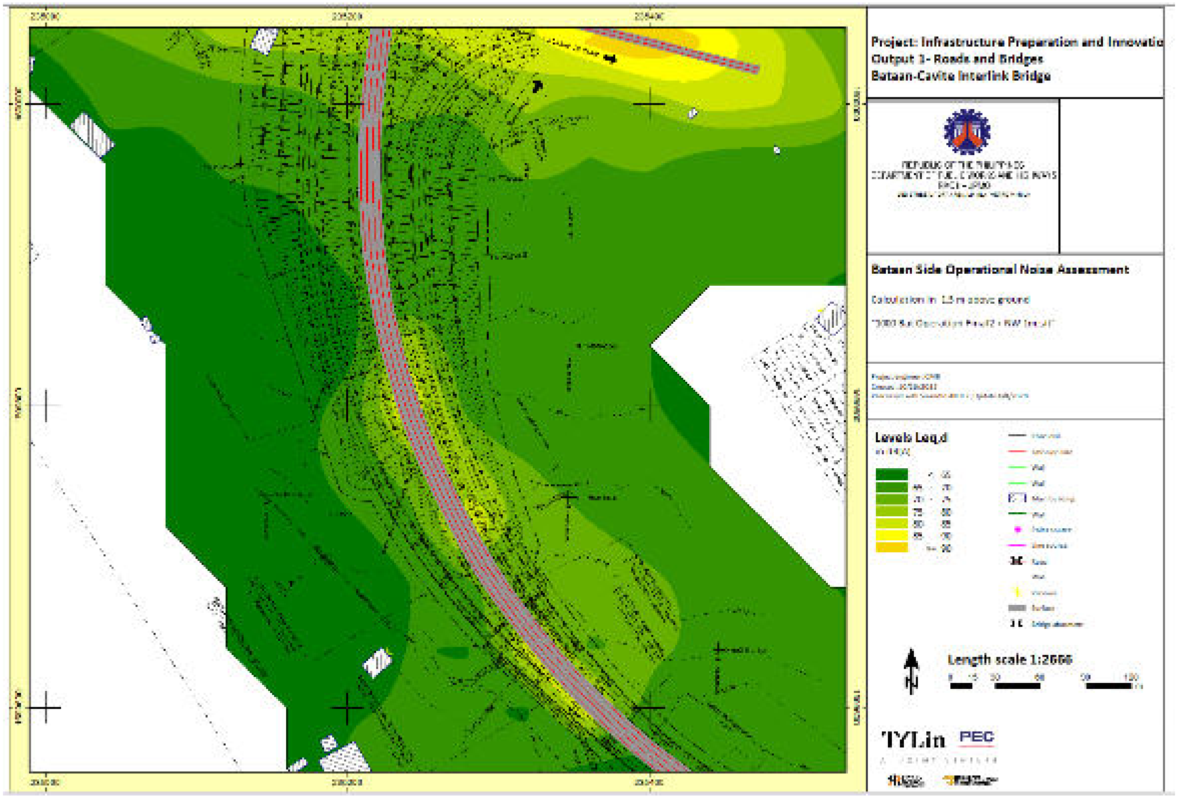


Figure A18. Section 2 Bataan Operational Noise Contour Map Day time 1m Noise Walls

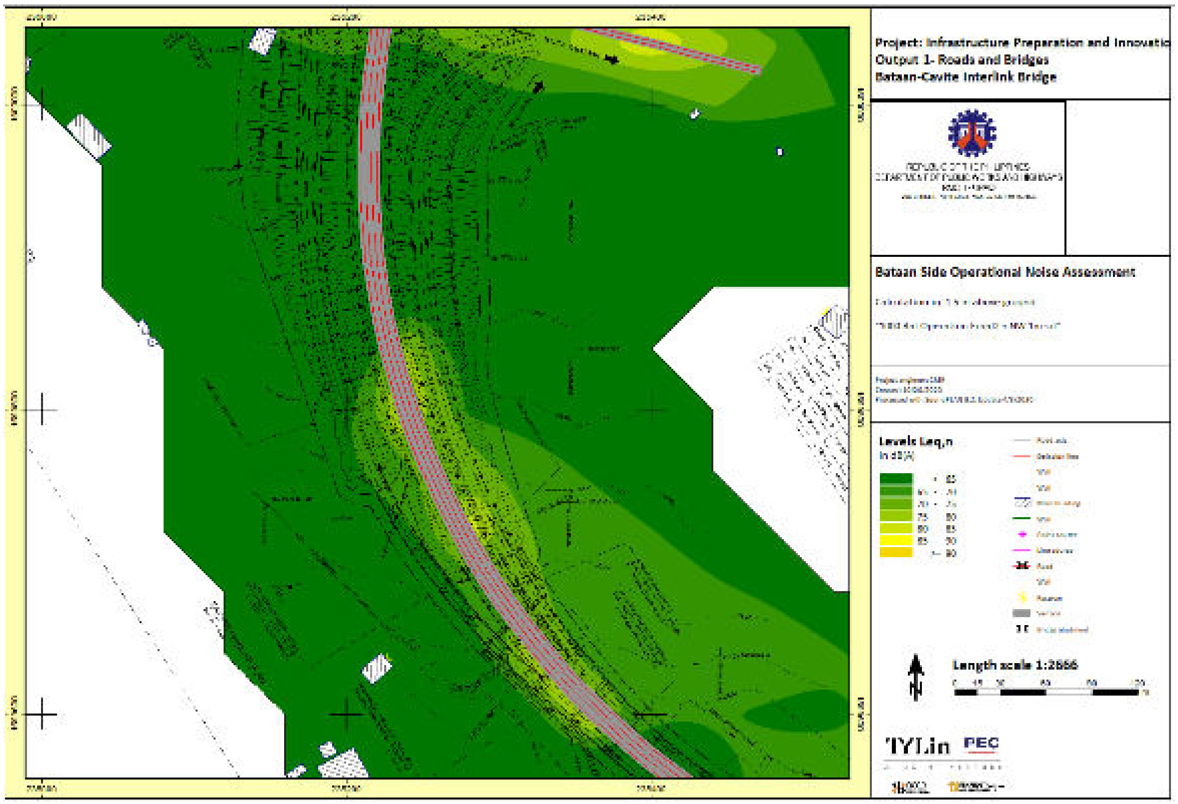


Figure A19. Section 2 Bataan Operational Noise Contour Map Nighttime 1m Noise Walls

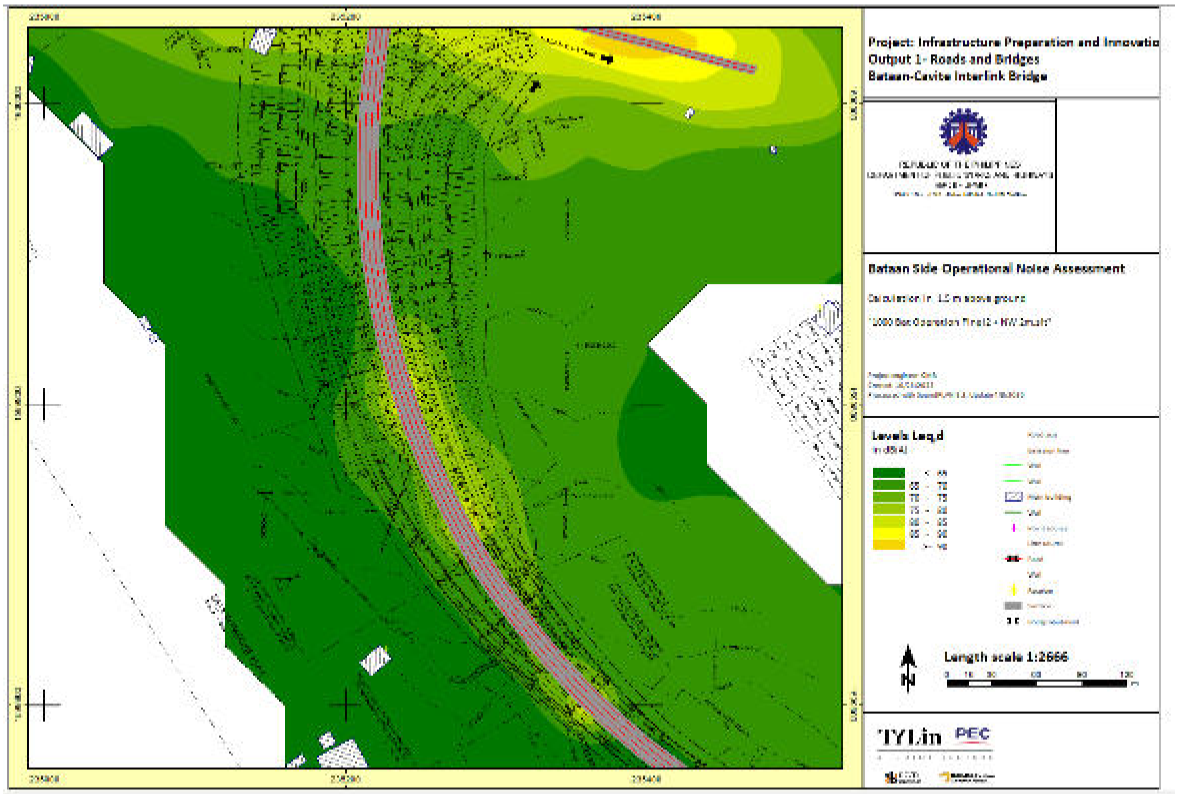


Figure A20. Section 2 Bataan Operational Noise Contour Map Day time 2m Noise Walls

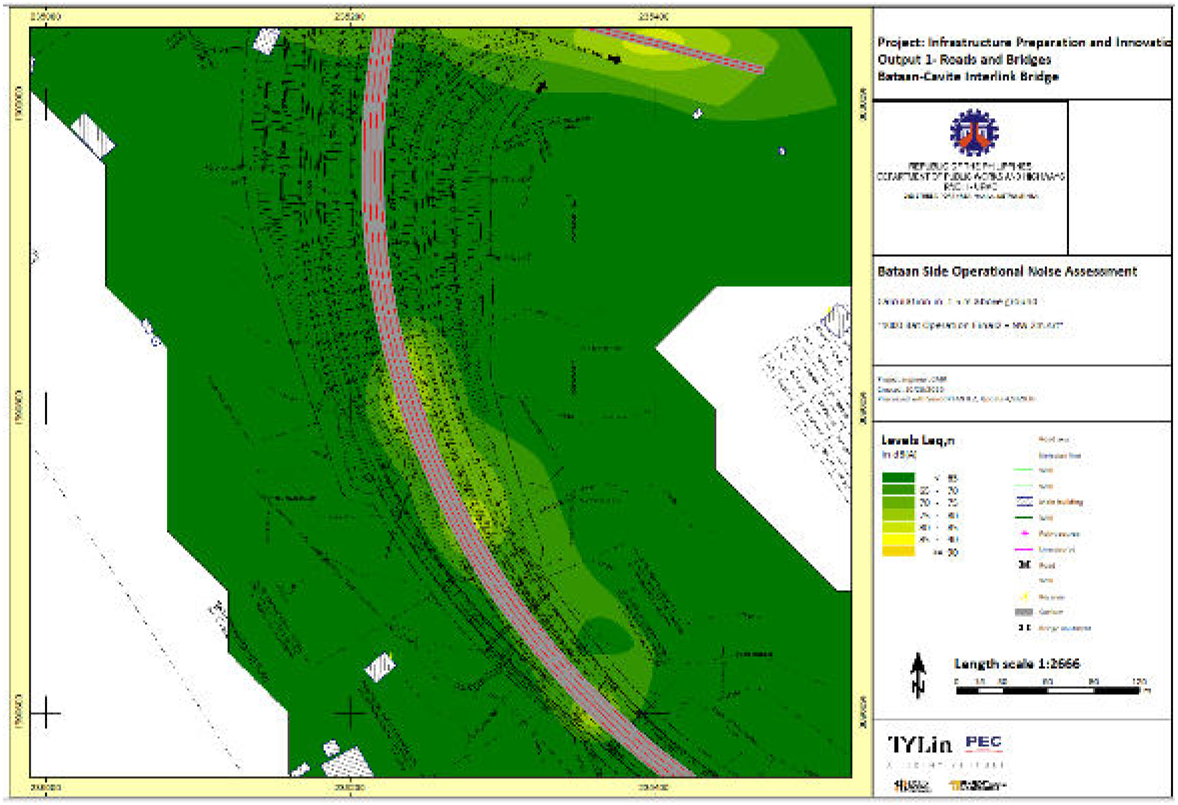


Figure A21. Section 2 Bataan Operational Noise Contour Map Nighttime 2m Noise Walls

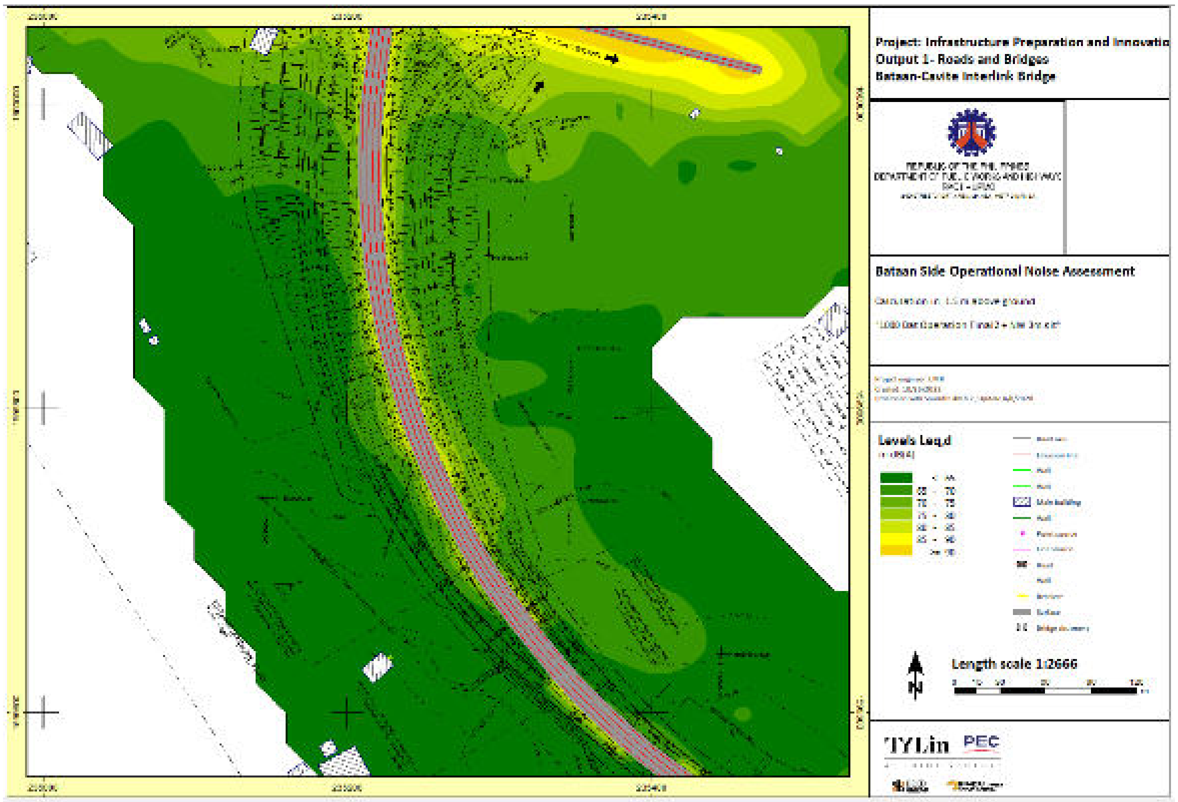


Figure A22. Section 2 Bataan Operational Noise Contour Map Day time 3m Noise Walls

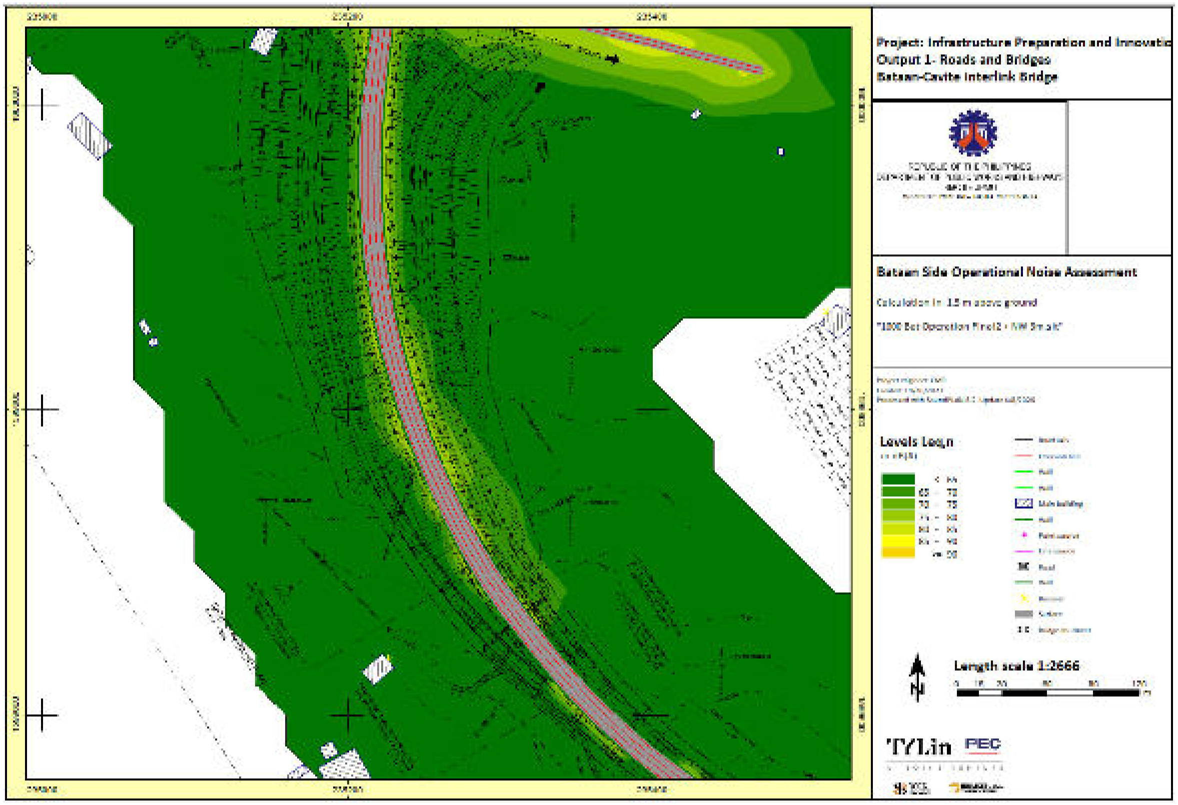


Figure A23. Section 2 Bataan Operational Noise Contour Map Nighttime 3m Noise Walls

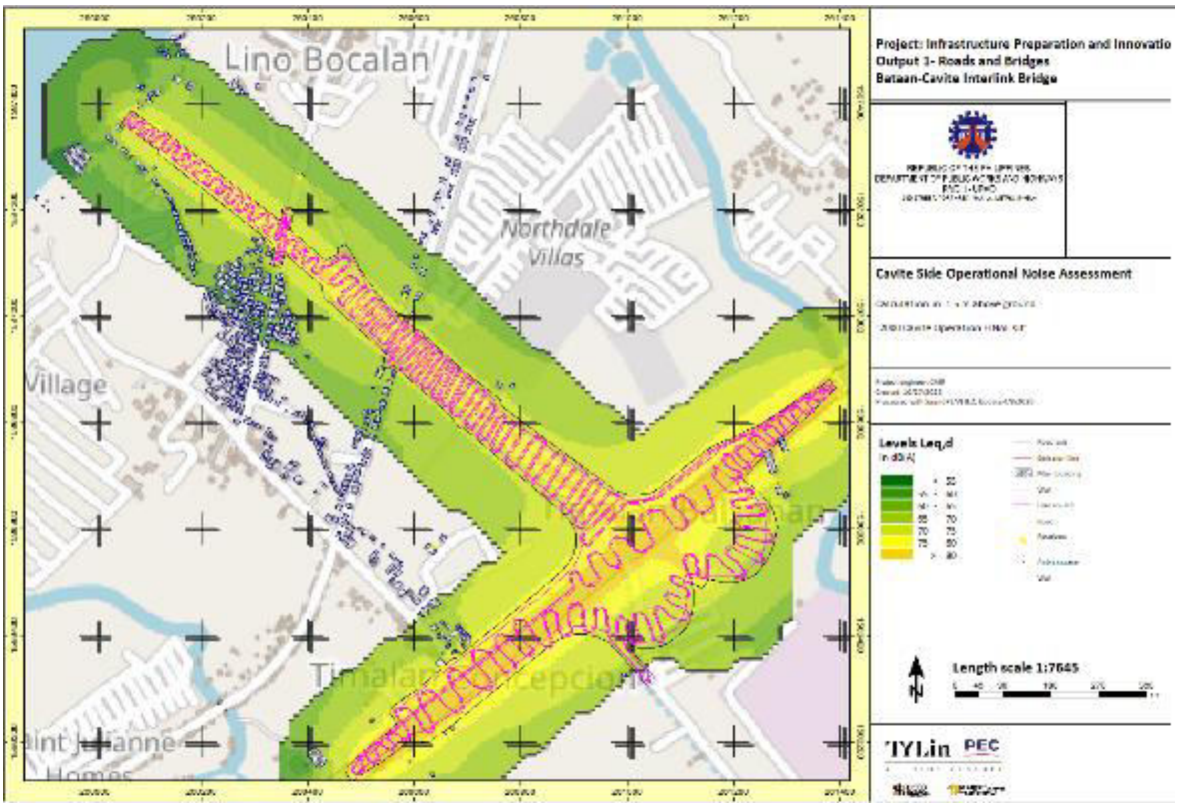


Figure A24. Entire Section Cavite Side Operational Noise Contour Map Day time Unmitigated

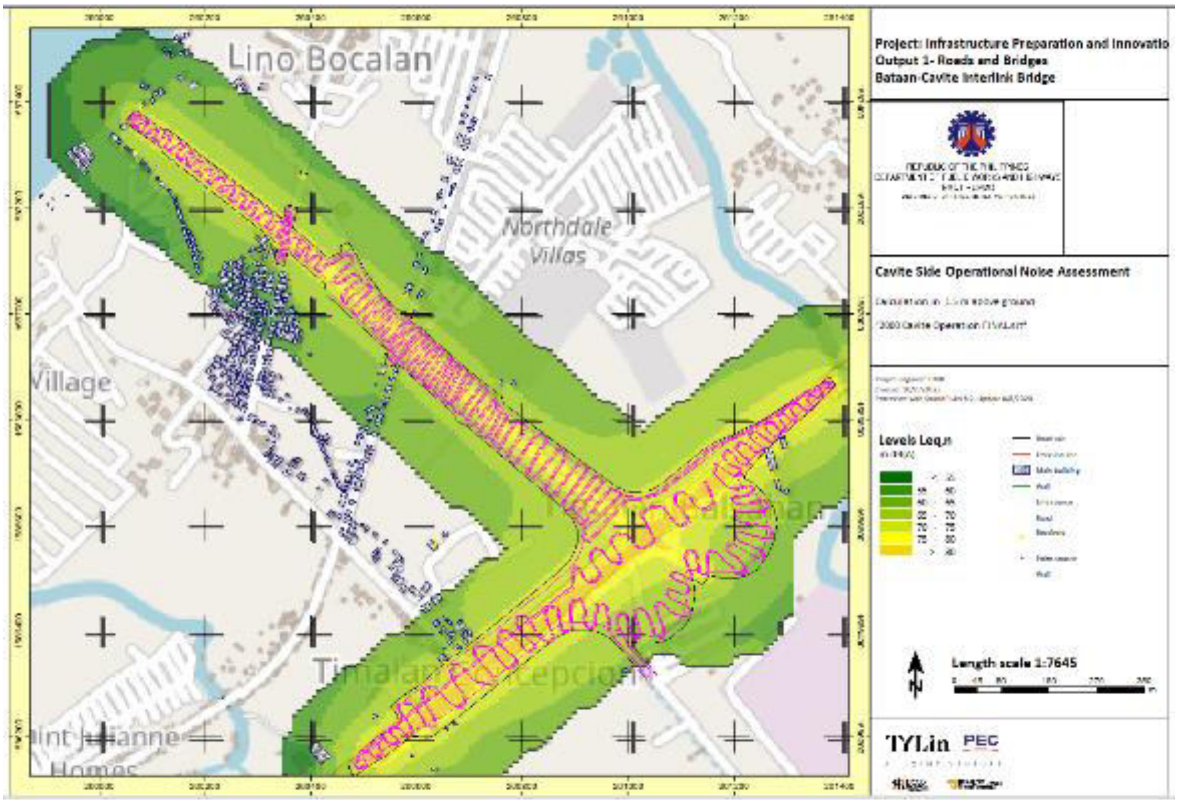


Figure A25. Entire Section Cavite Side Operational Noise Contour Map Nighttime Unmitigated

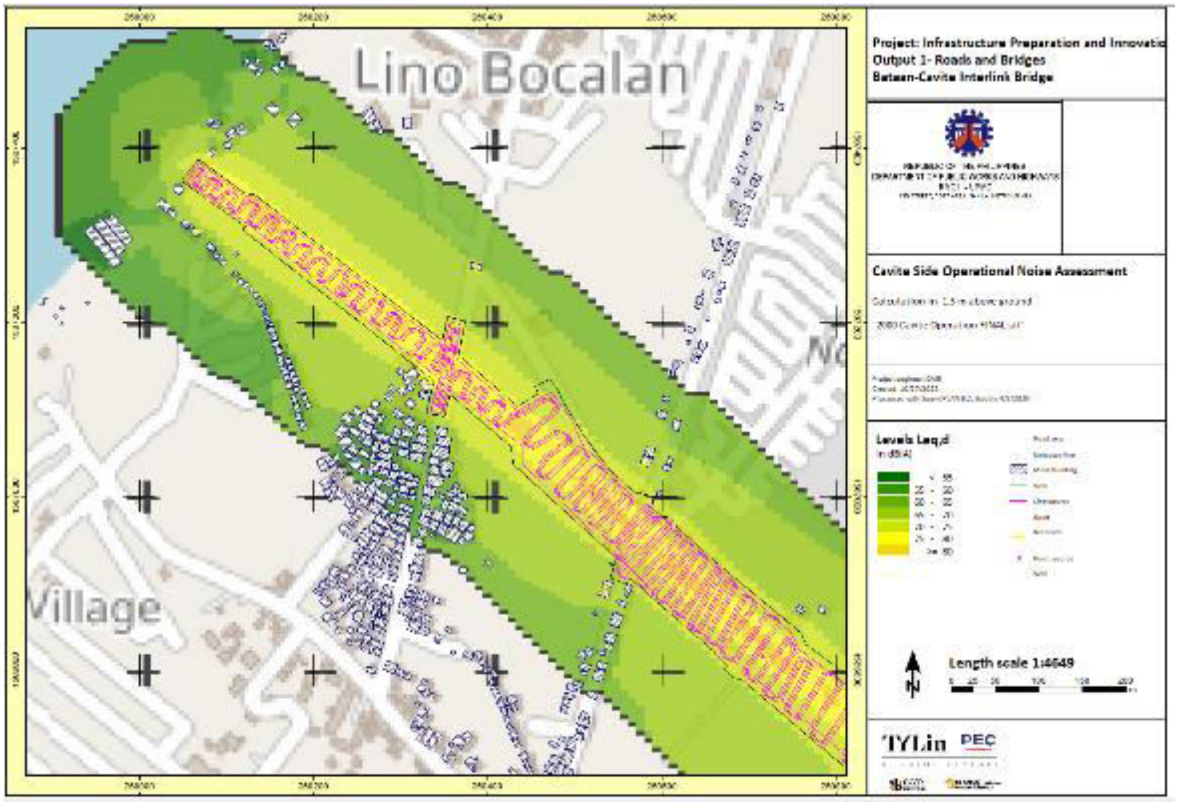


Figure A26. Section 1 Cavite Side Operational Noise Contour Map Day time Unmitigated

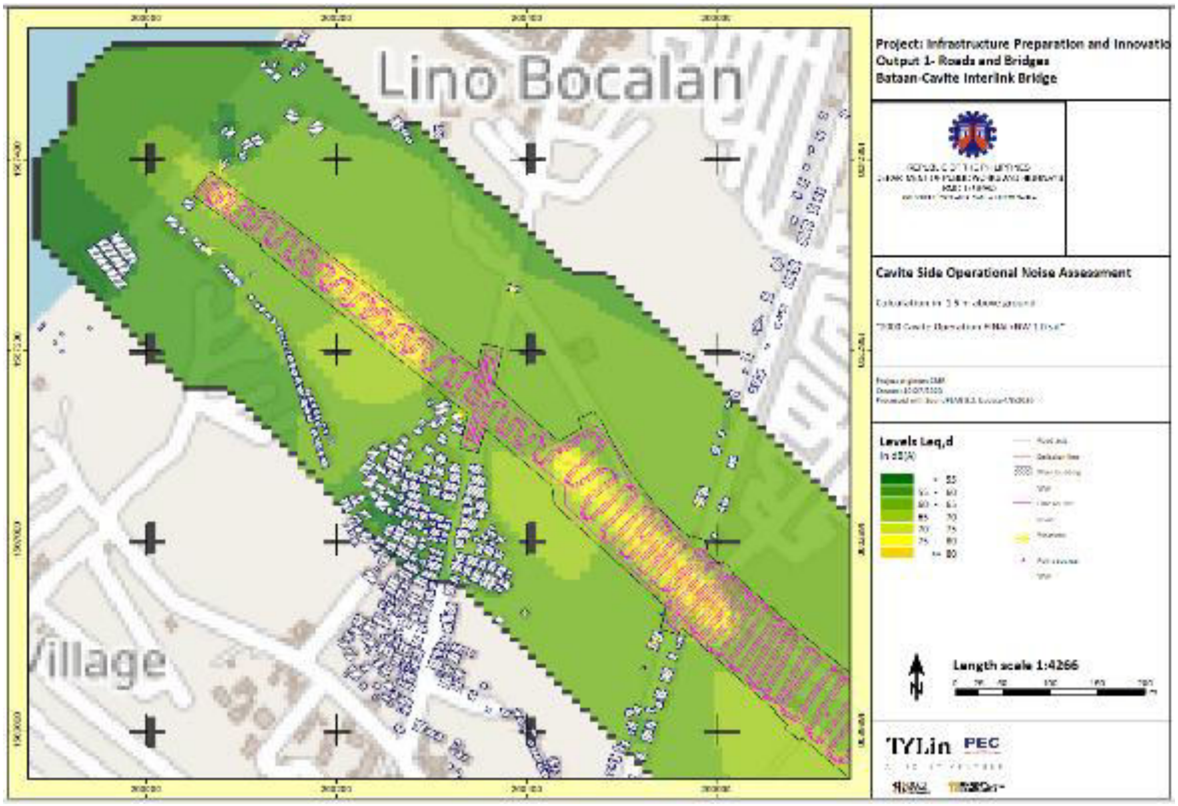


Figure A27. Section 1 Cavite Side Operational Noise Contour Map Day time 1m Noise Walls

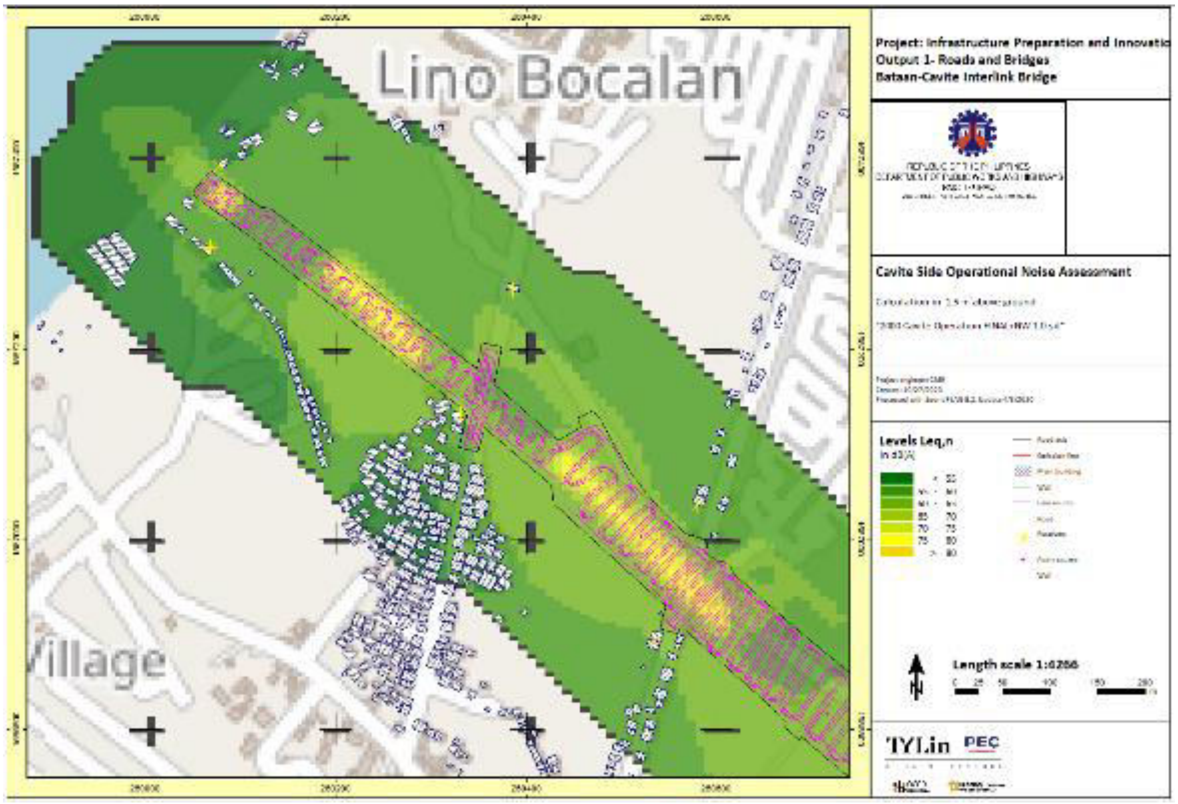


Figure A28. Section 1 Cavite Side Operational Noise Contour Map Nighttime 1m Noise Walls

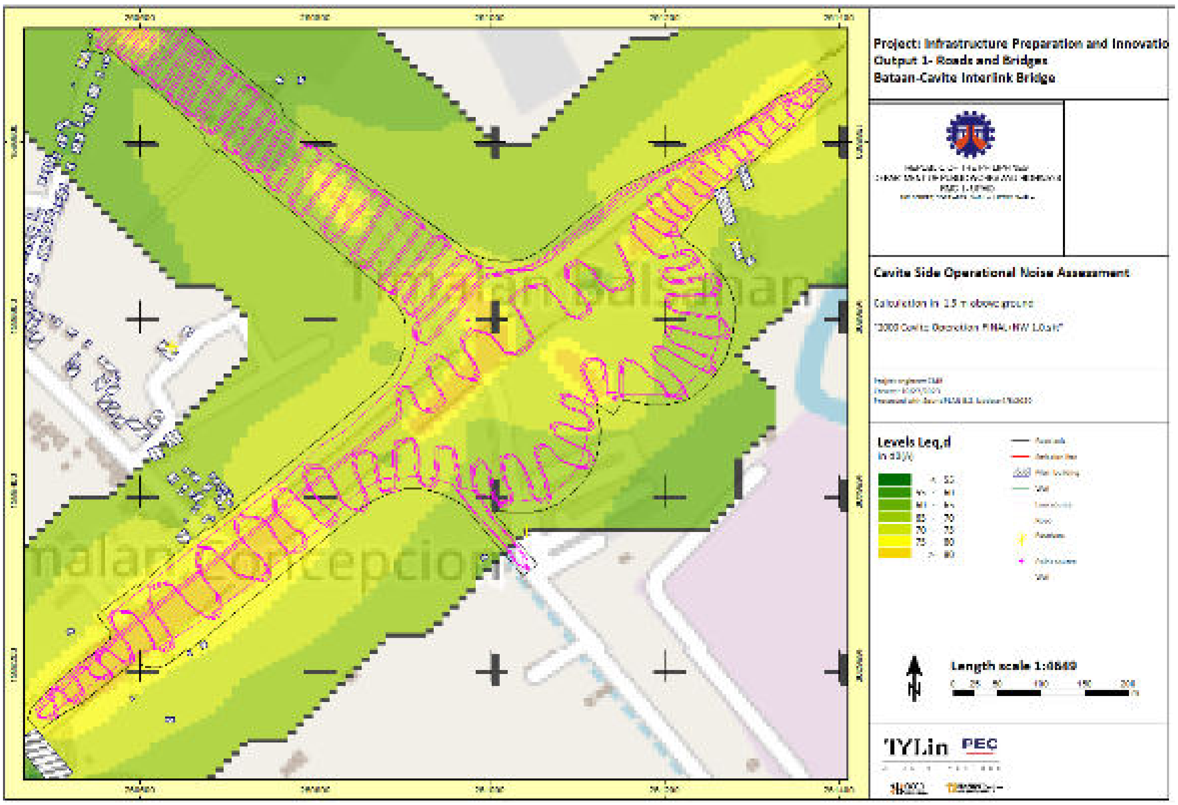


Figure A29. Section 2 Cavite Side Operational Noise Contour Map Day time 1m Noise Walls

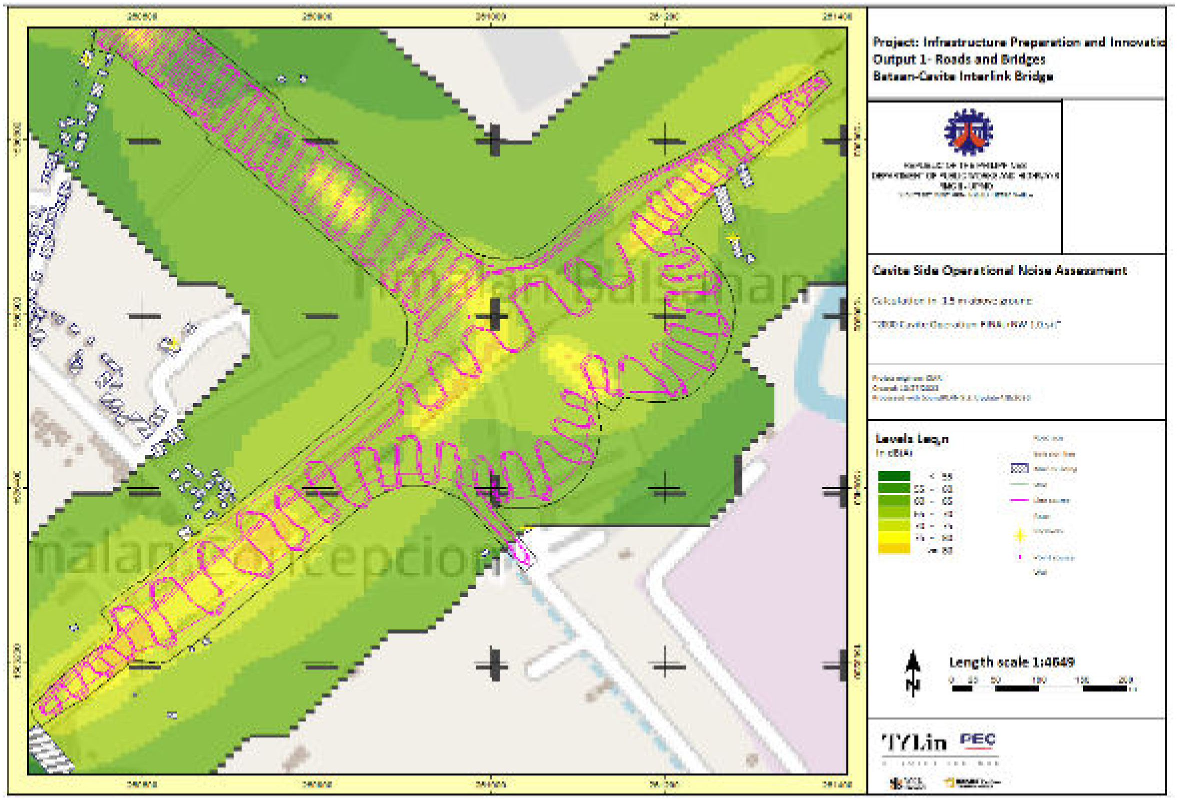


Figure A30. Section 2 Cavite Side Operational Noise Contour Map Day Nighttime 1m Noise Walls

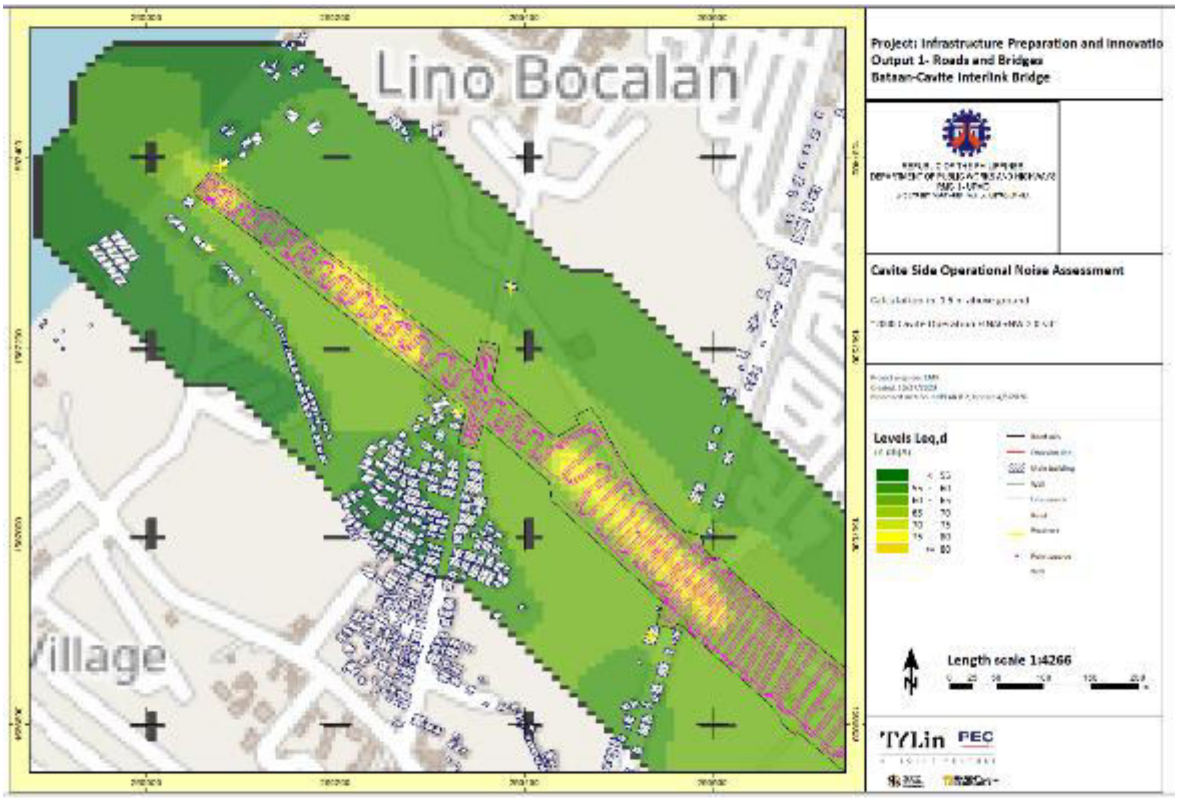


Figure A31. Section 1 Cavite Side Operational Noise Contour Map Day time 2m Noise Walls

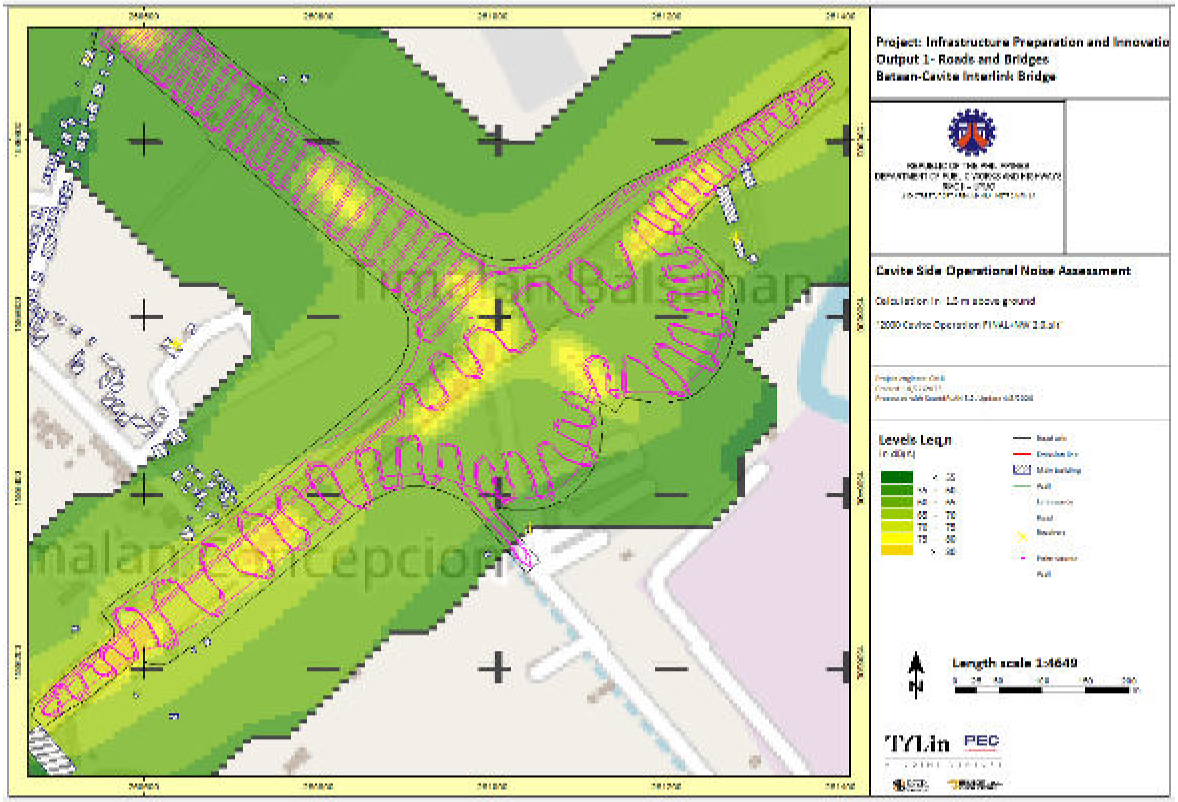


Figure A32. Section 2 Cavite Side Operational Noise Contour Map Day time 2m Noise Walls

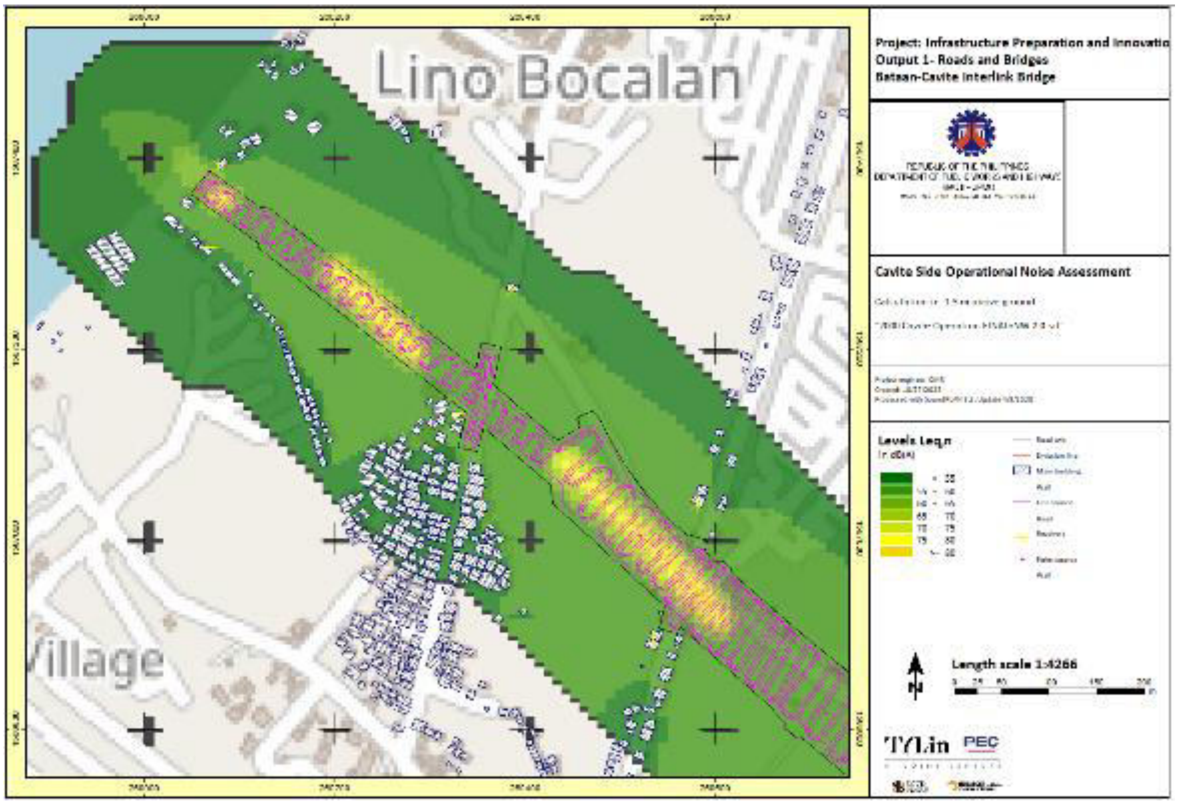


Figure A33. Section 1 Cavite Side Operational Noise Contour Map Nighttime 2m Noise Walls

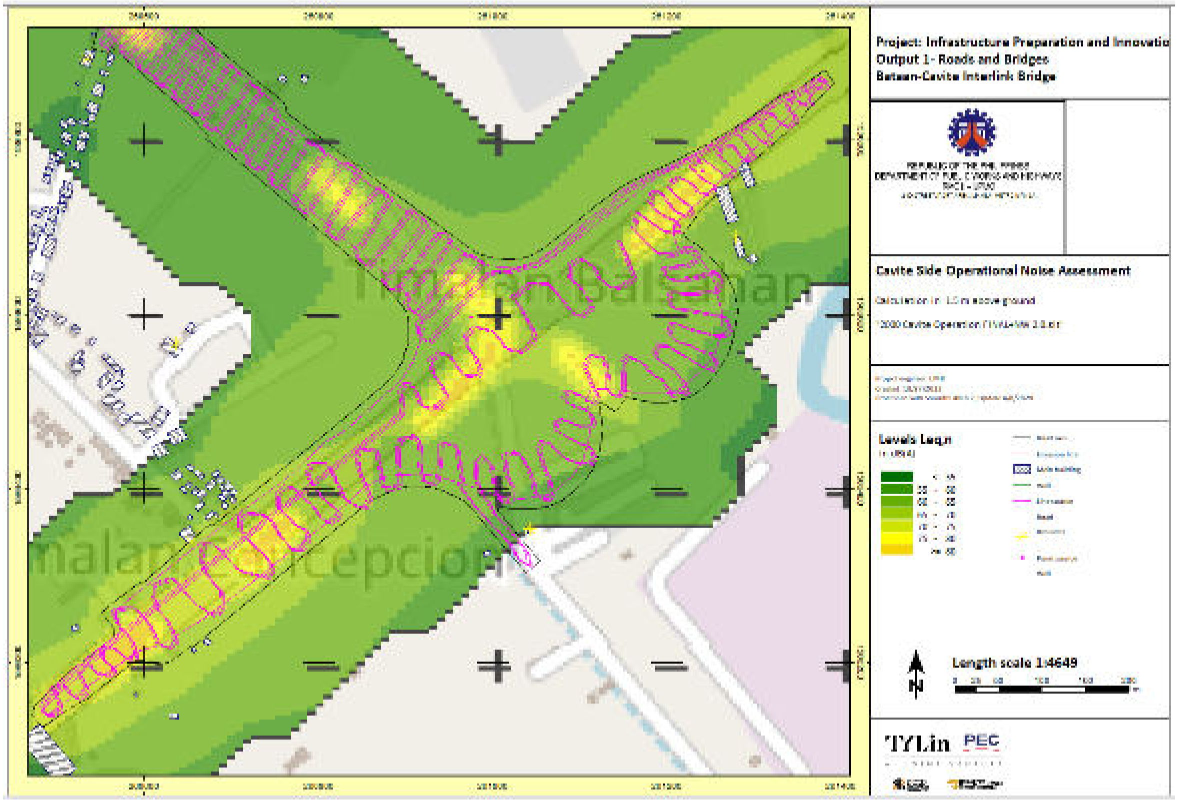


Figure A34. Section 2 Cavite Side Operational Noise Contour Map Nighttime 2m Noise Walls

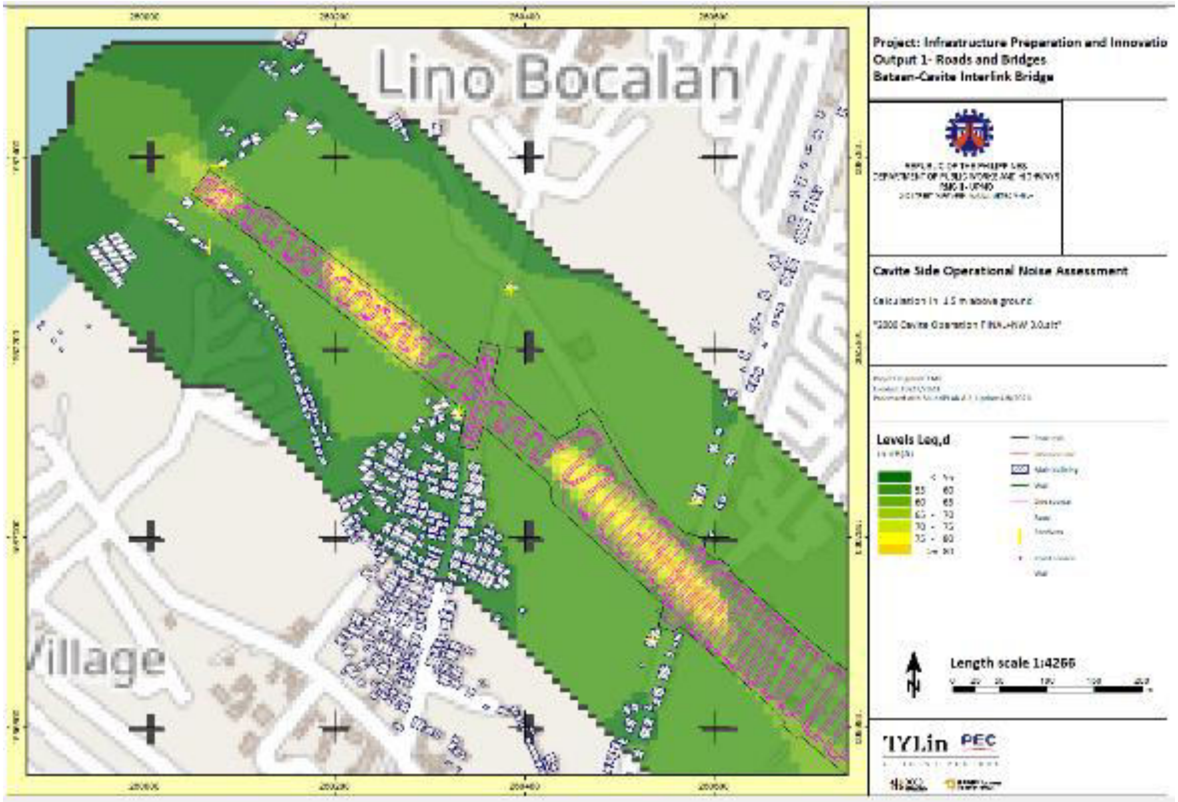


Figure A35. Section 1 Cavite Side Operational Noise Contour Map Day time 3m Noise Walls

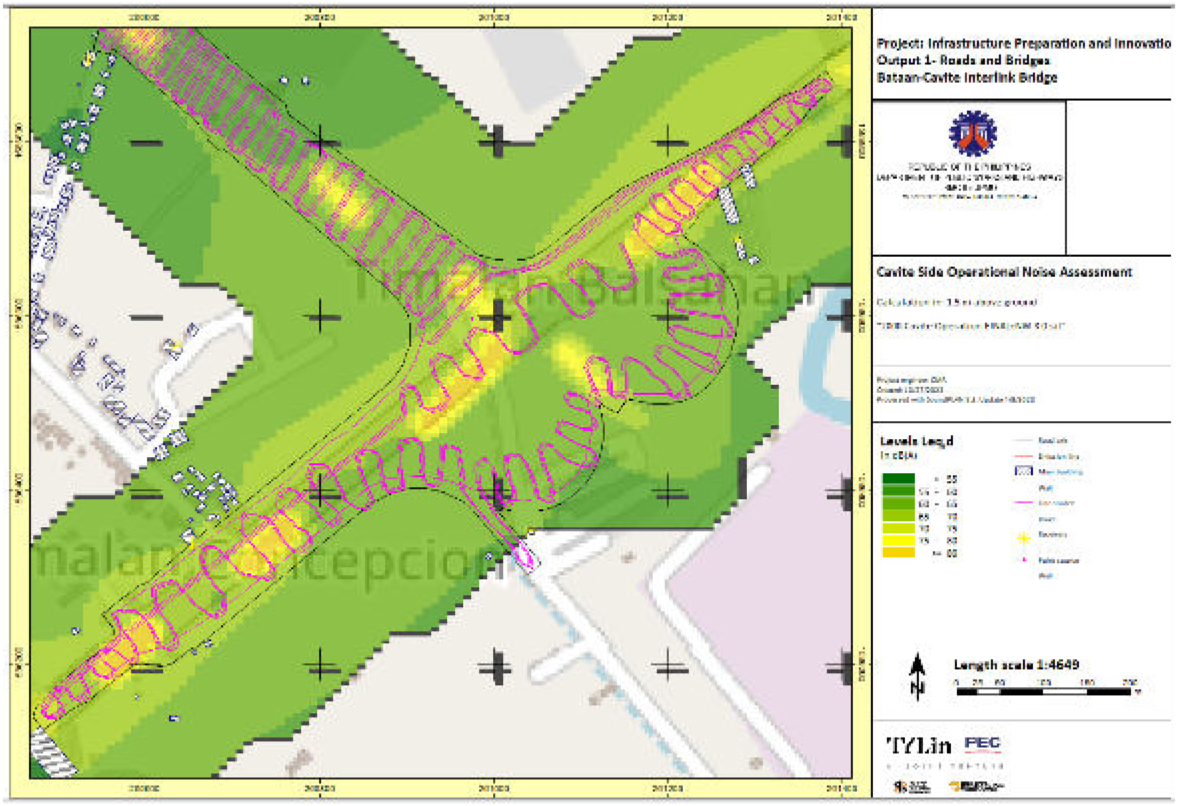


Figure A36. Section 2 Cavite Side Operational Noise Contour Map Day time 3m Noise Walls

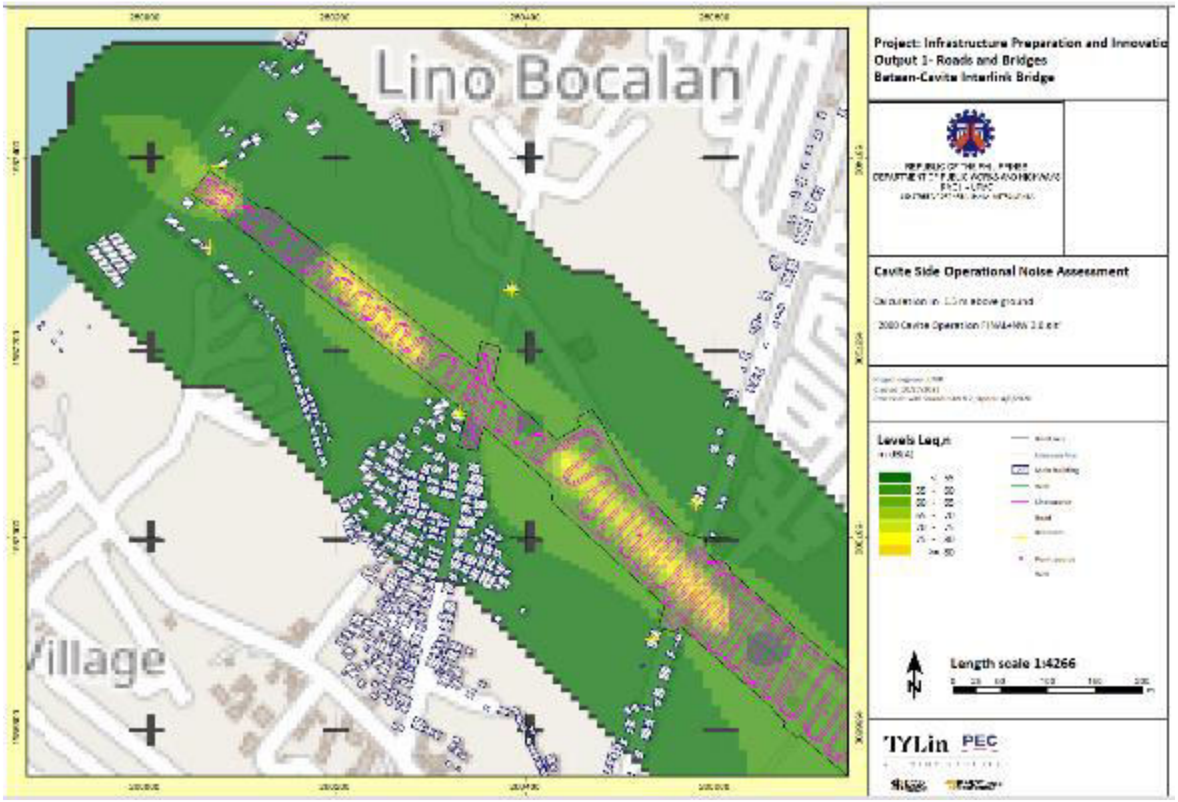


Figure A37. Section 1 Cavite Side Operational Noise Contour Map Nighttime 3m Noise Walls

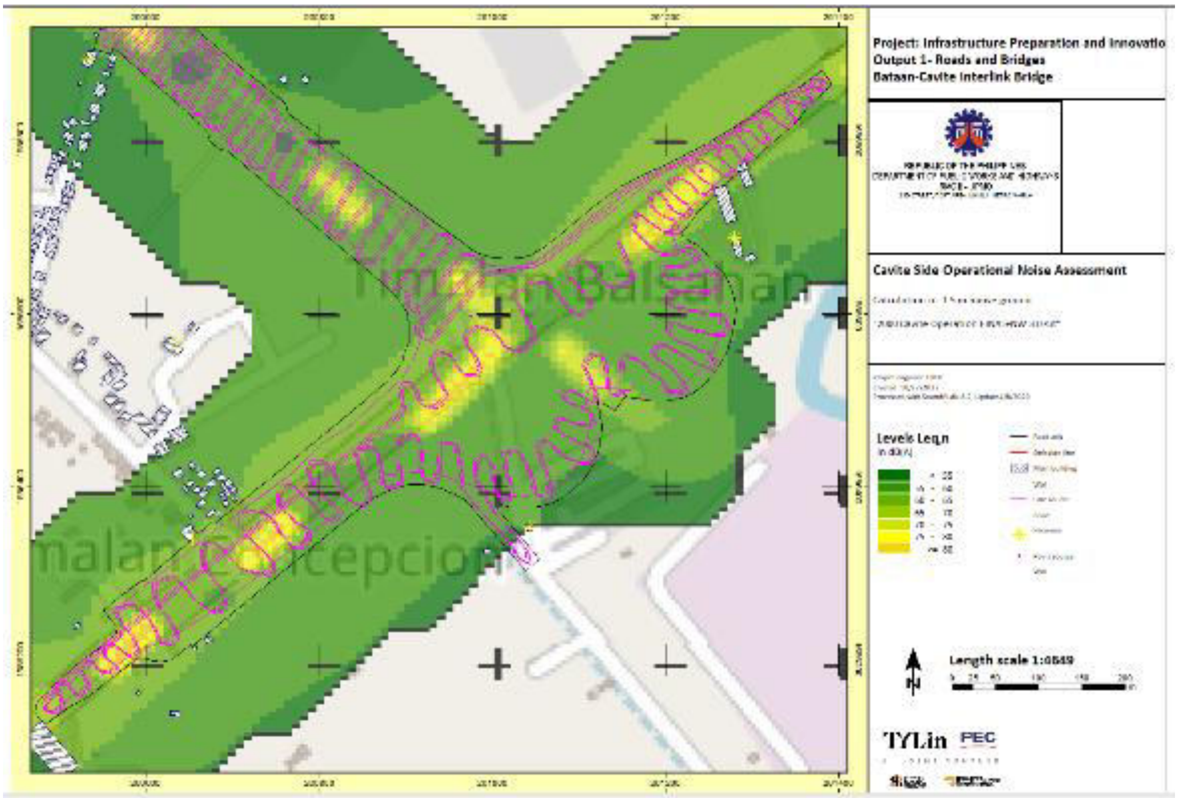


Figure A38. Section 2 Cavite Side Operational Noise Contour Map Nighttime 3m Noise Walls

ANNEX 10: CUMULATIVE TECHNICAL MEMORANDUM (SEPTEMBER 2023)

Cumulative Impacts Technical Memorandum to the BCIB EIA

Introduction and Objectives

As part of the Environmental Impact Assessment (EIA) requirements for financing the Bataan-Cavite Interlink Bridge (BCIB), a Cumulative Technical Memorandum (CTM) is provided to review the potential for occurrence of cumulative impacts. While the impacts of an individual project may be judged acceptable on their own, it is appropriate to consider the potential for a project's impacts to interact with those associated with other developments, producing cumulative effects that might not arise from any one project alone. For the purposes of this CTM, cumulative impacts from third-party projects are considered that may have additive, synergistic or interactive impacts on common receptors.

This CTM is based on a qualitative review of foreseeable projects and associated incremental environmental effects may combine with other environmental effects to result in cumulative impacts. The overall objectives are to:

- Identify potential receptors susceptible to cumulative impacts from the BCIB and wider development area;
- Define a list of foreseeable and relevant projects that may overlap in temporal and geographic manner to contribute to similar impacts on resources present;
- Produce a screening assessment of the list of projects, considering the spatial extent of each of the developments' potential impacts and if they are likely to interact with impacts from the BCIB in a cumulative manner; and
- Identify impact areas that may require additional or enhanced mitigation under the Environmental Management Plan (EMP) for the BCIB project, in light of any cumulative potentials identified.

Limitations in the Cumulative Assessment

The approach adopted in this CTM recognizes that, especially in emerging market contexts, there are many challenges associated with identifying and characterizing cumulative impacts, including lack of good-quality baseline data, uncertainty associated with anticipated developments, limited government capacity, and absence of strategic regional, sectoral, or integrated resource planning schemes. This CTM has been produced based on the limited information that was available for other third-party projects and has appropriately relied on professional judgment to help span information gaps.

The BCIB Project

The BCIB is a four-lane bi-directional road and bridge across the mouth of Manila Bay, which will create a direct connection between the Philippine provinces of Bataan and Cavite. The project will be 32 km in length overall, including 26 km of marine viaducts and bridges over the waters of Manila Bay. The BCIB project is proposed to help alleviate road congestion in Metro Manila, manage projected population growth pressures in the National Capital Region, support development of additional port capacity for Manila and central Luzon Island, enhance tourism potential in western Bataan and historic Corregidor Island,

and enable greater economic and social integration of the southern and northern parts of Luzon. The project proponent is the Department of Public Works and Highways (DPWH).

Methodology and Approach to the Cumulative Assessment

Resources/receptors were first reviewed in a two-step screening exercise to determine the potential for significant residual impacts from the BCIB project that could be experienced over a zone of influence broad enough produce interactions with contemporaneous developments. This yielded a list of impacts with both a significant residual component and a non-trivial potential for overlap with other projects. Subsequently, a list of other development projects proposed for the Manila Bay region was developed. Only 'reasonably foreseeable' projects that have funding commitments or are undergoing environmental review were considered. Each project on the list was screened based on available information about project location, scope, zones of influence, major activities and types of impacts expected. Finally, the nature, degree and significance of the potential overlap of impacts on similar geographic and environmental resources between the BCIB with those of other foreseeable projects was considered.

Definition of Zone of Influence

The relevant 'study area', or zone of influence (ZOI) was determined based on the relevant sections of the BCIB's EIA report, and informed identification of the spatial boundary within which other projects and their potential cumulative impacts should be considered. The ZOI for a project typically varies depending on the sensitivity of receptors, the nature of impact pathways and the location, intensity and duration of major project activities. For the BCIB project, the ZOI ranges from a narrow strip of just a few meters directly adjacent to the project right-of-way for some impacts (such as for noise impacts), to a few hundred meters for many others, and extending out for tens of kilometers for a minority of impacts.

Screening for BCIB Impacts with Potential for Cumulative Impacts

Resources/receptors were first screened at high level, based on information in the BCIB EIA report, to remove those impact topics that could be considered not to have any significant potential at all for cumulative effects, due to a low probability of residual effects that could interact with impacts from other projects. Resources/receptors were placed in this category in the screening if:

(1) the resource/receptor was considered to be in generally good health and the proposed Project would result in beneficial impacts, no significant adverse impacts, or minor adverse impacts that would be fully mitigated to a less-than-significant level through application of the mitigation hierarchy; or

(2) the resource/receptor was considered to be regulated in such a way that by obtaining the necessary permits and following the required regulations for impact avoidance or minimization and mitigation for impacts, a significant contribution to a potential cumulative impact would not occur.

The up-front screening identified a number of resources that could safely be considered not to pose a risk of cumulative impacts; these are shown in Table 1.

Table 1 Resources Screened Out Due to Low Potential for Residual Impacts from BCIB

Land Resources	Air Resources
• Geological stability • Aesthetic and Visual amenity • Contaminated Sites	• Terrestrial Noise Impacts • Greenhouse Gas / Climate Change
Water Resources	**People Resources**
• Rivers / Streams • Fresh / Groundwater Water Quality • Water supply	• Accessibility • Utilities • Health • Road Traffic • Archeological/Cultural sites

For the remaining resources/receptors identified in the BCIB EIA (Chapter 5 – Land, Chapter 6 – Water, Chapter 7 – Air and Chapter 8 – People), both the resources/receptors and the associated potential residual impacts were tabulated, as summarized in Table 2. For practicality, and to help simplify the screening exercise, the resources/receptors and impacts considered have been generalized.

Table 2 Residual Impacts of Potential Relevance to the Review

Resource/Receptor	Impact From BCIB	Impact Receptor – Secondary Receptor
Ecosystem Services / Natural Resources	Stress on water resources through consumption of potable water for construction / operation	Natural capital (freshwater and groundwater resources) – local population / land use / local economy
	Consumption of fossil fuels for plant, vehicles, equipment, and other combustion devices	Natural capital (oil, diesel, petrol and natural gas) – local population / land use / local economy
	Consumption of natural resources for construction materials	Natural capital (wood, metal ores, rocks, geological deposits and aggregates) - resident population / land use / local economy
	Alteration of land use for installation of project facilities and storage of construction and waste materials	Natural capital (Land use) – landowners / local population
Physical Environment	Release of air pollutants from various emission sources during construction / operation activities Release of dust and PM10 from construction / operation activities and road traffic	Air quality – health and nuisance resident population / employees / terrestrial habitats, flora and fauna
	Changes to currents and sedimentation	Erosion of land, increased turbidity, stress on marine fauna and flora
	Increase in sub-sea noise levels from construction / operation activities, plant equipment and vessels.	Disruption of marine fauna
	Increase in terrestrial ambient noise levels from construction / operation activities, plant equipment and vehicles.	Noise – health and nuisance – resident population / employees / terrestrial fauna
	Release of process and sanitary wastewater management (improper collection, storage, treatment and/or disposal) during construction / operation	Groundwater and soil – resident population / employees / land use / local economy Surface water (freshwater / marine) - biodiversity (flora and fauna) / land use / local economy

Resource/Receptor	Impact From BCIB	Impact Receptor – Secondary Receptor
	Release of non-hazardous (industrial and domestic) and hazardous substances during construction / operation	Groundwater and soil – resident population / employees / land use / local economy Surface water (freshwater / marine) - biodiversity (flora and fauna) / land use / local economy
	Accidental release of oil / effluence into the marine and terrestrial environment during construction / operation	Surface water (freshwater / marine) quality - biodiversity (flora and fauna) / land use / local economy
	Seabed work and disturbance during construction	Marine water quality - biodiversity (flora and fauna) / local economy
	Land take for installation of project facilities and storage of construction and waste materials	Soil and topography – resident population/ biodiversity (flora and fauna)
Biodiversity	Temporary or permanent alteration to physical environment during construction / operation	Terrestrial / marine habitats, flora and fauna
	Temporary or permanent disturbance during construction / operation	Terrestrial / marine habitats, flora and fauna
	Increase in lighting / noise during construction / operation.	Terrestrial / marine habitats, flora and fauna
	Accidental release of oil / effluence and other water pollutants into the marine and terrestrial environment during construction / operation	Terrestrial / marine habitats, flora and fauna
	Direct and/or indirect impacts on protected and designated areas	Terrestrial / marine habitats, flora and fauna
	Land take for site preparation / installation of project facilities, and storage and disposal of construction waste materials	Terrestrial habitats, flora and fauna
	Release of air pollutants from various emission sources during construction / operation activities	Terrestrial habitats, flora and fauna
Socio-Economic	Employment of local people and expatriates for construction / operation (direct and indirect employment) and in local markets (e.g., fisheries)	Employment – resident population / local economy
	Impacts on local livelihoods and industries.	Resident population / local economy
	Increased pressure on road traffic from transportation of equipment, machinery, raw materials, and wastes	Road traffic (congestion) – resident population / local economy
	Increased utilization and pressure on local infrastructure facilities / services	Local infrastructure/services - resident population / workers
	Temporary influx of a peak of workers into the area during construction	Community safety and security / relationship between local communities and workers
Community and Health	Release of air pollutants from various emission sources Release of dust and PM10 from construction / operation activities and road traffic	Air quality – health and nuisance - resident population / employees
	Increase in ambient noise levels from construction / operation activities, plant equipment and vehicles.	Noise – health and nuisance – resident population / employees
	Employment of local people and expatriates for construction / operation (direct and indirect employment)	Relationship between workers and local communities / local economy
	Increased traffic from transportation of equipment, machinery, raw materials and wastes	Road and marine traffic – resident population / workers

Resource/Receptor	Impact From BCIB	Impact Receptor – Secondary Receptor
	Risk of disasters / explosions, including marine vessel collisions around the Manila Bay area	Mortality risk and health to employees or workers and resident population
Cultural Heritage	Temporary or permanent disturbance to archaeological resources during construction / operation	Archaeological sites or sites of cultural and / or religious significance
	Cultural conflict of employment of local people and expatriates for the BCIB construction / operation	Resident population / employees

For a residual impact from the BCIB project to be considered potentially cumulative in concert with anticipated impacts from other development projects, the impacts of other projects should normally be of the same type, affect the same resources/receptors, and operate in overlapping geography and timeframes (although elongating similar impacts is also considered a cumulative impact). The next stop in the consideration of cumulative impact potential was to identify and characterize other foreseeable developments in the Manila Bay region.

List of Future Foreseeable Development Projects

In order to ensure comprehensive coverage of other projects in and around Manila Bay, which is a highly active developing region, a 'foreseeable list' of projects was developed through reference to available feasibility study and environmental assessment documentation, a list of current ECCs maintained by DENR-EMB, and various online resources. The foreseeable list is shown in Table 3. The list was scoped to include:

- Built and operational projects;
- Approved but not yet completed projects;
- Projects under construction; and
- Projects which are reasonably foreseeable, i.e., projects for which have an application, or an application has not yet been submitted, but which are likely to progress before completion of the development and for which sufficient information and robust assessment outcomes are available at the date of any appropriate assessment to assess the likelihood of cumulative impacts.

Projects listed in Table 3 have been grouped, where appropriate, based on the similarity of sector, project type, and similarity of anticipated resource impacts for evaluation. Projects were screened in or out depending on the significance of their impacts and the potential for overlap with the Project in relation to zones of impact (see Table 4). For many, there is currently limited publicly available information published about the identified third-party projects, and therefore, professional judgement based on familiarity with the environmental resources of Manila Bay and knowledge of impacts typically anticipated from particular types of projects was necessarily applied.

Table 3 Future Foreseeable Projects List and Potential Residual Impacts that Could be Combined and Result in Cumulative Impacts

Project Overview	Key Residual Impacts Anticipated
New Manila International Airport (Bulacan)	
Construction of a new international airport on a 2,565-ha coastal site approximately 18 km north-northwest of central Manila. Phase 1 of the airport will serve 35 million passengers per annum, with eventual design capacity of 100 million passengers. Four runways are planned, of which two will be developed in Phase 1. The airport site is close to sea level and construction of a filled platform over an area of approximately 1,700 ha will be required; this will displace mostly mudflats, mangroves and fishponds. Fill for the project will come from seabed mining on the San Nicolas Shoal (30 km away), and a 15-km x 250-m shipping channel will be dredged to provide access to the site for materials barges. The material dredged from the channel will be transported to an ocean disposal site outside Manila Bay. Substantial dredging will also be required on the landward side of the airport site to increase the capacity of existing river channels, with the aim of preventing induced flooding upstream. The project will include an 8-km toll road link to the Luzon Expressway, as well as a local access road. Site preparation began in 2022, and operation of the airport's first phase is scheduled to begin in 2027. The airport is being developed by the San Miguel Aerocity Corporation, under a 50-year land lease with the Government of the Philippines and a build-operate-transfer agreement with the Department of Transportation. The airport development site is approximately 46 km from the closest portion of the BCIB alignment, and the ocean disposal site is about 55 km west of the alignment.	• Hydrological modification • Loss and degradation of intertidal and nearshore benthic habitat • Disturbance of habitat use and bird migration • Water quality impacts from dredging, earthworks • Hydrocarbon spill risks • Dust • Air pollution from aircraft emissions (operations) • Noise (operations)
Sangley Point International Airport	
A joint venture deal has been signed between the Province of Cavite and a private consortium to develop a two-runway, USD 11 billion international airport at the present site of the Sangley Point air base. To be developed in three phases, the airport anticipates a passenger capacity of 80 million passengers per year, with eventual capacity of 130 million passengers if expanded to four runways. Development of the airport will require land reclamation to expand Sangley Point northwards into Manila Bay. The proposed airport site is approximately 21 km from the closest portion of the BCIB alignment.	• Hydrological modification • Loss and degradation of intertidal and nearshore benthic habitat • Disturbance of habitat use and bird migration • Water quality impacts from dredging, earthworks • Hydrocarbon spill risks • Dust • Air pollution from aircraft emissions (operations) Noise (operations)
Seabed Mining Projects in Manila Bay	
The Mines and Geosciences Bureau of DENR has granted seabed mining tenements covering most of Manila Bay (as detailed in the EIA), and a subset of those tenements have advanced through the environmental review process and been granted Environmental Compliance Certificates (ECCs). Others are in various stages of exploration and earlier project preparation and may come to fruition at some point in the future, although these projects are controversial, and a recent presidential order cast significant doubt over future ECC approvals for such projects within Manila Bay. Two of the already-approved seabed mining projects (by permit holders Philippine Reclamation Authority and VIL Mines, Inc.) cover tenement areas within 10 km of the BCIB alignment and extend right up to the alignment itself. Seabed mining is currently active off Cavite, on the San Nicolas Shoals and in the vicinity of the BCIB alignment. The seabed mining operations in Manila Bay primarily make use of suction dredges operated from large vessels.	• Loss of fish habitat (long-term) • Loss of fisherfolk livelihood (short-term and long-term) • Siltation and sedimentation (short-term) Underwater noise (medium term)
Shoreline Development and Land Reclamation Projects	
Apart from the two airport development projects already mentioned, numerous land reclamation projects have been proposed or are underway within Manila Bay, including those which would build out from shore and those that would create islands. These include: • Cavite Reclamation Project • Navotas Coastal Bay Reclamation Project (650 ha) • New Manila Bay Reclamation and Development Project (407 ha) • Manila Waterfront Reclamation Project • Horizon Manila Reclamation Project (419 ha)	• Hydrodynamic modification • Loss and degradation of fish habitat and fishing grounds • Siltation and sedimentation (short-term) • Underwater noise and vibration (short-term)

Project Overview	Key Residual Impacts Anticipated
• Pasay Harbour Reclamation Project (265 ha) • Parañaque Reclamation Project (287 ha) • Cavite Reclamation and Development Project Island C (205 ha) • Bacoor Reclamation and Development Project (230 ha) • Diamond Reclamation and Development Project (100 ha) • Bacoor Reclamation and Development Project (90 ha) The land reclamation projects listed are all proposed for urban development purposes and reflect the high cost of land in and around Metro Manila. Land reclamation in the Manila Bay context is typically accomplished with material dredged or mined from the seafloor and may make use of sheet piling installed with vibrational drivers.	
On-Shore Highway Projects	
Numerous expressway development projects are proposed or underway in the Manila Bay region, including: • Cavite-Laguna Expressway (CALAX) Cavite Section • San Pedro–C6 Laguna Lake Road (South Luzon Expressway Laguna to Taguig) • NLEX-C5 North Link Project Segment 8.2 in Central Manila • Pasig River Expressway • Skyway Stage 8 (Tanauan–Tagaytay Expressway) • Skyway Stage 7 (Taguig–Quezon City) Each of these expressway projects can be expected to involve substantial land acquisition and resettlement, as well as materials hauling and induced traffic congestion during the construction phase.	• Traffic congestion (construction) • Noise (construction and operations) • Emissions (construction and operations)
Over-Water Highway Projects	
The Manila-Cavite Toll Expressway Project (MCTEP) Segment 5 is proposed to extend the CAVITEX expressway from Kawit to Tanza and Cavite City by way of a 21.8-km raised dual carriageway, of which 3.7 km would be supported on a marine viaduct spanning open water and intertidal mudflats within Bacoor Bay, and 10.6 km would be over the nearshore zone of Manila Bay proper, following a path roughly parallel to the shoreline in most places. The marine viaduct piers would be installed using spread-foot foundations and concrete piles cast in situ with the help of coffer dams. The southwestern end of the expressway's marine viaduct would come ashore approximately 9 km northeast of the BCIB's Cavite landing point.	• Traffic congestion (construction) • Underwater noise (construction) • Adverse visual impacts • Siltation and sedimentation (construction)
Mass Transit Projects	
Several commuter rail projects are under development in and around Metro Manila, including: • Light Rail Transit (LRT) Line 2 West Extension Project • LRT Line 6A and Line 6B + C Project • Metro Manila Subway Project Phase 1 • Malolos–Clark Railway Project None of these projects is nearby either terminus of the BCIB, the closest being the LRT Line 6A and Line 6B+C project, whose southern terminus would be at Dasmariñas, Cavite, about 18 km from the BCIB interchange. Each of these rail projects will involve substantial land acquisition and resettlement, as well as materials hauling and induced traffic congestion during the construction phase.	• Traffic congestion (construction) • Noise (construction and operations) • Dust (construction)
Energy and Fuel Infrastructure Projects	
Several power generators, fuel transport and storage and petrochemical projects have been developed nearby the BCIB project area, particularly in Bataan. These include: • GN Power 2x600MW Coal- Fired Power Plant Project (GMCP 2) • SMC Limay 600 MW Power Plant Project • Petron Bataan Refinery Upgrade Project • GN Power Mariveles Energy Project (2x300MW Coal-Fired Power Plant) • PPDC Petrochemical Park • 1200MW Liquefied Natural Gas (LNG)-Fired Combined Cycle Power Plant • Bataan Combined-Cycle Power Plant Project	• Emissions from combustion and off-gassing

Project Overview	Key Residual Impacts Anticipated
• Additional 15 MW Diesel Power Project • 48 MW Diesel/Bunker- Fired Power Plant Some of the projects listed are nearby the Bataan terminus of the BCIB, notably the GN Power plants (4 .2 km west of the landing point) All of the projects listed have already been completed or will be before construction begins on the BCIB project.	
On-Land Quarries and Aggregate Projects	
The Sisiman Aggregate Quarrying and Crushing Project operated for many years on the north side of Sisiman Bay, about 7 km west of the BCIB's Bataan terminus. The quarry does not appear to be operational at the time of writing, and details of any future plans for its operation are not publicly accessible. The Zaccheus Farm Estate has been operating a basalt quarry on a site on the Mariveles shore, 3.2 km west of the BCIB alignment, since late 2021. This site is provisionally expected to be leased for use as a staging area for the BCIB marine works, hence the quarry operation would not overlap temporally with the BCIB construction works.	• Dust • Noise • Traffic congestion

Identification of Potential Cumulative Impacts

Project information was evaluated to ascertain the relevancy and scale of the various developments and plans with an indication, using a matrix of the key receptors, to whether there is a potential for them to result in impacts of a similar nature to the BCIB project. This evaluation considered the specific sensitivities and susceptibilities, spatial extent, and temporal dynamics of the impacts. Table 4 presents the project screening process that was undertaken as part of this CTM.

In general, the BCIB project's zones of influence with respect to issues such as land resources, air quality, road traffic, terrestrial noise and terrestrial ecosystems, sedimentation/scouring/erosion are not expected to significantly overlap with similar impacts from other projects. In the case of most impacts, the considerable distances between the BCIB and other projects identified simply outweigh even the most conservative estimation of ZOIs. Four of the projects included in the list were determined to be of negligible relevance on this basis. Some potential for cumulative impacts has, however, been identified in relation to a number of aspects during construction, specifically:

1. Multiple areas of marine disturbance, particularly with respect to noise generating activities such as piling and dredging, could synergistically impact marine fauna;
2. Concurrent operation of multiple marine projects within Manila Bay could result in cumulative impacts on the livelihoods of fisherfolk, mostly as a result of displacement of benthic habitat and fishponds; and
3. Concurrent operation of marine operations may increase the risks of vessel collisions and attendant spill risk given the presence of an increased number of vessels operating, including large numbers of barges, which are likely to be ganged or towed in series, and hence will have limited maneuverability.

Table 4 Summary of Significant Residual Impacts by Resource and Project

Project	Natural Capital	Land Take	Air Quality	Bird Foraging and Migration	Terrestrial Noise	Water Quality	Sediment Regime	Topography	Groundwater	Marine Noise	Fisherfolk Livelihoods	Road Traffic	Local Business / Economy	Local Infrastructure	Marine Traffic	Marine Accidents and Incidents
BCIB																
New Manila International Airport (Bulacan)																
Sangley Point Airport																
Seabed Mining in Manila Bay																
Shoreline Development and Land Reclamation																
On-shore Highways Projects																
Over-Water Highway Projects																
Mass Transit Projects																
Energy and Fuel Infrastructure Projects																
On-Land Quarries and Aggregates Projects																

(The header row spans "Environmental Aspect/Resource" over the resource columns.)

Key

(green)	Negligible or Positive Impact
(cream)	Potential Negative Impact but unlikely to overlap ZOI
(orange)	Potential Negative Impact and Potential for Overlap with BCIB ZOI – Risk of Cumulative Impacts

Conclusion and Implications for Management of Cumulative Impact Relative to the BCIB Project

Three areas of potentially significant cumulative impact have been identified, as follows:

1. Multiple areas of marine disturbance, particularly with respect to noise generating activities such as piling and dredging, could synergistically impact marine fauna;
2. Concurrent operation of multiple marine projects within Manila Bay could result in cumulative impacts on the livelihoods of fisherfolk, mostly as a result of displacement of benthic habitat and fishponds; and
3. Concurrent operation of marine operations may increase the risks of vessel collisions and attendant spill risk given the presence of an increased number of vessels operating, including large numbers of barges, which are likely to be ganged or towed in series, and hence will have limited maneuverability.

The likelihood and severity of the first and third of these potential cumulative impacts will be dependent on the nature and timing of activities on the various projects. For this reason, mitigation is likely to be best achieved through inter-project coordination and dialogue during the planning and phasing of project activities. It has therefore been recommended that requirements to pursue coordination with the proponents of temporally overlapping projects should be included in the EMP for the BCIB project; such coordination should be the joint responsibility of DPWH and its Construction Supervision Consultant. In the case of underwater noise, this recommendation has been reflected in extra EMP provisions in relation to development of the required Underwater Noise Management Plan, possibly involving adaptation of the marine piling schedule to limit additive noise effects. With regards to collision and spill risk, the recommended coordination has helped to shape EMP requirements around coordination with the Philippine Coast Guard on development of Spill Prevention and Response Plans, in line with the broader Manila Bay Oil Spill Contingency Plan.

Cumulative impacts on fisherfolk livelihoods are less appropriately addressed through coordinative action, as the cumulative dimension is derived more from the additive taking and degradation of benthic habitat important to populations of target fish species than it is from the simultaneity of habitat-affecting activity. It is incumbent on each project that may degrade or take fish habitat to devise and implement robust compensatory measures for fisherfolk, commensurate with its own expected impact. The Social Development Plan within the EMP for the BCIB project specifies both financial compensation measures and institutional innovations to help ensure long-term protection and rejuvenation of fisheries resources within the project's zone of influence for fisheries impacts. Other Projects are encouraged to participate in this implementation within the Manila Bay boundaries to ensure wide-spread success and longevity for fisherfolk livelihoods.