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† DECEASED

15 March 2022

5.9506

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Attention: **MS. MARIE GRACE T. PASCUA, CESO III**
Regional Director, NCIP MIMAROPA

ATTORNEY JANSEN I. JONTILA
Provincial Officer, NCIP Palawan

Re: Cease and Desist Order dated 7 March 2022

Gentlemen:

On behalf of **Ten Knots Philippines, Inc.** ("TKPI"), we write in relation to the Cease and Desist Order ("CDO") dated 7 March 2022, which TKPI received on 14 March 2022, directing TKPI to stop operating its projects in Villa Libertad and Pasadena.

With all due respect, the CDO does not have any factual and legal basis.

First, it is incorrect to state that TKPI "has not submitted itself to the Free and Prior Informed Consent (FPIC) process". In TKPI's letters dated 17 May 2021, 6 August 2021, 2 November 2021, and 6 December 2021, TKPI repeatedly and expressly committed to participate in all lawful processes determined by your office, including the FPIC process under Section 59 of the Indigenous Peoples Rights Act ("IPRA"). In fact, TKPI requested a technical conference with your office to discuss how to move the lawful processes forward.

Second, it was TKPI's understanding that the technical conference held on 8 February 2022 commenced the Section 59 process. During that technical conference, your office explained that a field-based investigation ("FBI") would first be conducted to determine whether the location of TKPI's projects overlaps with *existing* ancestral domains; and if so, TKPI would have to go through the FPIC process. You also confirmed during the technical conference that no delineation of ancestral domains had yet been made for Ms. Remedios Cabral's CADT Application, which you categorically stated would start only in March 2022. Hence, there cannot be any recognized ancestral domain yet with respect to Ms. Cabral's CADT Application.

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Third, pursuant to the technical conference and in compliance with your letter dated 13 February 2022, TKPI submitted all the documents that you requested in relation to the FPIC process, even though TKPI had questioned the propriety and basis of your reliance on the letter dated 3 December 2020 of Mr. Brenn P. Cabiguen (of the NCIP Roxas Service Center), which enumerated 15 barangays to be identified and recognized as "Ancestral Domain Claims" ("Cabiguen Letter"). Thus, TKPI submitted the following documents on 3 March 2022 to your office:

Project	TCTs or Tenurial Instruments and date	Environmental Compliance Certificate ("ECC")
Lio Airport and Lio Estate	1. TCT No. 065-2017000586; 2. TCT No. 065-2017000587; 3. TCT No. 065-2019000100; 4. TCT No. 065-2019000724; 5. TCT No. T-8895; 6. TCT No. T-8986; 7. TCT No. T-8996; 8. TCT No. T-9035; 9. TCT No. T-9038; 10. TCT No. T-9041; 11. TCT No. T-9065; 12. TCT No. T-9504; 13. TCT No. T-10195; 14. TCT No. T-10549; 15. TCT No. T-10551; 16. TCT No. T-11709; 17. TCT No. T-11710; 18. TCT No. T-11829; 19. TCT No. T-11835; 20. TCT No. T-11838; 21. TCT No. T-12014; 22. TCT No T-15316; 23. TCT No. T-11717; 24. TCT No. 05-2019001619; 25. TCT No. 065-2019000288; 26. TCT No. T-17148; 27. TCT No. T-17149; 28. TCT No. T-18787; and 29. TCT No. T-19399	ECC-R4B-1607-0024 dated 19 September 2016
Lagen Island Resort	Special Use Permit No. DENR IV-110499-0008 dated 4 November 1998; Forest Land Use Agreement for Tourism Purposes ("FLAGT") No. DENR IV-MIMAROPA-	ECC dated 9 August 1990 ECC No. 9002-04450120A dated 19 September 1990

	12302030-0008 issued on 27 December 2005.	
Miniloc Island Resort	Special Use Permit No. DENR-IV-PENRO-110699-0005 dated 6 November 1998; FLAGT No. DENR IV-MIMAROPA-11302030-0005 issued on 23 November 2005	Project was established in 1981 prior to the issuance of Presidential Decree No. ("PD") 1121 (Creating the National Environmental Protection Council) and PD 1586 (Establishing an Environmental Impact Statement System) ECC-4B-134-PA-9690-2005 dated 27 June 2005
Pangulasian Island Resort	Special Use Permit No. DENR-IV-PENRO-100699-0004 dated 6 November 1998; FLAGT No. DENR IV-MIMAROPA-12302030-0009 issued on 27 December 2005	ECC No. 9302-003-402C dated 27 June 1994; ECC-R4B-0905-102-9690 dated 4 December 2009
El Nido Cove Resort (stopped operations on 20 January 2020)	1. TCT No. 065-2017000013; and 2. TCT No. 065-2017000014	ECC-4B-163-PA-9690-2007 dated 13 December 2007

In its letter dated 3 March 2022, TKPI again affirmed its commitment to participate in whatever lawful processes deemed necessary by the NCIP. TKPI also requested another technical conference with your office to discuss the next steps.

Clearly, TKPI, without prejudice to its lawful remedies, has submitted to the FPIC process and is merely waiting for your office's advice on the next steps. TKPI has been cooperating with your office and has provided all the documents that you requested in connection with the FPIC process. Instead of directing TKPI on the next steps of the FPIC process, you precipitately and unjustly issued the CDO.

Fourth, TKPI requested a list of ancestral domain areas in Region IV-B from the Recognition Division of the Ancestral Domains Office ("ADO").[1] The ADO then emailed a file containing, among other matters, the following information:

1. List of Approved CADTs in Region IV-B as of 31 January 2022;
2. List of on-process CADTs in Region IV-B;
3. List of Direct CADT Applications in Region IV-B for processing; and
4. List of Identified ancestral domain areas in Region IV-B.

[1] A printout of the email dated 1 March 2022 with timestamp at 3:55 p.m. is attached hereto as **Annex "A"** and made an integral part hereof.

For your reference, we are furnishing you with the file provided by the ADO containing the foregoing lists.

None of the 15 barangays enumerated in the Cabiguen Letter is listed in the ADO's records.

To note, the lists given by the ADO are based on available data or reports provided and submitted by NCIP Field Offices as of 31 January 2022. Had there been any FBI or any site visit in Barangay Villa Libertad, Pasadena, or any of the other barangays mentioned in the Cabiguen Letter that resulted in the identification of "ancestral domain claims", the same would have already been transmitted and filed with the ADO and reflected in the above-mentioned lists. Again, TKPI understood that the FBI would only commence in March 2022, as you advised during the technical conference.

For these reasons, the CDO is baseless in fact and in law. Since there is no recognized ancestral domain yet, particularly in Barangays Villa Libertad and Pasadena, we respectfully submit that there is no basis to proceed further with the FPIC process, much less to issue a CDO against TKPI's projects in those areas for supposedly not submitting itself to the FPIC process.

Nevertheless, to reaffirm TKPI's continuing commitment to abide by the processes of your good office, TKPI submits herewith the following documents pertaining to its projects in Barangays Villa Libertad and Pasadena:

Description	Document
1. Endorsement from the appropriate regulatory agency	a. Resolution No. 59, s. 2015 dated 19 October 2015 from the Office of the Sangguniang Barangay of Villa Libertad; b. Resolution No. 18, s. 2015 dated 5 October 2015 from the Office of the Sangguniang Barangay of Pasadeña; c. Resolution No. 15-180 adopted by the Sangguniang Bayan of El Nido, Palawan; d. Resolution No. 12469 s. 2016 adopted by the Sangguniang Panlalawigan of Puerto Princesa City, Palawan; e. SEP Clearance No. LTE-033116-50 issued by the Palawan Council for Sustainable Development on 31 March 2016; and f. Zoning Certification dated 20 May 2015.
2. Company Profile	a. Ten Knots Company Profile
3. Project Profile, which includes the nature and purpose of the project location and administrative maps,	a. Lio Tourism Estate Project Profile & Development Plan

abstract of proposed project, duration of the project, and preliminary assessment on economic, social, cultural, and environmental effects	
4. Indicative Budget	
5. Operational Plan and Activities	
6. Persons to be involved in implementation	
7. Profile of the applicant	
8. Environmental Impact Assessment from the DENR	a. Lio Tourism Estate Environmental Impact Assessment Report

Considering that TKPI has clearly submitted to the FPIC process (notwithstanding the lack of an FBI and the lack of recognized ancestral domains in the area) and has consistently demonstrated its willingness to cooperate with the NCIP, it is respectfully requested that your good office reconsider and recall the CDO while the FPIC process is ongoing.

For context, the CDO you issued will affect not only TKPI, but more than 500 employees who are employed by the different establishments in TKPI's projects. The loss of employment of these employees also impacts their families. These are the same employees and families severely affected by the downturn of the tourism industry due to the pandemic. The CDO will have widespread adverse repercussions and will result in unquantifiable damage to the businesses and enterprises reliant on the daily operations of the Lio Airport. The closure of the Lio Airport will affect an average of 600 passengers who fly in and out of El Nido daily. It will also affect the operations of the Iloilo-Negros Air Express Company ("INAEC") and the Joint Task Force Malampaya who land their aircrafts at the Lio Airport. The CDO will close down not only the Lio Airport, but also the seaport, hotel, and retail establishments located in Villa Libertad and Pasadena. All of these would halt efforts to revive the local economy.

Should you be minded, despite the foregoing explanation and submission of additional documents, to enforce the CDO based on your erroneous belief that TKPI has not submitted to the FPIC process, TKPI requests for a period of 30 days, or until 13 April 2022, within which to wind down operations in Villa Libertad and Pasadena. TKPI would have to arrange for the transport of guests out of Villa Libertad, give airline passengers bound for Lio Airport an opportunity to cancel flights, wind down inventories of retail and commercial establishments, and make arrangements for affected staff who will be out of jobs, among other things.

Lastly, TKPI is requesting for guidance on the next steps to be taken in order that the FPIC process may take its full course.

TKPI reserves its rights under the law.

Respectfully,

ANGARA ABELLO CONCEPCION REGALA & CRUZ

By:

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Reply all Delete Junk Block sender ...

Annex "A"

Re: LIst of AD areas in Region IV-B

J

Jessica Sharla G. Bustamante
Tue 3/1/2022 4:02 PM

To: Recognition, ADO NCIP <recognitionado@gmail.com>

Confirming receipt, thank you so much!

Sincerely,
Jessica Sharla G. Bustamante
Associate
Litigation and Dispute Resolution Department
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From: Recognition, ADO NCIP <recognitionado@gmail.com>
Sent: Tuesday, March 1, 2022 3:54 PM
To: Jessica Sharla G. Bustamante <jgbustamante@accralaw.com>
Subject: LIst of AD areas in Region IV-B

Maam,

Herewith lists of Ancestral Domain Areas in Region IV-B.

For your information and reference.

Paul
Recognition Division-Ancestral Domains Office (RD-ADO)
NATIONAL COMMISSION ON INDIGENOUS PEOPLES
6th/7th Flr. Sunnymede IT Center 1614 Quezon Ave.Quezon City
Trunk-Line 575-1200 local 1015-1017

Reply | Forward

Republic of the Philippines
Province of Palawan
Municipality of El Nido
Barangay Villa Libertad
Office of the Sangguniang Barangay

EXCERPTS FROM THE MINUTES OF THE REGULAR SESSION OF THE SANGGUNIANG BARANGAY OF VILLA LIBERTAD, EL NIDO, PALAWAN HELD OCTOBER 19, 2015 AT BARANGAY SESSION HALL OF BARANGAY VILLA LIBERTAD, EL NIDO, PALAWAN:

Present:

Hon. Ruben V. Arzaga	Punong Barangay/P.O.
Hon. Bernie P. Gutierez	Barangay Kagawad
Hon. Johny M. Fabrigas	-do-
Hon. Richard V. Villanueva	-do-
Hon. Fe Y. Manga	-do-
Hon. Teodoro F. Parangue	-do-
Hon. Marieta G. Ulla	-do-
Hon. Jonamie D. Cabutihan	-do-
Ana P. Valdespina	Brgy. Secretary

xx xx xx xx xx xx xx xx

RESOLUTION NO.59
Series of 2015

A RESOLUTION TO GRANT FAVORABLE ENDORSEMENT TO TEN KNOTS PHILIPPINES, INC. (TKPI) AND AYALA LAND, INC. ("ALI") FOR ITS APPLICATION FOR ENVIRONMENTAL COMPLIANCE CERTIFICATE (ECC) FOR THE DEVELOPMENT OF THE PHASE 2 OF LIO TOURISM ESTATE WITH A TOTAL AREA OF APPROX. 196.7329 HECTARES LOCATED WITHIN BARANGAY VILLA LIBERTAD, EL NIDO, PALAWAN

WHEREAS, Ten Knots Philippines, Inc. ("TKPI") together with Ayala Land, Inc. ("ALI") are developers of good track record in El Nido and other parts of the country adhering to sustainable development.

WHEREAS, TKPI and ALI intends to expand its development of a masterplanned tourism estate from the approved and ongoing Phase 1 with an area of 24.77 hectares to a total area of approximately 325 hectares in mainland El Nido, located along Bacuit Bay

WHEREAS, approximately 196.7329 hectares of the total area is located in Barangay Villa Libertad shall be part of the Phase 2.

WHEREAS, TKPI conducted a public consultation meeting with the stakeholders and complied with all requirements on the proposed project which addresses the possible environmental and social impacts of the proposed project in line with the developer's vision of an ecologically-sustainable tourism development.

WHEREAS, the TKPI has provided four (4) access roads from the National Road to the beach and shall not prevent any of the members of the community to access the beach. The said access roads are as follows: one (1) in the area of So. Baled, one (1) at So. Pasto and two (2) in the area of Dalimatan

WHEREAS, the developers and the Sangguniang Barangay endeavors to work together towards creating a task force that will implement peace and order within the estate and the community as well as coordinate on all matters affecting the community and the environment

WHEREAS, the TKPI has committed to prioritize hiring of qualified employees from the Barangay for its requirements during construction and operation; and shall conduct trainings and livelihood to the uplift the quality of life of the people of the community

WHEREAS, the Sangguniang Barangay recognizes the economic significance of this project for the growth of tourism in the area and positive developmental benefits to Barangay and the Municipality of El Nido

NOW, THEREFORE, upon mature deliberation and motion by Kagawad Marieta G. Ulla and was duly seconded by Kagawad Jonamie D. Cabutihan be it

RESOLVED, AS IT IS HEREBY RESOLVED, to grant favorable endorsement to Ten Knots Philippines, Inc. for its application for Environmental Compliance Certificate for its development project called Lio Tourism Estate (Phase 2) located in Barangay Villa Libertad and Barangay Pasadeña, El Nido, Palawan.

RESOLVED FINALLY, that copy of this resolution be furnished to Ten Knots Philippines, Inc., the office of the Sangguniang Bayan, Office of the MLGOO of El Nido, Palawan, for their information and submission to other related agencies.

Unanimously carried on October 19, 2015

I HEREBY CERTIFY to the correctness of the foregoing resolution

Certified Correct:

ANNA P. VALDESPINA
Brgy. Secretary

HON. RUBEN V. ARZAGA
Presiding Officer

Conforme:

HON. BERNIE P. GUTIEREZ
Kagawad

HON. JOHNY M. FABRIGAS
Kagawad (absent)

HON. RICHARD V. VILLANUEVA
Kagawad

HON. FE Y. MANGA
Kagawad

HON. TEODORO F. PARANGUE
Kagawad

HON. MARIETA G. ULLA
Kagawad

HON. JONAMIE D. CABUTIHAN
Kagawad

Approved by:

HON. RUBEN V. ARZAGA
Punong Barangay/Presiding Officer

Conforme:

HON. BERNIE P. GUTIEREZ
Kagawad

HON. JOHNY M. FABRIGAS
Kagawad (absent)

HON. RICHARD V. VILLANUEVA
Kagawad

HON. FE Y. MANGA
Kagawad

HON. TEODORO F. PARANGUE
Kagawad

HON. MARIETA G. ULLA
Kagawad

HON. JONAMIE D. CABUTIHAN
Kagawad

Approved by:

HON. RUBEN V. ARZAGA
Punong Barangay/Presiding Officer

Republic of the Philippines
Province of Palawan
Municipality of El Nido

OFFICE OF THE SANGGUNIANG BAYAN

November 16, 2015

MS. MARIAN S. REYES
Attorney-in-Fact
Ten Knots Philippines Inc.
El Nido, Palawan

Madam:

I am furnishing herewith Resolution No. 15-180, adopted by the Sangguniang Bayan of El Nido, Palawan in its Session for your information and appropriate action.

Please acknowledge receipt hereof.

Very truly yours,

MIGUEL F. GACASA
Secretary to the Sanggunian

Republic of the Philippines
Province of Palawan
Municipality of El Nido

OFFICE OF THE SANGGUNIANG BAYAN

EXCERPT FROM THE MINUTES OF THE REGULAR SESSION OF THE SANGGUNIANG BAYAN OF EL NIDO, PALAWAN HELD AT THE SANGGUNIAN SESSION HALL ON NOVEMBER 9, 2015.

Present:

HON. NIEVES C. ROSENTO	Municipal Vice Mayor, PO
HON. JOHN ROSTUM T. VIDAL	SB Member
HON. FERDINAND A. BATOY	SB Member
HON. GERALDO B. DIAZ	-do-
HON. HELSON B. GONZALES	-do-
HON. JUN M. MONES	-do-
HON. MATEO A. CANTUBA	-do-
HON. AMADO C. BALUARTE, SR.	-do-
HON. BERNARDO D. LEGASPI	-do-, ABC President
HON. PROSPERO D. CASTRO	-do-, IP's Representative

xxx xxx xxx

RESOLUTION NO. 15-180

A RESOLUTION TO GRANT FAVOURABLE ENDORSEMENT TO TEN KNOTS PHILIPPINES, INC. (TKPI) AND AYALA LAND, INC. (ALI) FOR ENVIRONMENTAL COMPLIANCE CERTIFICATE (ECC) FOR THE DEVELOPMENT OF THE PHASE 2 OF LIO TOURISM ESTATE PROJECT COVERING AN AREA OF MORE OR LESS 325 HECTARES LOCATED AT BARANGAY VILLA LIBERTAD AND BARANGAY PASADENA, ALL AT EL NIDO, PALAWAN.

Authored by: Hon. John Rostum T. Vidal

WHEREAS, the applicant of Lio Development Project Phase 2 (Land Development) is Ten Knots Philippines, Inc. duly represented by Ms. Marian S. Reyes and the Location of the Project is at Sitio Calelenday, Bgy. Villa Libertad, El Nido, Palawan;

WHEREAS, Ten Knots Philippines Inc. (TKPI), together with Ten Knots Development Corporation (TKDC), is a developer with good track record for almost three decades of experiences in developing and operating successful eco-resorts within the El Nido;

WHEREAS, the project and the utilization of the said property is subject to monitoring;

WHEREAS, no activity other than applied for and granted shall be conducted with the project site;

WHEREAS, any misrepresentation, false statement or allegation material to the issuance of this decision shall be sufficient cause for its revocation;

WHEREAS, provision of easement and setback, yard requirements, bulk, area, height and other restrictions shall be a sufficient cause for its revocation;

WHEREAS, TKPI shall initiate trainings and seminars to increase employment and livelihood opportunities and shall likewise prioritize the hiring of qualified residents of El Nido, Palawan;

WHEREAS, all properties within Phase 2 of Lio Tourism Estate Project covering an area of more or less 325 hectares that are subject for litigation or with complainants or claimants are/is not part of this endorsement including, but not limited to, Lot. 965-B, Pls – 33 with Tax Declaration No. 013-0667-A with an area of 44,188.00 square meters located at Sitio Lamuro, Bgy. Pasadena, El Nido, Palawan;

WHEREAS, part of Lot 974, Pls 31 with Tax Declaration No. 013-0684-A with an area of 30,658.00 square meters, part of Lot 1321, Cad 1037-D with Tax Declaration No. 013-0684-A with an area of 186,103.00 square meters and part of lot 1327, Cad 1037-D with Tax Declaration No. 013-0667-A with an area of 83,373.00 square meters, respectively located at Sitio Lamuro, Barangay Pasadena, El Nido, Palawan, that are TIMBERLAND, shall not be part of this endorsement and shall be subject for verification to the DENR;

WHEREAS, non-compliance therewith shall be a cause for cancellation or legal action;

WHEREAS, the Sangguniang Bayan of El Nido recognizes the economic significance of this project in the municipality of El Nido.

NOW, THEREFORE, on motion of Kagawad Vidal and was unanimously seconded, be it

RESOLVED, AS IT IS HEREBY RESOLVED, to grant favourable endorsement to Ten Knots Philippines (TKPI) and Ayala Land Inc. (ALI) for Environmental Compliance Certificate (ECC) for the development of the Phase 2 of LIO Tourism Estate Project covering an area of more or less 325 hectares located at Barangay Villa Libertad and Barangay Pasadeña, El Nido, Palawan.

RESOLVED FINALLY, that copy of this resolution be furnished to the Hon. Edna Gacot-Lim, Municipal Mayor and to the representatives of Ten Knots Philippines, Inc. for their information and appropriate action.

ADOPTED.

xxx xxx xxx

I HEREBY CERTIFY to the correctness of the foregoing resolution.

MIGUEL F. GACASA
Secretary to the Sanggunian

ATTESTED AND CERTIFIED TO BE DULY ADOPTED:

NIEVES C. ROSENTO
Municipal Vice Mayor

APPROVED:

EDNA GACOT-LIM
Municipal Mayor

Republic of the Philippines
Provincial Government of Palawan
OFFICE OF THE SANGGUNIANG PANLALAWIGAN
Puerto Princesa City

EXCERPT FROM THE MINUTES OF THE 123RD REGULAR SESSION OF THE 41ST SANGGUNIANG PANLALAWIGAN HELD AT THE SANGGUNIANG PANLALAWIGAN SESSION HALL ON JANUARY 19, 2016 CITY OF PUERTO PRINCESA

PRESENT:

Hon. Victorino Dennis M. Socrates,	Vice Governor and Presiding Officer
Hon. Leoncio N. Ola,	Chairman, Pro-Tempore
Hon. Eduardo Modesto V. Rodriguez,	Acting Floor Leader -2nd District
Hon. Marivic H. Roxas,	Floor Leader
Hon. Winston G. Arzaga,	Asst. Floor Leader 1st District
Hon. Albert G. Rama,	Asst. Floor Leader -3rd District
Hon. Roseller S. Pineda,	S.P. Member – 1st District
Hon. Cherry Pie B. Acosta,	S.P. Member – 1st District
Hon. Sharon Abiog-Onda,	S.P. Member – 2nd District
Hon. Sunny G. Batul,	S.P. Member – 2nd District

ABSENT:

Hon. Albert G. Rama,	Asst. Floor Leader -3rd District
Hon. Richristopher C. Magbanua,	S.P. Member – PCL President
Hon. Abraham M. Ibba	S.P. Member - Pres. Liga ng mga Barangay

xxx xx xxx

RESOLUTION NO. 12469
SERIES OF 2016

INTERPOSING NO OBJECTION ON THE PROJECT AND ACTIVITIES SUBMITTED TO THE SANGGUNIANG PANLALAWIGAN BY MISS MABEL REYES AND MR. ANTHONY ARGANA, PROJECT DEVELOPMENT MANAGER AND REPRESENTATIVE RESPECTIVELY, TEN KNOTS PHILIPPINES INC. FOR THE ESTABLISHMENT OF LIO PROJECT LOCATED AT BARANGAY VILLA LIBERTAD AND BARANGAY PASADEÑA, EL NIDO, PALAWAN FOR CONCURRENCE BY THE PALAWAN COUNCIL FOR SUSTAINABLE DEVELOPMENT PURSUANT TO PROVINCIAL ORDINANCE NO. 682, SERIES OF 2003

Authored by:

THE COMMITTEE ON ENVIRONMENTAL PROTECTION AND NATURAL RESOURCES

WHEREAS, the august Body has enacted Provincial Ordinance No. 682, series of 2003 mandating that all projects and activities in the Province of Palawan with environmental impact, whether public or private should have the concurrence by the Sangguniang Panlalawigan pursuant to Section 27 of the Local Government Code;

WHEREAS, the project and activities submitted by Mr. Anthony Argana, Ten Knots Philippines Inc. for the establishment of Lio Project located at Barangay Villa Libertad and Barangay Pasadeña, El Nido, Palawan was referred to the Provincial Board for evaluation and appropriate action;

WHEREAS, after thorough deliberations thereon, the Sangguniang Panlalawigan interposes no objection on the said project and activities;

NOW, THEREFORE, on motion of the Honorable Leoncio N. Ola duly seconded, be it

RESOLVED, as it is hereby resolved, to interpose no objection on the project and activities submitted to the Sangguniang Panlalawigan by Miss Mabel Reyes and Mr. Anthony Argana, Project Development Manager and Representative respectively, Ten Knots Philippines Inc. for the establishment of Lio Project located at Barangay Villa Libertad and Barangay Pasadeña, El Nido, Palawan for concurrence by the Palawan Council for Sustainable Development pursuant to Provincial Ordinance No. 682, series of 2003;

RESOLVED FURTHER, that a copy of this resolution be furnished to Ms. Mabel Reyes , Project Development Manager, and Mr. Anthony Argana, Representative, Ten Knots Philippines Inc. Barangay Villa Libertad, El Nido, Palawan, for their information and appropriate action.

CARRIED UNANIMOUSLY.

XXX XXX XXX

I CERTIFY to the correctness of the above-quoted resolution.

ANGELA RODRIGUEZ-PEÑA
Secretary to the Sanggunian

ATTESTED:

VICTORINO DENNIS M. SOCRATES
Vice Governor and Presiding Officer

APPROVED:

JOSE CH. ALVAREZ
Governor

FEB. 1, 2016
Date

This document is not valid without Sangguniang Panlalawigan Seal.

JCA/VDMS/ARP/*epp – 1/20/16*

Republic of the Philippines
(Republic Act 7611)
PALAWAN COUNCIL FOR SUSTAINABLE DEVELOPMENT
PCSD Bldg., Sports Complex Rd., Bgy. Sta. Monica, Puerto Princesa City, Palawan

WECAN do it together

SEP CLEARANCE

No. LTE -033116-050

Pursuant to the mandate of the Palawan Council for Sustainable Development (PCSD) under Republic Act 7611 and concurred by the Department of Environment and Natural Resources (DENR) as provided in its Memorandum of Agreement with PCSD dated 29 December 1994, this SEP Clearance is issued to:

Lio Tourism Estate
Name of Project

Barangays Villa Libertad and Pasadena, El Nido, Palawan
Project Location (Street, Sitio, Barangay, Municipality)

TEN KNOTS PHILS., INC.
Name of Proponent

18/F, B.A. Lepanto Bldg., Paseo De Roxas, Makati City
Address of Proponent

This Clearance is approved on the 31st day of March 2016 in Puerto Princesa City.

JOSE CH. ALVAREZ
Chairman, PCSD

O.R. No. : 5525352
Dated : 4-14-16
Amount : ₱5,060-

Not Valid Without PCSD Official Seal
(PLEASE SEE OVERLEAF FOR THE TERMS AND CONDITIONS OF THIS CLEARANCE)

"PCSDS: Working together towards sustaining the future"

Head Office:
PCSD Building Sports Complex Road
Sta. Monica Heights, Puerto Princesa City, Palawan
P.O. Box 45 PPC 5300 Palawan, Philippines
☎ (048) 434-4235 ● Telefax: 434-4234
Email: oed@pcsd.ph ● Website: pcsd.ph

Metro Manila Liaison Office:
Units 402 / 408 The One Executive Office Bldg.
West Ave. cor Col. Martinez St., Quezon City
☎ 376-2060 / 2061

PALAWAN COUNCIL FOR SUSTAINABLE DEVELOPMENT STAFF
RELEASED
DATE: 4-14-16
TIME: 2:25 pm
BY:
PUERTO PRINCESA CITY

TERMS AND CONDITIONS

This Clearance is issued subject to the following terms and conditions:

1. Confine project operation within the allowed area of 319.824 hectares, excluding the shoreline to ensure public access.
2. Strictly implement and comply with the mitigating measures stipulated in Initial Environmental Examination (IEE) Report.
3. Secure permits/Clearances from other concerned agencies prior to implementation and furnished PCSDS copies thereof.
4. Should the implementation of the project cause adverse environmental impact and pose nuisance to public health and safety as determined by PCSDS, these factors shall be sufficient ground for the cancellation or suspension of the SEP Clearance.
5. Adopt the PCSD's Zero Carbon Resort Project through the following:
   a. Register to the ZCR Project within 30 days from receipt of the SEP Clearance. Registration forms are available at the PCSD Main Office and at the District Management Office.
   b. Institute an energy and resource efficient measures and other green methodologies in the operation of the following systems: lighting, transport, ventilation, refrigeration, air-conditioning, waste disposal, water supply, water heating, and supply chain.
   c. Effect a yearly reduction in the energy bill from fossil fuel sources.
   d. Establish monthly self-monitoring system which would include among others power/energy, water and chemical consumption, effluent and ambient water quality and volume of solid and liquid wastes generated. Water and electricity bills and fuel receipts are required as supporting documents, if applicable. This shall be audited by the PCSD-ZCR Team.
6. Enhance the landscaping of the area by planting appropriate tree species or ornamental plants.
7. The herein grantee shall assume full responsibility and liability for damages to private/public property caused by the project.
8. In case there is a need for additional condition(s) to ensure environmental integrity and public safety as a result of regular monitoring/inspection, the same shall be imposed by PCSD.
9. Any expansion of the project is subject to a separate SEP Clearance.
10. This Clearance may be transferred to another only after the requisites stipulated in Section 15 of PCSD AO No. 6, as amended, are complied with.
11. The issuance of the SEP Clearance is subject to a post-condition that the corresponding LGU endorsement, ECC, CNC, FPIC, license, permit and other similar instruments must be subsequently secured, a copy of which will be furnished to the PCSD;
12. The Proponent shall pay the corresponding monitoring fee to the ECAN Board which will form part of the monitoring fund to be used by the latter in monitoring activities;
13. In the exercise of their visitorial power, authorized PCSD/S officials /personnel and ECAN Board by itself or through its SMT shall be allowed to conduct monitoring/inspection of its documents, structures, equipment's and operation at any time of the day or night without prior notice.

Non-compliance with any of the above conditions shall be sufficient cause for the suspension or cancellation of the above clearance and/or penalty in an amount of not less than Fifty thousand pesos (PHP 50,000.00) for every violation pursuant to Sections 23.4 of the PCSD Administrative Order No. 06, as amended.

CONFORME

I, _____, proponent/grantee of the foregoing Clearance, hereby certify that I have read and understood the Terms and Conditions for which this SEP Clearance is issued and I hereby express my conformity thereto and my commitment to abide by the provisions of Republic Act 7611, PCSD Administrative Order No. 06, as amended, and other PCSD policies related thereto. ALEXANDER C. DALABAJAN

Signature over Printed Name

Date Signed: 04/14/16

SUBSCRIBED AND SWORN to before me this ____ of APR 14 2016 in PUERTO PRINCESA CITY affiant exhibiting to me valid government identification no. SSS - Unified CRN - 0033 - 187 2640-0

Doc No. 306
Page No. 62
Book No. XVI
Series of 2016

ATTY. GIL A. ACOSTA, JR.
NOTARY PUBLIC UNTIL 12/31/16
PTR NO. 6236671-1/7/16-PPC
IBP NO 011935
ROLL NO. 61891
MCLE-GOV. BOARD NO. 1 SERIES OF 2008
ADMITTED TO THE BAR APRIL 25, 2013

Republic of the Philippines
Province of Palawan
Municipality of El Nido

OFFICE OF THE ZONING OFFICER

ZONING CERTIFICATION

TO WHOM IT MY CONCERN:

THIS IS TO CERTIFY that **TKPI** (*thru* ***Ms. Mabel S. Reyes***) is an applicant for a Zoning Certification of **TCT no. T-8996 with Lot no. G-15017, TD no. 13-013-0779 with Lot no. 968, TD no. 13-013-0777 with Lot no. 965-A, TD no. 13-013-0778 with Lot no. 965-B, TCT no. T-10547 with Lot no. H-110655, TCT no. T-5166 with Lot no. H-19196-A, TCT no. T-17256 with Lot no. 5, TCT no. T-17255 with Lot no. 4, TCT no. T-17254 with Lot no. 3, TCT no. T-17253 with Lot no. 2, TCT no. T-17252 with Lot no. 1, TCT no. 065-2012000702 with Lot no. 1-A, TCT no. T-16898 with Lot no.1-B-10, TCT no. T-16897 with Lot no.1-B-9, TCT no. T-16896 with Lot no.1-B-8, TCT no. T-16895 with Lot no.1-B-7, TCT no. T-16894 with Lot no.1-B-6, TCT no. T-12630 with Lot no. 1-B-11, TCT no. T-16891 with Lot no.1-B-1, TCT no. T-16900 with Lot no. 1-B-2, TCT no. T-16892 with Lot no. 1-B-3, TCT no. T-16893 with Lot no. 1-B-4, TCT no. 19006 with Lot no. 1-B-5, TCT no. T-12640 with Lot no.1-C, TCT no. 17129 with Lot no. 1-D, TCT no. T-12654 with Lot no. 1-Q, TCT no. 065-2013000700 with Lot no. 1-G, TCT no. 065-2013000699 with Lot no. 1-J, TCT no. T-17130 with Lot no. 1-M, TCT no. T-12651 with Lot no. 1-N, TCT no. T-16899 with Lot no. 1-O, TCT no. 065-2012000227with Lot no. 1-P, TD no. 13-013-0723 with Lot no. 974(part), TD no. 13-013-0702 with Lot no. 1321, TCT no. 065-2012000674 with Lot no. 2-D, TCT no. 065-2012000131 with Lot no. 2-C, TCT no. 065-2012000486 with Lot no. 2-B, TCT no. 065-2012000545 with Lot no. A, TCT no. 065-2013000480 with Lot no. 1665, TD no. 13-013-0690 with Lot no. 1327(part)** located at Bgy. Pasadeña, El Nido, Palawan, as per approved Comprehensive General Land Use Plan of this municipality, the aforementioned areas was classified as ***Commercial Area.***

Issued upon the request of the above – named this 20th day of May 2015.

FERDINAND B. GARCELLANO
MGADH – I (AMPDC)
ZONING OFFICER

Amount paid: P 2000.00
Under O. R. # 2672858 I
Issued on: May 19, 2015
At El Nido, Palawan

Republic of the Philippines
Province of Palawan
Municipality of El Nido

OFFICE OF THE ZONING OFFICER

ZONING CERTIFICATION

TO WHOM IT MY CONCERN:

THIS IS TO CERTIFY that **TKPI** (*thru **Ms. Mabel S. Reyes***) is an applicant for a Zoning Certification of **TCT no. T- 10549 with Lot no. Pi-1353, TCT no. T-10195 with Lot no. 954-B, TCT no. T-12014 with Lot no. 952 , TCT no. T-8895 with Lot no. 954-A, TCT no. T-9041 with Lot no. 944, OCT no. E-3405 with Lot no. 943, TCT no. T-8986 with Lot no. 956, TCT no. T-18787 with Lot no. 5705, TCT no. T-17149 with Lot no. 5708, TCT no. T- 11835 with Lot no. 949-A, TCT no. T-11838 with Lot no. 949-C, TCT no. T-11829 Lot no. 947-A, TCT no. 065-2012000349 with Lot no. 947-B-2-D (port), Katibayan ng Orihinal na Titulo Blg. E-36935 with Lot no. 5802-A, TD no. 13-017-0372 with Lot no. 5635, TD no. 13-017-0377 with Lot no. 940(port), OCT no. 4642 with Lot no. 935-B, OCT no. 4642 with Lot no. 935-A(part), TCT no. 065-2013000247 with Lot no. 1319-D, TCT no. 065-2012000735 with Lot no. 1319-C, TCT no. 065-2012000734 with Lot no. 1319-B, TCT no. 065-2013000248 with Lot no. 1319-E, TCT no. T-11716 with Lot no. B, TCT no. 065-2013000316 with Lot no. 981-B, Katibayan ng Orihinal na Titulo Blg. E-22057 with Lot no. 980, TCT no. T-11709 with Lot no. 977, TD no. 13-017-0005 with Lot no. 976, TCT no. 065-2012000156 with Lot no. 1228, TCT no. T-21893 with Lot no. 4930, TD no. 13-017-1012 with TD no. 1216** located at Bgy. Villa Libertad, El Nido, Palawan, as per approved Comprehensive General Land Use Plan of this municipality, the aforementioned areas was classified as ***Commercial Area.***

Issued upon the request of the above – named this 20th day of May 2015.

FERDINAND B. GARCELLANO
MGADH – I (AMPDC)
ZONING OFFICER

Amount paid: P 2000.00
Under O. R. # 2672857 I
Issued on: May 19, 2015
At El Nido, Palawan

Republic of the Philippines
Province of Palawan
Municipality of El Nido

OFFICE OF THE ZONING OFFICER

ZONING CERTIFICATION

TO WHOM IT MY CONCERN:

THIS IS TO CERTIFY that **TKPI** (*thru* ***Ms. Mabel S. Reyes***) is an applicant for a Zoning Certification of **TCT no. T- 15983 with Lot no. 935-C, TCT no. 065-2013001144 with Lot no. 1198, TCT no. 065-2010000421 with Lot no. 1197-F-9-C-6, TCT no. 065-2010000419 with Lot no. 1197-F-7** located at Bgy. Villa Libertad, El Nido, Palawan, as per approved Comprehensive General Land Use Plan of this municipality, the aforementioned areas was classified as ***Residential Area.***

Issued upon the request of the above – named this 20th day of May 2015.

FERDINAND B. GARCELLANO
MGADH - I (AMPDC)
ZONING OFFICER

Amount paid: P 200.00
Under O. R. # 2672856 I
Issued on: May 19, 2015
At El Nido, Palawan

Ten Knots
PHILIPPINES
INCORPORATED

TEN KNOTS COMPANY PROFILE

The name TEN KNOTS is based on the definition of knot as a unit of speed of one nautical mile per hour. The founders of Ten Knots were divers who explored dive sites in the Philippines on board their dive boat, the M/V Via Mare. They believed that ten knots is the ideal speed not only in getting to their dive destination quickly, but also cruising leisurely enough to appreciate and enjoy nature's endowments. Thus, the name Ten Knots reflects the company's ideals to strive for a balance between meeting human needs and caring for nature.

Ten Knots Group opened its first El Nido Resort at Miniloc Island in Bacuit Bay, El Nido, Palawan, in December 1982. A dive camp with very basic facilities, it has since evolved into a 50-room resort with amenities for a more diverse clientele. The second El Nido Resort opened at Lagen Island in 1998, also with 50 rooms. The third one, the 50-room Apulit Island Resort in Taytay, Palawan, started operating in December 2010. Finally, the fourth one at Pangulasian Island opened with 42 villas in 2012.

The Ten Knots Group is primarily comprised of 2 main companies- Ten Knots Development Corporation (TKDC) which develops and operates El Nido Resorts, and Ten Knots Philippines, Inc. (TKP) which focuses on estate development and property management.

Ten Knots has advocated responsible tourism and has exercised stewardship over its natural environment. For over three decades, Ten Knots has strived to maintain a delicate balance between achieving tourism development goals, conserving El Nido's fragile environment, and meeting the needs of the local community. In 2013, Ten Knots became a wholly-owned subsidiary of Ayala Land, Inc.

Vision on Sustainability

Ten Knots has always developed its business based on the philosophy of responsible and sustainable tourism development. The company's Management Committee enjoins everyone in the organization to contribute to efforts to:

- Increase local hiring and local purchases
- Enhance guest experience further by presenting El Nido as a living community with its unique blend of natural, social and cultural features
- Increase the number and scope of training for the local communities by the resorts' supervisors, several of whom are locals themselves.
- Participate in community environmental projects
- Discover more natural and cultural attributes of El Nido for a stronger pride of place
- Explore ways to be involved in resolving the local Municipality's planning and carrying capacity issues, especially for common tourist sites

MILESTONES IN TEN KNOTS HISTORY

1979 Nissin becomes joint venture partner with a Filipino group in forming Ten Knots Philippines that engages in the business of chartering/operating dive boat tours on the M/V Via Mare. Guests are primarily Japanese divers.

1981 M/V Via Mare runs aground. TKP shifts focus to land based dive-operations. El Nido in Palawan is selected as the development site on the basis of its diverse and exotic marine life, varied diving opportunities, unique and scenic landscape, secluded pockets of white sand beaches and lush wilderness.

Ten Knots' first resort in Miniloc Island opens under the name "El Nido Resort." All-inclusive packages allow guests to fully experience nature through sightseeing, island hopping, and private beach lunches. El Nido Resort gains a reputation for exceptional service and personalized itineraries. The staff is encouraged to act as hosts with pride of ownership, welcoming friends to their home. This service philosophy is the foundation for today's no-tip policy. Resort employees make it a practice to welcome arriving guests and to send off departing guests with native *Cuyonon* songs, endearing the staff to guests and making their stay more memorable. This resort later becomes known as Miniloc Island Resort. In the mid-90's, when Ten Knots opens more resorts on other islands, each resort is branded by their unique island address. El Nido Resorts becomes the common name of all of Ten Knots' resorts.

1991 On November 27, A. Soriano Corporation (ANSCOR) buys out original group of Filipino investors in TKP.

1992 On June 30, TKDC is organized by the new joint venture partners to develop and operate resorts while TKP focuses on property management.

1993 The first project of TKDC, Pangulasian Island Resort (PIR) opens with 30 air-conditioned rooms with en suite bathrooms, considered "AA" category resort at that time.

1994 El Nido Foundation is established to undertake and manage community development and livelihood projects. ENF projects include watershed rehabilitation, livelihood development, waste management for ecological protection, micro-financing, and malaria healthcare programs.

1995 TKDC receives the *Highly Commended Tourism for Tomorrow Award* from British Airways.

TKDC receives the Most Outstanding Program in Environmental Protection from Personnel Management Association of the Philippines

TKDC receives the *Best ASEAN Conservation Effort Award* from the ASEAN Tourism Association.

TKDC receives the *Kalakbay Award for Outstanding Contribution in the Promotion and Development of Philippine Tourism* from the Department of Tourism.

1996 TKDC receives the *Tourism for Tomorrow Pacific Region Award* from British Airways.

1997 Miniloc Island Resort receives *Kalakbay Award for Resort of the Year "A" Category.*

TKDC receives the Pacific Asia Travel Association (PATA) *Green Leaf Award for Ecotourism and Travel-related Projects.*

1998 On March 15, Lagen Island Resort soft-opens with 51 rooms in the "AAA" category, further raising the quality standard of El Nido Resorts.

Ten days later, the resort in Pangulasian is razed by accidental fire. No casualties except for company pride.

On December 15, ANSCOR divests its holdings in Ten Knots.

1999 TKDC and El Nido Foundation are cited as a model of cooperation involved in tourism development working with its local community through a partner social development agency in the Asia Pacific Economic Cooperation publication entitled "Community Based Tourism in the Asia Pacific Region."

Miniloc Island Resort receives *Kalakbay Award for Resort of the Year "A" Category* for the second time.

2000 TKDC receives the *PATA Gold Award for Education and Training*

2001 On March 22, ACC Resorts, Inc. acquires majority control of Ten Knots. ACC believes in accountability for a triple bottom line that consists of: Financial Profitability, Corporate Social Responsibility, and Environmental Conservation. ACC's financial expertise supports Ten Knots in improving operational efficiencies in order to achieve sustainable profitability. ACC assists in attracting environmental grant funds to help the efforts of conservation.

Miniloc Island Resort receives *Kalakbay Award for Resort of the Year "A" Category* for the third time and is inducted into the *Kalakbay Hall of Fame.*

Lagen Island Resort receives *Kalakbay Award for Resort of Year "AAA" Category.*

2003 Miniloc Island Resort receives *Kalakbay Award for Resort of the Year "A" Category* for the fourth time.

Lagen Island Resort receives *Kalakbay Award for Resort of the Year "AAA" Category* for the second time.

2004 The reality television show *The Amazing Race* includes El Nido as a stopover on its international broadcast finale.

El Nido Foundation signs an agreement with the Global Environment Facility for biodiversity conservation. In the agreement, Ten Knots is recognized for its past and potential contribution to environmental conservation of El Nido.

2005 President Gloria Macapagal Arroyo is first sitting President to be a guest at El Nido Resorts.

Ten Knots is selected as a private sector partner in the USAID-funded Sustainable Coastal Tourism Initiative in Asia project.

Pangulasian Island re- opens as a beach club

2008 El Nido Resorts receives Green Hotel Recognition Award from the Association of South East Asian Nations (ASEAN) The ASEAN Green Hotel Recognition Award after passing the green hotel standards implemented by the ASEAN National Tourism Organization

El Nido Resorts was included in Travel + Leisure's (South Asia edition) "Our 15 Favorite Green Hotels".

Miniloc Constructs 10 new rooms; Deluxe Seaview Room (DSVR)

2009 El Nido Resorts wins Wild Asia's Responsible Tourism Award under the Mid-size to Small Accommodation Operators category. Wild Asia, a non-profit organization based in Malaysia, judged El Nido resorts based on its practices that aims to protect and sustain the world's natural and cultural resources while ensuring that it meets its potential as a tool for poverty alleviation.

Lagen Island Resort was named one of the top Leisure Resorts in Asia in Smart Travel Asia's Best in Travel Poll 2009

2010 El Nido Resorts (through the Department of Tourism's recommendation) receives Green Hotel Recognition Award from the Association of South East Asian Nations (ASEAN) for the second time.

Ten Knots Development Corporation acquires Club Noah Isabelle. This resort will be reopened on December 1, 2010 under a new name – Apulit Island Resort.

El Nido Resorts wins Hotel Investment Conference Asia Pacific's (HICAP) Sustainable Hotel Award (Sustainable Destinations Category)

2011 El Nido Resorts win the prestigious PATA (Pacific Asia Travel Association) Gold Award 2011 - Environmental Education Programme for the *Be G.R.E.E.N.* (Guard, Respect, Educate El Nido) Campaign

2012 On October 15, 2012, Pangulasian Island Resort opens as El Nido Resorts' eco-luxury island resort under the Ayala brand.

2013 El Nido Resorts win the Community Benefit Award from the World Travel and Tourism Council, Tourism for Tomorrow Awards.

2014 Launch of Lio Tourism Estate

Lio Tourism Estate

Project Profile & Development Plan

LIO TOURISM ESTATE PROJECT PROFILE

I. NATURE & PURPOSE OF THE PROJECT

Lio Tourism Estate ("Lio") is owned and developed by Ten Knots Philippines, Inc. Ten Knots Group is most well-known for the El Nido Resorts, a group of island resorts in Northern Palawan. Ten Knots Group has operated in Palawan for over three decades with sustainability as its guiding principle - advocating responsible tourism, stewardship over the natural environment, and community engagement since its inception.

Lio is masterplanned as an integrated, mixed-use, ecologically sustainable tourism destination in El Nido, Palawan. The development will be home to hotels and resorts, commercial establishments and residential communities with amenities that blend with the natural landscape. Lio is a township development in Northern Palawan designed, developed and operated with sustainability and inclusive business in mind ensuring minimal impact to the environment while benefiting its guests, residents and the local community.

Lio offers you a truly immersive experience – interact with the island, embrace its culture, and be enlightened by a destination that not only strives to provide comfort but takes every effort at the conservation and preservation of the island's natural beauty.

II. LOCATION: EL NIDO, PALAWAN

Lio Tourism Estate is located in Barangay Villa Libertad and Barangay Pasadeña of the Municipality of El Nido, Province of Palawan.

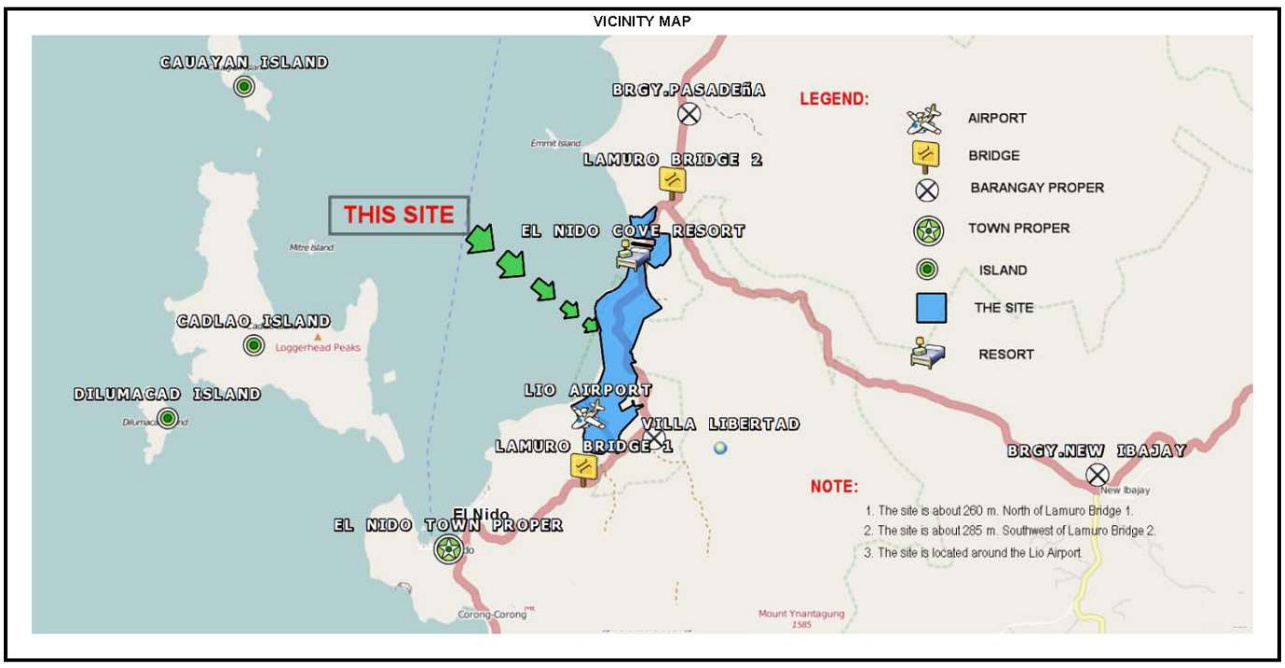
About El Nido, Palawan

Palawan has been voted as the "**Best Island in the World"** for 6 years in a row since 2014 by international magazines like Conde Nast Traveller and Travel+Leisure, with **El Nido** gracing the covers of the magazines several times.

El Nido, located in Northern Palawan, is blessed with natural wonders - karst limestone, islands and islets, coves, beaches, lagoons, and pristine waters. Diverse flora and fauna, astonishing biodiversity and wild life abound not only within Bacuit Bay but throughout the area and neighboring towns, both land and sea. El Nido is internationally recognized to have one of the best beaches in the world. The diverse ecology, natural beauty, and local inhabitants of El Nido are tremendous assets that make the region attractive as a tourism destination.

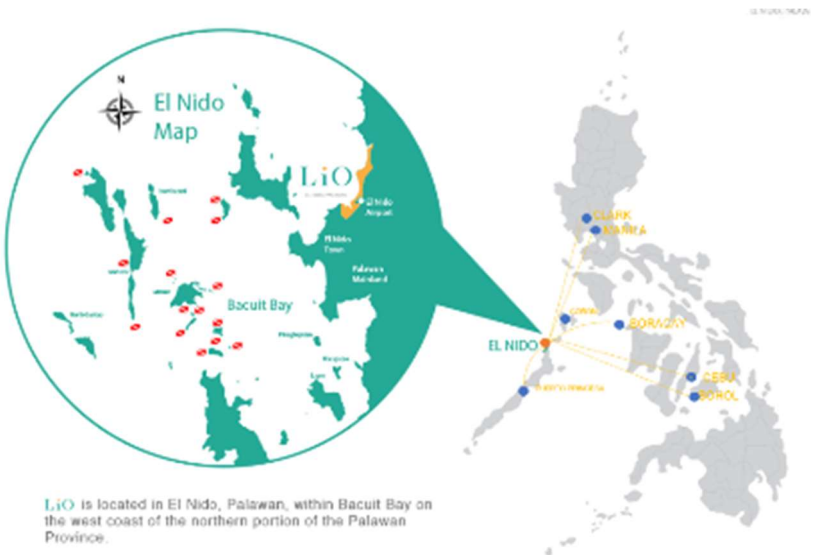
Where is Lio?

It is located in Barangays Villa Libertad and Pasadeña in the Municipality of El Nido in NW mainland Palawan. The site is located 430km southwest of Manila and 238km northwest of Puerto Princesa City. Geographically, the site is located at center coordinates 11.219314 North latitude and 119.421442 East longitude.



How to get to Lio, El Nido

Lio is about 15 minutes away or 7 kilometers from El Nido Town.



AirSWIFT flies directly to Lio Airport. Lio Airport is located within Lio Tourism Estate

- 5 daily round-trip flights from Manila
- 2 daily round-trip flights to Cebu
- 1 daily round-trip flight to Clark
- 1 daily round-trip flight to Caticlan
- 4 times a week round-trip flights to Bohol, Puerto Princesa or Coron

Lio is also accessible via commercial flights to Puerto Princesa plus a 5-hour land transfer to El Nido or commercial flights to San Vicente and a 3-hour land transfer to El Nido.

III. ABSTRACT OF THE PROJECT

Project Rationale

Tourism has become one of the main economic activities of El Nido since 2012. The improvement in infrastructure in Palawan and the fast growth of low-cost airlines in the past decade have spurred the fast growth of the tourism industry in El Nido. From a sleepy beach town, El Nido has grown to a bustling destination with a wide range of accommodations and activities.

There are about 2,000 hotel rooms in El Nido as of 2021. Other boutique operators have also invested in building hospitality facilities to cater to both local and international travelers across different price points.

Tourist arrivals in El Nido have grown from about 50,000 arrivals in 2012 to more than 300,000 tourist arrivals in 2019.

Project Description

Lio encompasses a total land area of **325 hectares more or less of contiguous land**, with Bacuit Bay on the west coast of the northern portion of the Palawan Province and mountain ranges on the east.

Lio Tourism Estate Masterplan and Components

Lio is envisioned to be an integrated township with complete infrastructure and facilities. Below is the summary of the existing and proposed components of the estate:

Infrastructure and Utilities
- Lio Airport Terminal
- Lio Pier and Lounge
- Road Development and Streetlights
- Power Distribution System
- Water Treatment Plants and Distribution System
- Sewage Treatment Plant
- Material Recovery Facility
- Stormwater and Drainage System
- Telecommunication and Cable Systems
- Security Management System (i.e. perimeter fence, CCTV systems, security posts)

Components and Locators
- Hotels and Resorts
- Lodging and Accommodation
- Health and Wellness
- Residential Communities
- Bars, Restaurants, Cafés, Dining Shops
- Commercial Establishments
- Tourism Establishments and Services
- Banks, Convenience Stores, Pharmacy

Estate Facilities and Institutional Locators
- Educational and Training Institutions
- Medical Facilities
- Tourist Center / Eco-Center
- Civic Space and Cultural Center
- Kalye Artisano
- Plaza / Market
- Parks / Open Space
- Eco-Activity Areas
- Estate Offices and Centralized Facilities
- Estate Facilities (i.e. Police Station/Security Outpost/ Fire Station)
- Transport Terminal and Shuttle Service
- Employee Housing

In order to improve access and logistics, first to be developed was the **Lio Airport Terminal** and Runway both conveniently located within the estate for a convenient guest experience from arrival to departure.

The Lio Airport was recently expanded to be to accommodate larger aircraft (i.e. 72-Seater ATR). Airfield lights were also installed on the runway to allow for night operations and further expand the capacity of flights. Lio Airport operates under strict compliance with national and international aviation rules. Smaller passenger aircrafts and chartered flights are also allowed to land in Lio Airport with permit to land.

The Lio Masterplan was designed after careful evaluation of the site and conduct of extensive due diligence which includes topographic surveys, tree tagging, hydrology studies, geotechnical surveys, bathymetry and coastal studies. Densely forested areas and waterways are declared as nature reserve sites and shall not be developed.

Land Use and Buildable Area

- Total developable area for Lio is at 56% of the total 325 hectares.
- About 100 hectares of the gross land area is earmarked as salable lots where locators and tourism enterprises can build.
- Within the lot itself, locators are only allowed to build between 20% and 60% of the lot, depending on the prescribed maximum footprint on the design guidelines. The rest of the lot shall be allocated as open space, roads, parks or greenways.

Lio Tourism Estate Land Use Plan

Land Use Area Summary

COMPONENT	AREA (in sq.m.)	PERCENT
Tourism Development Area	1,525,479.00	47 %
Infrastructure/ Utility Area	292,113.00	9 %
Buffer Zone/Open Space	32,457.00	1 %
Nature Reserve and Non-Build Areas	1,395,651.00	43 %
TOTAL	**3,245,700 sqm**	

ASSESSMENT ON ECONOMIC, SOCIAL, CULTURAL AND ENVIRONMENTAL IMPACTS

A. ECONOMIC IMPACTS

Projected employment to be generated inside the Development

Activity	Construction Stage	Operation Stage
Infrastructure Development		
Land Development	300 pax	40 pax
Airport Runway and Terminal	150 pax	10 pax
Jetty Pier and Lounge	150 pax	100 pax
Utilities and Service Providers	100 pax	150 pax
Estate Operations		
Development of Enterprises		
Ongoing Developments	800 pax	330 pax
Future Development		
Hotel and Mixed-Use Commercial Dev't	4,500 pax	1,750 pax
Residential and Housing Developments	2,500 pax	120 pax
Retail Development for Lease	1,500 pax	500 pax
TOTAL ESTIMATED EMPLOYMENT	**10,000 pax**	**3,000 pax**

- **Increased employment**

  Over 3,000 jobs will be generated by this development from construction to operations, not to mention the ancillary services and indirect jobs brought about by the tourism to the local economy. The community will be Lio's primary source for manpower and supplies for the hotel construction and operations as part of the sustainable efforts to support local products.

- **Livelihood Programs**

  Ten Knots is an equal opportunity employer. Through the creation of meaningful employment opportunities and the commitment to hire and promote locally, the people of El Nido and Taytay have a viable option to earn a decent living and stay in their own community. Scheduled trainings are offered to the local community to improve the skill set for potential employees not just for the resort, but also for other tourism developments in the area.

  Since 2005, resort supervisors have been training local people for basic skills in the areas of food & beverage, housekeeping, and kitchen. Working with professional trainers, local women are trained to become massage therapists. Over the years, banca owners from the town have been regularly providing the transportation needs of El Nido Resorts guests.

  The development will provide opportunities for direct and indirect livelihood for the surrounding communities. Ten Knots shall endeavor to provide gender-sensitive and sustainable livelihoods during the development life cycle up to operations. Some of these livelihoods may include community-based tourism and enterprises that are essential in the tourism supply chain such as agri-based development, food production and ancillary services.

  Women from several barangays (villages) in El Nido have also been trained in weaving to produce native bags and slippers that are purchased by the resorts. The bags and slippers are given as complimentary room amenities, thereby ensuring continuous demand. Ten Knots goal is to further reduce food miles by sourcing locally. Locally and organically produced vegetables comprise 60% of total kitchen purchases, while locally reared livestock comprise 90% of total kitchen purchases.

- **Locally hired employees**

  The company hires around 600 employees within the estate and the resort properties. Around 90% of the employees of the island resorts, hotels and the estate are hired locally thus providing employment opportunities.

- **Support for local merchants**

50% of the locators and merchants of the Shops@Lio are local entrepreneurs of El Nido or Puerto Princesa thus providing opportunities for small scale businesses. The merchants also provide livelihood and employment to locals.

B. Social Impacts

Ten Knots Philippines Inc. recognizes the importance of building a strong relationship with the local community, understanding its customs and traditions, and ensuring it's a sustainable development. Ten Knots Philippines Inc., along with the Foundation are continuously working together to prepare local communities towards a sustainable social development plan. The goal of this initiative is to provide sustainable livelihood and develop opportunities for the local community for inclusive growth by linking the development programs with the supply chain of the estate (hotels, retail and locators) as well as manpower requirements.

- **Town facilities and amenities**

  The local community and employees of the estate are also a main consideration in the planning and development of the masterplan. Facilities which are essential elements of a town are also to be developed such as transport terminals, schools, church, market, medical facilities, employee housing, and civic spaces.

- **PWD-friendly Development**

  The estate is designed to be PWD-friendly and endeavors to ensure accessibility throughout. Ramps, railings and comfort rooms are installed wherever necessary. These are also required of all locators for their own establishments.

C. Cultural Consideration

<u>Mechanisms on cultural awareness and preservation</u>

- **Filipino Architecture**
  Lio has design guidelines that promotes sustainable and Filipino-inspired architecture within the estate. It is encouraged to promote the Philippines arts and culture by incorporating Filipino elements in the design.

- **Use of Local Materials**
  The use of local materials such as bamboo, buri, and sawali are highly encouraged during the construction and operations of Lio.

    - **Promotion of Cultural Heritage**
      Ten Knots developed Community Engagement programs that showcases local products and promote the cultural heritage of Palawan.

- AFI supported the Sibaltan Heritage Council by assisting in the registration with SEC and gaining recognition from the NCCA as an Indigenous People's Council.
- A pilot program is the Sibaltan Heritage Museum which showcases the way of life of Cuyunon (i.e. tribal house, culinary, crafts and practices).
- AFI also organized the Sibaltan Dance Troupe and provided training and scholarships to the young constituents of Sibaltan.

It is the goal of Ten Knots to increase its programs on Cultural Tourism Enhancement by supporting other groups of El Nido in curating possible community-based tours similar to the success of the program in Sibaltan.

- **Community Engagement**
  Continuous community engagement through the AFI enables Lio to hosts events that showcases local arts and crafts. Trainings are also held for students, out-of-school youths and qualified individuals for hospitality and technical skills as well as the Palawan brand of hospitality.

D. Environmental Impacts and the appropriate mitigating measures

Environmental Management Measures

Project Phase	Environmental Component	Potential Impacts	Mitigating Measures	Impact Prediction
Pre-construction		None	None	No Impact
Construction	Wildlife	Clearing of Vegetation	1. Areas to be cleared of vegetation should be fenced to avoid unnecessary expansion of clearing. 2. Cleared vegetation should be replanted using indigenous plants (i.e. fruit bearing plants for bats and birds, and flowering plants for nectar feeding birds and insects). 3. Roads widths should be minimized to reduce impacts to adjacent habitats, and avoid wildlife migration and dispersal.	High
		Noise Pollution	1. Operation of high noise-emitting equipment must be scheduled. 2. Devise a routing scheme to minimize disturbance. 3. Vehicles and equipment should be subjected to regular maintenance.	Medium
		Dust Accumulation and Rock Debris	1. Water should be sprinkled first in areas to be excavated to minimize dust accumulation and spreading. 2. Excavated soil should not be deposited on native vegetation but placed on proposed future road surfaces.	High
		Siltation	1. Excess gravel, cement and asphalt should be recycled as back filling materials. 2. Water the areas to be excavated	High
		Disturbance from housed personnel and field quarters	1. Quarters can be constructed on existing cleared area. 2. Implement a system of penalties for workers who engage in poaching activities. 3. Workers should be placed in nearby barangays to reduce the number of personnel staying at the project site. 4. Designate disposal areas.	High
		Solid Waste Pollution	1. Designate disposal areas within the premises of resort. 2. Implement regulations on solid waste management. 3. Implement a system for solid waste segregation and weekly collection of garbage. 4. Implement a system of penalties for littering within the premises of the construction site.	High

	Coral Reefs and Associated Marine Organisms	Increase sedimentation deposition and turbidity	1. Implement riverbank and slope stabilization strategies before earth moving activities are performed. 2. Placement of erosion and desilting measures near the beach 3. Deployment of silt curtains during jetty construction 4. Conduct sedimentation, water quality and benthic community monitoring 5. Use of fabricated construction materials. 6. Development of an action plan in cases of severe effects clearly attributable to plant construction	Moderate
		Nutrient enriched freshwater run-off from vegetation clearing and landscaping activities	1. Revegetation of denuded areas. 2. Minimize fertilizer application. 3. Conduct water quality and benthic community monitoring.	Minimal
		Increased sewage and spillage of petroleum-based products	1. Placement of regulations on proper waste disposal that will include all parties involved in both in-shore and offshore construction. 2. Provide proper waste disposal facilities for petroleum products, and solid wastes. 3. Provide sufficient toilet facilities for workers.	Minimal
		Solid Waste Generation	1. Utilize pre-cast construction system to minimize debris on the site. 2. Placement of regulations for site workers on proper segregation and disposal of solid wastes. 3. Provide trash bins in major construction areas. 4. Require site contractors to dispose of their solid wastes properly.	Minimal
		Marine Vessel Grounding	1. Mark shallow reef areas with buoys and provide updated nautical charts to captains of delivery barges. 2. Provide temporary anchoring buoys. 3. Allow delivery of construction materials only during good sea conditions.	Minimal
Operation	Wildlife	Solid Waste Pollution	1. Designate disposal areas within the premises of resort. 2. Implement regulations on solid waste management. 3. Implement a system for solid waste segregation and weekly collection of garbage. 4. Implement a system of penalties for littering within the premises of the resort.	High
		Poaching	Implement a system of penalties for visitors and locals who will engage in hunting, killing and selling wildlife animals from the premises of the resort.	High

		Noise generated by the visitors	1. Designate tourist guides who are aware of the wildlife animals inhabiting the premises of the resort in guiding the visitors. 2. Create a daily schedule for visitors' tour.	Medium
		Water Contamination (Pond)	1. Put plants capable of accumulating heavy metals from the pond to prevent contamination of freshwater wildlife and avoid disruption of nutrient cycle. 2. Regulate the number of fishes to be imported for breeding. 3. Deposit gravel to increase the spawning habitat.	High
		Contamination by pesticide	1. Use organic fertilizer to avoid contamination or any adverse effects to terrestrial wildlife. 2. Use nets to prevent ground dwelling animals (mammals) from eating the crops	Medium
	Coral Reefs and Associated Marine Organisms	Increased sewage and spillage of petroleum-based products	1. Placement of regulations on proper waste disposal that will include all parties involved in both in-shore and off-shore construction. 2. Provide proper waste disposal facilities for petroleum products and solid wastes. 3. Provide sufficient toilet facilities for workers.	Moderate
		Boat traffic and marine vessel grounding	1. Mark shallow reef areas with buoys and provide updated nautical charts to captains of delivery barges. 2. Provide temporary anchoring buoys. 3. Allow delivery of construction materials only during good sea conditions.	Minimal
		Release of chlorinated water	1. Implement a slow release of pool water. 2. Set to an effective minimum for the addition of chlorine.	Minimal
		Solid waste generation	1. Implement strict waste segregation policy and ensure that all guests are informed of this practice. 2. Strategically place color-coded trash bins around the resort. 3. Establish a material recovery facility where solid wastes can be processed daily.	Moderate
Abandonment	Wildlife	Solid Waste Pollution	1. Supervise proper waste disposal. 2. Rehabilitation of the site using indigenous plants.	Minimal
	Coral Reefs and Associated Marine Organisms	Disposal of wastes	1. Supervise proper waste disposal. 2. Ensure the appropriateness of the selected landfill site for remaining waste products. 3. Revegetation of the project site using native flora.	Minimal

INDICATIVE BUDGET

The project is expected to cost around Php2 billion for land development, infrastructure and utilities.

TYPE OF INFRASTRUCTURE/UTILITIES/OTHER FACILITY	AMOUNT IN PHP
Road network, landscaping, street lighting and signage A road network will be constructed throughout the estate. The road network of Lio Tourism Estate will include a 13m wide spine road, 10m wide jetty road, and 8m wide resort town roads. Internal roads will be 6m wide. Landscaping, hardscape, fencing, sidewalk and trails development.	1,000,000,000.00
Lio Airport Runway and Terminal Lio Airport measuring 1, 240 meters by 30 meters effective runway Lio Airport Terminal with gross floor area of 3,000 square meters	500,000,000.00
Lio Pier & Lounge Lio Pier measuring 150 meters by 6 meters developed using pile drive systems	100,000,000.00
Power distribution system Combination of power sources: Powerhouse development with generator sets to green energy sources (water, power, etc.)	200,000,000.00
Water & Sewer distribution system Construction of water lines connected to a water reservoir supplied by shallow well developments within the estate. Construction of the sewer lines connecting to a centralized STP for the estate	200,000,000.00
TOTAL	**PhP 2,000,000,000.00**

OPERATIONAL PLAN & ACTIVITIES

SUSTAINABILITY INITIATIVES IN DESIGN, CONSTRUCTION AND OPERATIONS

Lio is guided by three main planning principles: Sustainable development, inclusivity and authenticity.

A. DESIGN PHASE

- Lio estate has successfully integrated the site's natural features, such as mangroves, lagoons, and forests, into the estate's overall design. Generous buffer zones and setbacks are provided in order to protect these Nature Reserve sites.
- During the planning phase, comprehensive ecological and environmental studies were conducted to determine development capacities and identify measure to ensure least impact to the environment. These measures that are implemented in the estate include engineering solutions, design standards and operational policies that mitigate or avoids adversely affecting the environment.
- All locators, merchants and guests must adhere to the guidelines and regulations of the estate for planning, design, development and operations of their establishments.
- All utility lines for power, water, sewage, drainage and telecommunications are developed underground and designed for full build-out taking into consideration anticipated capacities.
- Structures are set back over 40 meters from the shoreline throughout the 4.2-km beachfront, to facilitate the natural movement of sand on the beach. This also protects the buildings and their occupants from storm surges.
- Building height is capped at about 2 to 3 floors along the beachfront and maximum of 4 floors as you go inland. This ensures that the area's natural beauty is preserved, and remain the main attraction of the development.
- Endemic and native species of plants are recommended for the landscaping within the estate. Lio has developed its own nursery which harvests and reproduces planting materials for landscaping of the common areas and for locators.

B. Construction Phase

The project shall be developed in phases subject to market conditions. Construction works will commence once pre-construction activities are completed. A general contractor and specialty contractors will undertake the construction works. Activities during this phase will involve the following:

- Civil works
- Installation of utilities (electrical, water distribution, sewerage system, storm drains, telecommunication lines)
- Interior and exterior finishing
- Landscaping

Civil works will include land clearing and site preparation and the construction of the various structures. A contractor chosen by Ten Knots will undertake the civil works. All construction materials will be sourced from within El Nido, if available. However, it is likely that most construction materials will be sourced from outside El Nido and will be brought to the site using a barge. Ten Knots will ensure that the contractor will undertake all civil works with minimum impact to the marine and terrestrial environment.

Landscaping materials will consist of indigenous and endemic planting materials. The use of exotic or imported plant species will be avoided in order to preserve the ecological integrity of the project site.

The construction phase will take about 10 years in total.

C. Operation Phase

Project operations will commence upon completion of Lio Tourism Estate in phases.

The food requirement of the resort guests and staff will be sourced locally and from neighboring towns as well as from Metro Manila. Food processing for the proposed resort hotel as well as for the other Ten Knots resorts will be done at the F&B commissary that will be built as part of this project. Food wastes and trimmings will be disposed in the Ten Knots composting area while recyclable wastes will be stored in the Ten Knots material recovery facility. The residual wastes will be disposed in the municipal landfill.

Local service providers will provide services such as boat transfers, laundry, etc. Ten Knots will provide the utilities such as power and water supply as well as wastewater treatment and processing.

The resort will employ guest activity officers who will coordinate the recreational activities of the resort guests.

Sustainable Practices During Operations at Lio

Local Sourcing of Supplies

- We encourage locators and merchants to source locally-farmed products such as vegetables, fruits and meats
- The estate does not allow serving/selling of produce that are not sustainably sourced such as wild groupers or lobsters or produce that are already thinning in population
- Merchandise made from seashells are also strictly prohibited.
- We also encourage sourcing of design materials, furniture and packaging materials that are locally-made.

Environmental and Sustainable Practices

- Locators also undergo training under the BE GREEN (Guard Respected and Educate El Nido) which includes energy and water conservation practices
- Part of the training are also environmental policies towards marine conservation, wildlife protection and biodiversity preservation.
- Locators are also taught the importance of the eco-system and the protection of the wildlife within the estate such as marine turtles, monkeys and endemic species of flora and fauna.
- During construction, briefing is also done with the locators for information of contractors on reduction and proper disposal of waste, and policies towards wildlife

Zero Waste Management

- On-site sorting of trash is done and merchants are incentivized to minimize their non-biodegradable wastes
- Garbage is collected and brought to the centralized Materials Recovery Facilities wherein in biodegradable wastes are sorted to be used for composting. The compost is later used for the organic fertilizer of the Lio Farm which also produces fruits, vegetables and pork

No Plastic Policy

- A no-plastic policy is implemented within the estate for packaging, utensils and cups.
- Plastic straws are banned. We encourage the use of paper straws or bamboo straws (locally-made)

Other Best Practices

- Operating the estate as a model for sustainable development along with basic principles of sustainable travel such as impact management, CLAYGO, wildlife friendly practices and low-impact activities.
- Rules and regulations are implemented within the estate in line with estate guidelines, government policies, as well as global trends on sustainable tourism.
- Regular monitoring of consumption (waste, water, fuel and other resources) as well as environmental parameters and biodiversity for benchmarking and data-driven improvement programs.
- Regular coordination meetings with partners, contractors, locators to address concerns and help enhance their sustainability programs

Waste management practices and procedures *(solid and liquid waste management system)*

- **Solid Waste Management**

  Solid wastes are segregated at source. Color-coded waste bins are provided in common areas and in the guest rooms. Sorting of wastes are done at the material recovery facility. Recyclable wastes are sold to recyclers in El Nido or processed through various recycling initiatives while biodegradable wastes are composted in Lio's composting facility. Residual wastes are disposed in the municipal disposal site.

- **Wastewater Management**

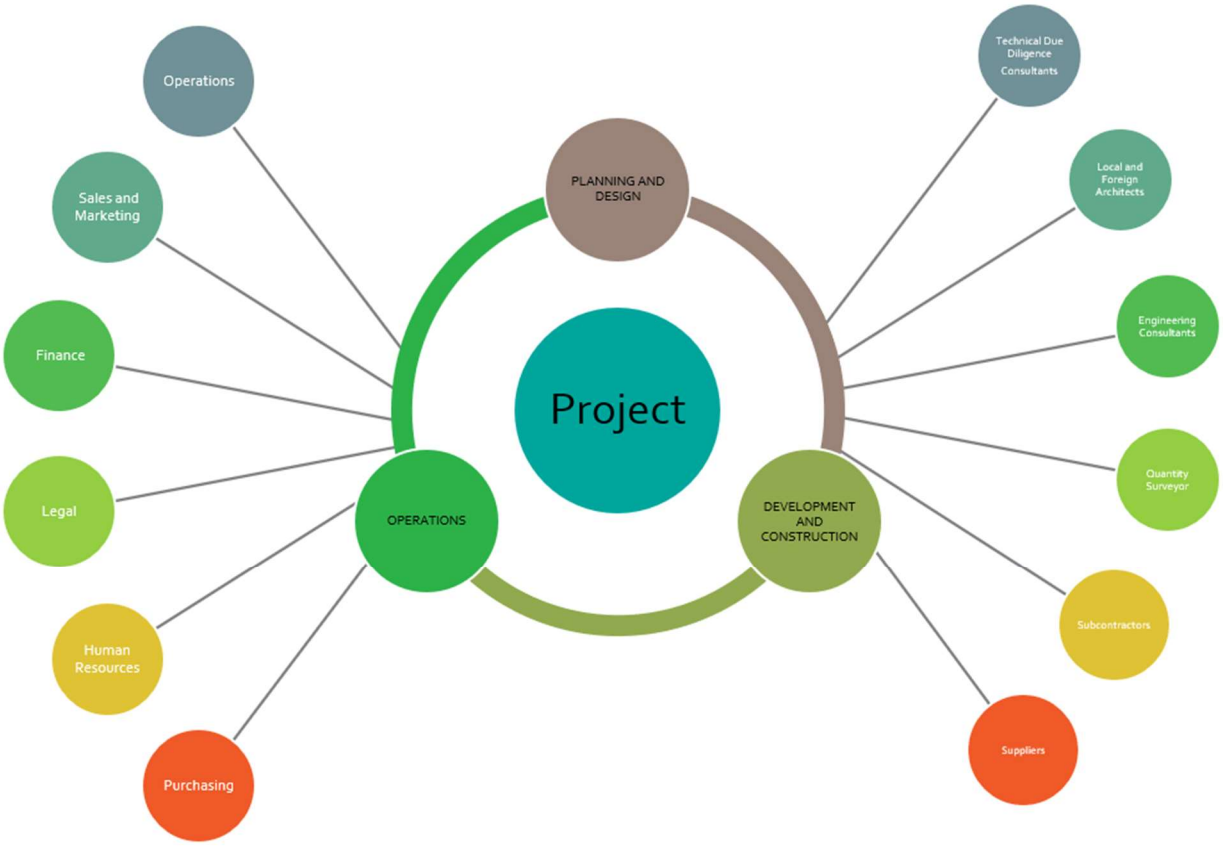
  Centralized sewage treatment plants (STP) for black water and grey water will be installed throughout the estate. Larger resort developments are to be designed to have individual STPs.

  This will involve separate collection systems for black water and grey water. Black water will be collected from water closets, kitchen sinks and urinals while grey water will be collected from the shower, lavatory and condensate from air-conditioning systems. Both the black water and grey water will be piped to the respective chambers for primary and secondary treatment. Effluent from the primary and secondary treatments will be transferred to a tertiary treatment chamber and the final product water will be piped to clear water tanks for non-potable water supply. The STPs will be either a sequential batch reactor or any applicable technology.

PERSONS INVOLVED IN THE IMPLEMENTATION

The development involves various departments and specialization from planning & design, development & construction up to operations. The project shall be worked on by employees of the company, consultant/suppliers/contractors and other external parties such as non-government organizations.

Moreover, the community, local government and other stakeholders shall be part of the planning and development from the start. As part of the company's thrust for inclusive business, community development programs shall be implemented to ensure shared values and sustainable growth for both the company and the community.



PROFILE OF THE APPLICANT

The proponent of the Lio Tourism Estate is Ten Knots Philippines, Inc. (TKPI). TKPI is part of the Ten Knots Group which owns and operates the El Nido Resorts (Miniloc, Lagen, Pangulasian and Apulit island resorts), a group of eco-resorts located in El Nido and Taytay municipalities in northern Palawan. The resorts offer genuine, local hospitality and unique and enriching experiences amidst the beautiful natural landscape. El Nido Resorts has been operating responsibly and sustainably within an environmentally protected area, the El Nido-Taytay Managed Resource Protected Area (ENTMRPA). The resorts exercise stewardship over the natural environment and stress the importance of preserving nature to all its visitors.

Nissin Sugar Corporation of Japan and a Filipino group established TKPI in 1979, and subsequently constructed and started operating Miniloc Island Resort in 1982. TKPI developed Lagen Island Resort in 1998. In 2001, Asian Conservation Corporation acquired majority stake in Ten Knots, then fully acquired the company in 2006. TKPI acquired and started operating Apulit Island Resort in Taytay, Palawan in 2010. On the same year, Ayala Land, Inc. (ALI) acquired majority stake in the Ten Knots group. Pangulasian Island Resort was re-opened in 2012. In 2013, ALI fully acquired the Ten Knots group.

Throughout the operation of the El Nido Resorts from the opening of Miniloc Island Resort in 1982, TKPI has embarked on a quadruple bottom line: (1) financial growth; (2) environmental stewardship; (3) community engagement and (4) organizational development. Sustainable operations are employed in the island resorts, through the use of zero-waste technology, particularly for water supply and wastewater management. TKPI is also active in biodiversity conservation, coastal cleanup activities, outreach and medical missions and support for environmental research. TKPI also supports local produce and livestock by acquiring food supply from local producers. Souvenirs for guests are also supplied by local cottage industries. Through these efforts, TKPI was able to sustain the growth of guest arrivals through the years.

As a testament to TKPI's sustainable tourism initiatives, it has won awards from various international award-giving bodies, some of which are shown in the figure below.

In 2013, El Nido Resorts bagged the prestigious World Travel & Tourism Council's Tourism for Tomorrow Awards for Community Benefit. Last year, the resort group garnered multiple recognitions that include ASEAN Green Hotel Standards for Pangulasian Island, Sustainable Hotel Awards from Hotel Investment Conference of Asia Pacific (HICAP) and the Asia's Responsible Tourism Award from the World Travel Awards.

TKPI is developing a master planned tourism destination in El Nido, Palawan dubbed as Lio Estate.

LIO TOURISM ESTATE

Environmental Impact Assessment Report

A Sustainbale Tourism Development by
Ten Knots Philippines, Inc. and Ayala Land, Inc.

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1 EXECUTIVE SUMMARY

1.1 PROJECT FACT SHEET PD SUMMARY

Project Name	Lio Tourism Estate
Project Location and Area	The project site is located in Barangays Villa Libertad and Pasadeña in the northern part of the Municipality of El Nido in mainland Palawan. It encompasses a total land area of approximately 325 hectares. The site is located north of the existing Lio Airport (**Figure 1**) and bounded by the following geographic coordinates: 1. (North) Pasadena – 11.240331 N latitude, 119.427867 E longitude 2. (West) Lamarao Pt. – 11.222431 N latitude, 119.415808 E longitude 3. (South) Lio Airport – 11.196756N latitude, 119.414900 E longitude 4. (East) Hillside – 11.220839N latitude, 119.428381 E longitude
Nature of Project and Scale / Threshold Limit	Lio Tourism Estate is a tourism industry project that is classified under Group II, No. 138, O.1 of Annex 2-1b of DENR Administrative Order No. 30 series of 2003: "*Resorts and other tourism/leisure projects*". To secure an Environmental Compliance Certificate (ECC) from the Department of Environment and Natural Resources (DENR), this project type requires the submission of an Environmental Impact Statement (EIS) if the area to be developed is more than 25 hectares.
Project Rationale	Lio Tourism Estate is masterplanned as an integrated, mixed-use, ecologically sustainable tourism destination in El Nido, Palawan. The development will be home to hotels and resorts, commercial establishments and residential communities with world-class amenities that blend with the natural landscape. Lio Tourism Estate will provide a new destination in Northern Palawan as well as alternative accommodations and commercial tourist facilities in the municipality of El Nido.
Project Components	Lio Tourism Estate will consist of the following main components: (1) airport terminal, runway, apron and taxiway; (2) jetty and jetty lounge; (3) centralized facilities; (4) hotels and resorts; (5) lodging and accommodation; (6) spa and wellness; (7) residential communities and retirement homes; (8) commercial and retail establishments; (9) educational and training institutions, (10) medical facilities; (11) tourist center; (12) estate offices and; (13) civic space and cultural center; (14) eco-center and eco-amenities; (15) parks/open space/leisure amenities and (16) plaza/market. The infrastructure and utilities components of Lio Tourism Estate will include a road system, streetlights, power distribution system, water treatment plants and distribution system, sewage treatment plant, material recovery facility, stormwater and drainage system, telecommunications and cable system, security management system (perimeter fence, CCTV, security posts) and estate facilities (police station/ security outpost, fire station).
Manpower	Approximately 500 workers will be on site during the construction phase. Qualified local workers shall be trained for lead roles in construction. The target room to staff ratio is 1:1, thus approximately 2,500 employees will be employed during the operation phase. About 70% of this manpower requirement will be sourced from El Nido and nearby towns.
Capital Cost	The proposed Lio Tourism Estate has an estimated cost of Php2 billion for the land development, infrastructure and utilities. This does not include yet the capital cost of locators and structures within the estate.

Proponent Contact Details and Profile	Name of Proponent	*Owner/Proponent*: Ten Knots Philippines, Inc. (TKPI) *Development Manager*: Ayala Land, Inc. (ALI)
	Address	*Makati Head Office:* 18/F 8747 Paseo de Roxas Street, Salcedo Village, Makati City *El Nido Town Office*: Real St., Brgy. Masagana, El Nido, Palawan
	Authorized Representative	Ruby P. Chiong TKPI President
	Contact Numbers	+632.813.0000 +632.759.3957 (fax) +63.917.553.7986 (El Nido Office) Email: info@lio.ph; reyes.marian@ayalaland.com.ph
	Brief Profile of Proponent	The Ten Knots Group, through its subsidiaries, operates four boutique island resorts known as El Nido Resorts in Palawan– Miniloc, Lagen and Pangulasian in El Nido and Apulit in Taytay. In these resorts, tourism, the local community and conservation of the natural environment are harmonized with one another. Ten Knots recently launched a 20-room resort in mainland El Nido called El Nido Cove. The Ten Knots Group specializes in resort operations. The company observes quadruple bottom line, namely financial growth, environmental stewardship, community engagement and organizational development. Ten Knots has been operating responsibly in an ecologically endowed area. The company has a strong commitment to sustainability and exercises stewardship over the flourishing diverse environment where the resorts operate. The resorts stress the importance of preserving nature to the resort guests. Ten Knots has been globally recognized for its nature-based guest activities and sustainable menus, and for providing environmental education programs for staff and guests, and for providing employment opportunities for the local community. In 2013, Ayala Land, Inc. (ALI) thru its subisidiary AyalaLand Hotels and Resorts Corp. acquired the remaining stake in the Ten Knots Group from its partners, Asian Conservation Company resulting to 100% ownership of TKPI. Ayala Land, Inc. is the leading, most diversified and fully integrated property developer in the Philippines. ALI is well known for large-scale, masterplanned, mixed-use and sustainable communities that become thriving economic centers in their respective regions.

		ALI's years of experience in real estate development shall aid TKPI in terms of providing technical, professional and financial support, marketing and promotions. Lio Tourism Estate shall benefit from the synergies of ALI as a successful developer and TKPI being in the forefront of sustainable tourism.
Preparer Contact Details	Name of EIA Preparer	Seastems, Inc.
	EIA Preparer Representative	Alvin F. Nacu EIA Team Leader
	Address	Room 103 Virata Hall, E. Jacinto St. UP Diliman, Quezon City
	Contact Numbers	+632.920.1706 info@seastems.com

1.2 PROCESS DOCUMENTATION OF THE CONDUCT OF THE EIA STUDY

1.2.1 Terms of Reference of the EIA Study

The terms of Reference for this EIA Study was defined during the meeting with DENR EMB Region IV-B EIA Division personnel on 10 July 2014 (**Appendix 1**). Considering that the project is an expansion of the 24.77-hectare Lio Development Phase 1, DENR required the preparation of an EIS-based Environmental Performance Report and Management Plan (EPRMP) for Lio Tourism Estate, as listed in the Technical Scoping dated 10 July 2014, with information of the following:

- Baseline data on terrestrial and marine flora and fauna
- Updated Site development Plan
- Baseline data on water, air and noise
- New PCSD SEP Clearance covering the additional area
- Proof of Public Consultation
- Sewerage System/Plan
- Drainage Plan
- Provision of access to the barangays (affected areas) going to the shoreline of Bacuit Bay

1.2.2 Name and Expertise of EIA Preparation Team

The EIA team for Lio Tourism Estate consists of the following individuals (**Table 1**). Seastems, Inc. fielded a multi-disciplinary team during the conduct of the EIA study to ensure that concerns on all environmental aspects are addressed by the EIA study.

Table 1. Personnel Involved in the Preparation of the EPRMP for Lio Tourism Estate.

Name of EIA Team Member	EIA Module
TKPI	***Project Proponent***
Ruby P. Chiong	TKPI President and authorized signatory
Marian S. Reyes	ALI Project Development Manager – Project Description
Seastems, Inc.	***Environmental Consulting Team***

Alvin Nacu	Team Leader
Armie Jean Perez	Physical Environment
Badi Samaniego, M.Sc.	Marine Ecology (Reef Fishes)
Victor Ticzon, M.Sc.	Marine Ecology (Corals)
Daniel Torres	Fisheries
Alvin Nacu	Terrestrial Ecology
Alvin Nacu	Terrestrial Wildlife
Ma. Roscela Pamela Poyatos	Socio-economic Conditions
Pedro Peralta, Jr.	GIS mapping

1.2.3 EIA Study Schedule

The EIA study commenced with field activities that were conducted from 01 to 05August 2014. The field activities included underwater surveys, collection of marine and surface water samples for laboratory analysis, key informant interviews with barangay officials and other residents, modified transects walks and plot surveys for plant and wildlife surveys, shoreline traverse and visual observations for physical environmental features. Ambient air quality and noise sampling was conducted on 13-14 August 2014.

Report writing and integration was done during September and October 2014. The report was submitted to TKPI for review and was finalized after incorporating the client's comments on the draft report.

1.2.4 EIA Study Area

The EIA study area is confined to the 325-ha Lio project site including the marine waters fronting the property.

Regional discussions on marine ecology, oceanography and water quality were limited to the Bacuit Bay area while discussions on socio-economic conditions were limited to El Nido Municipality and Barangays Villa Libertad and Pasadeña.

1.2.5 EIA Methodology

The EIA study was conducted in accordance with DENR guidelines and accepted protocols. The information presented in the report presents the status of the existing environment and people within the anticipated impact areas, the predicted impacts and the proposed management plan.

The data presented include secondary information collected from various government agencies including the host local government unit (LGU) and technical studies commissioned by Ten Knots (e.g. oceanography, hydrology, coastal dynamics). Primary information was gathered during onsite field sampling, mapping and measurement of environmental parameters. Compilation of environmental data was done using Geographic Information System (GIS) software.

The specific approach and methods utilized for each EIA module is discussed in Chapter 3.

1.2.6 Summary of Participation in Conduct of EIA

The following public participation activities were conducted forLio Tourism Estate.

Table 2. List of public participation activities for Lio Tourism Estate.

Name of Activity	Date of Activity	Venue	Participants
Barangay presentation	10 June 2014	Barangay assembly area, Brgy Pasadeña	Barangay captain & barangay officials Women's groups

			Fisherfolks Barangay residents
Site scoping	13 June 2014	El Nido Legislative Hall	LGU &Barangay officials NGOs/POs PAMB Enforcement agencies Education Sector Health Sector Youth Sector Fisheries groups IP Representative
Barangay presentation	13June 2014	Barangay assembly area, Brgy Villa Libertad	Barangay captain & barangay officials Women's groups Fisherfolks Barangay residents

A summary of issues and concerns raised during the site scoping is presented in **Table 3** while the signed copy of the issues and concerns is presented in **Appendix 2**.

Table 3. Summary of issues and concerns raised during the Site Scoping (13 June 2014).

EIA Module	Issues/Suggestions raised by stakeholders	Proponents Response
Project Description	How many phases will project development be?	Three phases.
	Phase 1 will involve hotels?	Phase 1 ECC covers first hotel, airport and roads.
	Will there be high-rise hotels?	Possibly until four storeys, not exceeding tree line Smallest lot parcel is 4 hectares
	What is the maximum number of rooms per hotel?	The first hotel, Seda Lio will have 150 rooms. The number of rooms will depend on the size of the lot and shall adhere to a predetermined room to plot ratio set by the estate.
	Please explain Phases 2 and 3	Phase 2 will involve lots north of Phase 1. It will involve development of lots for more hotels, leisure residential communities. Phase 3 involves development of the area south of the runway.
	Will banks be established in the development?	Yes. BPI is the first bank locator being a sister company of Ayala Land. Other banks will be invited as well
	Will the market be for the development only or for the entire town?	The commercial center will be an open area. The public (tourists and locals) are welcome to visit these places.
	Will water system include the town?	Phase 1 water supply will come from 50% desalination and 50% treated groundwater.
	Can Ayala not partner with the LGU for water supply development since it is already involved in water supply in Metro Manila? This way, there will be	ALI will consider this recommendation. In fact, Manila Water Company which is part of the Ayala Group has already been in touch with the LGU previously.

EIA Module	Issues/Suggestions raised by stakeholders	Proponents Response
	only one development that can supply the town.	
	Existing entry points are Puerto Princesa, San Vicente and Sandoval. What is the possibility that Lio Airport will be opened for commercial aircraft?	Development of the Lio Airport is limited by the presence of wetlands that TKPI/Ayala wants to preserve. In the future, opening the airport to commercial aircraft may be considered. Sandoval airport is currently being rehabilitated. ITI is not sure that the airport can accommodate ATR planes currently used by the company. The nearest airport that can possibly accommodate commercial flights is in the Municipality of San Vicente.
	Where will the project get its power supply?	TKPI is currently discussing with PALECO whether they will be able to supply the power requirement of the project. Generator sets will supply power for Phase 1 development.
	Will the project include a hospital for the public?	Development is also for medical tourism. Ayala has a unit that is involved in medical services so it is being invited to set up in the Lio
	Where will the project source its construction materials? There is now a shortage in terms of trees for construction materials. The municipality is now implementing reforestation projects to protect the environment.	Construction materials shall be coming from Manila, Cebu, Visayas and Puerto Princesa. However, we encourage the use of local materials whenever possible to reduce carbon footprint of the development.
	What is the area encompassed by the development? The project will have impact on fisherfolks.	The proponent will enforce the required setback, 20m to 40m from the coast. This is also part of the protection against storm surge. The proponent shall consider the concerns of the fisherfolks in planning the development.
	Roads are already being constructed. Does TKPI have an agreement with Brgy Villa Libertad regarding the development in the area?	The road development is part of the first phase of the development. Continuous consultations are being done with Brgy Villa Libertad and other impact areas of the project. There is an existing agreement with the barangay for access roads.
	Are there planned developments in the far end of the Ayala Property	Planned projects are only until the extent of the property of Ayala Land near the El Nido Cove.
People	Will the project hire locals during project development and operation?	Yes, the plan is to develop local skills for project operation and development.
	The Lio development will lead to the development of El Nido. Maybe the municipal and provincial governments can discuss with concerned agencies for the improvement and development of the airports in the area.	The proponent shall coordinate with the respective agencies for impact management. TKPI/ALI are open to partnerships in co-development that will further enhance El Nido and Palawan.

EIA Module	Issues/Suggestions raised by stakeholders	Proponents Response
	Rights and privileges of indigenous peoples should be respected by the government and companies who will introduce development projects in El Nido	

The list of issues and concerns raised during the barangay presentation in Pasadeña is presented in **Table 4**.

Table 4. List of issues and concerns raised in Brgy Pasadeña (10 June 2014).

Issues	Response
Will project include development of road access/right of way to the sea? Residents fear that project will limit local access to the sea.	Lio resort town is a public place and anyone can have access to the area. The plan also includes a fisherman's village. With fishing as part of the local culture, TKPI/ALI wants to preserve this culture.
Which part of Pasadena will the resort be located so the locals will have an idea of where the local access will be?	Exact location cannot be identified at present but project will be in the general area of Lamuro. Consultants will advise ALI/TKPI on how best to preserve the receiving environment
Will the project provide livelihood to the residents of Pasadena?	TKPI/ALI will come to the barangay to discuss with local women's groups, etc. on possible livelihood enterprise projects that can be tied up with the resort development project.
What will be the restrictions during full project implementation aside from access through Ten Knots properties? Locals at present are not allowed to pass through the ALI properties.	Ten Knots is giving priority to security of the site at present but once everything is in place, Ten Knots will discuss with local stakeholders regarding ground rules on access through the TKPI properties.
Residents may not be allowed access to the sea when site is developed.	Ten Knots cannot determine right of way at present but when plans are firmed up, ROW access will be discussed with the barangay
Residents are not allowed access to the beach at present. Residents fear that there will be more restrictions when establishments are built. Why not provide temporary access at present so that residents especially fishermen can have access to the sea. Boats cannot pass through the river when water level is low.	TKPI will conduct dialogue with the barangays regarding access to the sea and proper docking sites.

Issues and concerns raised during the barangay presentation in Villa Libertad is listed in **Table 5**.

Table 5. List of issues and concerns raised in Brgy Villa Libertad (13 June 2014).

Issues raised by project stakeholders	Proponent response
Were endorsements and permits already issued for the project?	TKPI has an agreement with the barangay for Lio Development Phase 1 This presentation is for the succeeding part of the Lio Tourism Estate

Issues raised by project stakeholders	Proponent response
What does presence of jetty indicate? Will it be for public use?	The jetty will be used for island transfers, island hopping and other marine activities. Permits for the jetty will be discussed with MARINA and other concerned agencies. Public use of jetty will be considered.
Plans for Phase 2 should be clear	This is first of series of consultations. Plans will be discussed in public hearing.
Fishing is banned in front of resorts. Guards ask people passing by the beach to sign logbook. There are also resorts that ban placing nets in front of resort even if outside buoys set up by the resort. For the new development, will fishermen be banned from fishing in front of establishments?	These issues will be discussed with concerned government agencies such as BFAR. The EIA will also discuss presence of commercial fishes in the area. Availability of fishing areas will be discussed with concerned groups.
All workers in the Lio Tourism Estate should secure CTC and permits from the barangay	This recommendation will be noted and the proponent will work out with the barangay how this can be executed.
Where is the extent of the development area?	Dalimatan and portions of Lamuro will be developed. Other parts for development still being studied.
Does the project have foreshore lease? Will proponent give ROW to residents of Lamuro?	Foreshore lease will be secured from DENR. This issue was raised during the consultation in Pasadena and proponent response was that this will part of the dialogues with Pasadena regarding appropriate location
Will the proponent give right of way for Phase 2 development?	TKPI is still studying the location of the road to the beach. Dalimatan appears not be the ideal road location due to the presence of wetlands. Alternative road access will be identified. Rest assured that road to the beach will be developed.
Previous presentations promised livelihood for farmers. Now it was not part of the presentation. What happened to the plan? Is there a plan for the fish docking area? Will the foreshore lease cover the area after the Lio airport?	TKPI and Ayala Foundation will meet with women's group for livelihood project. Livelihood project for farmers may be available after the project development. No contractor yet for fish docking site. Foreshore lease will only be until the property of TKPI near the airport.
Can the project prioritize hiring of workers from the barangay?	This recommendation will be considered by the proponent. Barangay residents are encouraged to join skills training that will be launched by TKPI and its foundations.
Chiara of Ayala Foundation offered clustered livelihood projects to residents of Villa Libertad but residents want individual livelihood projects.	This will be brought up to the foundations for consideration in their planning
Mostly laborers are needed. What about skilled workers? There are several training programs but nothing happens because financial assistance for livelihood projects is not available.	EIA will identify available skills in the barangays so it will be used for job matching
Presentation indicated availability of training programs for skills development. However, skills	Will recommend to AFI for alternatives to be reviewed for livelihood projects.

Issues raised by project stakeholders	Proponent response
gained from trainings are lost when not used for several months or years. There is not enough livelihood options available for residents who have undergone trainings. Conditions imposed by Ayala Foundation for livelihood projects cannot be met by barangay residents.	
Sibling has been working for three years in the Lio Airport. Was laid off from work when he/she did not report for work on Friday when day off was on a Wednesday – contractual worker with ITI	An operations issue not related to the development
Resident was not allowed to pass through the airport near the river. Family used to own the land where airport was built. Airport management should be more considerate. Family knows Mr Homa, a former incorporator of resort. Walking on the beach is also not allowed. Residents should be given access to the beach.	Location of access road will be studied together with the barangay. As mentioned, the development is intended to be opened for the public use.
Ten Knots blacklisted some workers from Villa Libertad. Residents feel that they will not be considered in the new project.	Barangay should endorse these workers to TKPI and MDC provided that they are qualified and of good moral character.
How far is the salvage zone from development?	Water code indicates 20m from salvage zone DPWH is studying distance of development 40m from coast, part of disaster preparedness and sustainability. The development will respect the salvage zone and provide sufficient setbacks
Construction materials should be sourced from outside El Nido to preserve the environment	Suggestion is noted. Materials that will not harm the environment but are readily available will likewise be considered.
Barangay resolution not to issue foreshore lease agreements to applicants. This means that barangay is not amenable to issuing foreshore lease agreements in the coastal area of Villa Libertad. This resolution was submitted to concerned agencies – PPA, CENRO, PENRO, etc.	Proponent requested copy of barangay resolution for reference.

1.3 SUMMARY OF BASELINE CHARACTERIZATION OF KEY ENVIRONMENTAL IMPACTS AND MANAGEMENT AND MONITORING PLAN AND EMF AND EGF COMMITMENTS

Impact Area	Potential Impacts	Nature (+/-)	Magnitude	Probability of Occurrence	Reversibility/ Permanence	Impact Duration	Geographic Extent
Pre-construction/Construction Phase							
The Land	Site preparation activities will impact on geologic processes (i.e., erosion, siltation, long-shore sedimentation, etc.)	-	Low	Low to moderate	Reversible	During site preparation and construction	Active construction areas
	Road construction will affect the adjacent remaining habitat especially the wetland/marsh area. This will affect the amphibians, reptiles and wetland birds	-	Low	Low to moderate	Reversible	During site preparation and construction	Active construction areas
	Clearing of vegetation will affect the local abundance or occurrence of wildlife	-	Low	Low to moderate	Reversible	During site preparation and construction	Active construction areas
	Increased presence of humans will increase disturbance to wildlife and will increase the likelihood of the introdcution of exotic species in the area	-	Low	Low to moderate	Reversible	During site preparation and construction	Active construction areas
	Dusts created by construction activities can smother leaves of nearby plants affecting their photosynthetic activity	-	Low	Low to moderate	Reversible	During site preparation and construction	Active construction areas
	Landscaping the resort grounds with exotic species for landscaping will impact on local biodiversity	-	Low	Low to moderate	Reversible	During site preparation and construction	Active construction areas
	Site development of will stimulate project development in the northern side of El Nido	+	Moderate to high	Moderate to high	Reversible	During construction and once resort is constructed	Barangay Villa Libertad and adjoining barangays
The Water	Water quality degradation during the construction phase may occur	-	Low to moderate	Low to moderate	Reversible	During construction	Surface and marine waters near the site
	Increased sedimentation will increase turbidity resulting to reduced primary production in coastal waters	-	Moderate	Moderate to high	Reversible	During site preparation and construction	Nearshore primary impact areas
	Discharge of untreated wastewater from the construction camp and spillage of petroleum	-	Moderate	Moderate to high	Reversible	During site preparation and construction	Nearshore primary impact areas

Impact Area	Potential Impacts	Nature (+/-)	Magnitude	Probability of Occurrence	Reversibility/ Permanence	Impact Duration	Geographic Extent
	products are major sources of coral reef degradation and algal growth.						
The Air	Construction activities are expected to lead to increased suspended particulates in the atmosphere, increased noise levels and possibly increase in gas emissions from operation of construction equipment	-	Low	Low to moderate	Reversible	During site preparation and construction	Active construction areas
The People	Construction activities will provide employment opportunities for residents of Barangay Villa Libertad and Pasadena and nearby areas in El Nido and Taytay	+	Moderate to high	Moderate to high	Reversible	Duration of construction activities	El Nido and nearby municipalities
Operation Phase							
The Land	Use of chemical insecticides may kill beneficial insects and other invertebrates important in plant pollination	-	Low	Low to moderate	Reversible	During project operation	Landscaped areas within Lio Tourism Estate
The Water	Discharge of untreated domestic waste from guest accommodations will cause significant increase in nitrogen and phosphorus based nutrients that can cause nutrification in Bacuit Bay	-	Moderate	Low	Reversible	During project operation	Nearshore primary impact areas
	Discharge of chlorinated freshwater from the pool could be a source of contaminant to receiving systems – it can depress phytoplankton productivity and can damage physiological processes of marine organisms	-	Moderate	Low to moderate	Reversible	During project operation	Nearshore primary impact areas
	Increased boat traffic and conduct of marine sports activities have the potential to cause actual physical damage to corals and associated organisms	-	Low	Low	Reversible	During project operation	Nearshore primary impact areas
The Air	Operation of generator sets will have gaseous emissions and may have high noise levels that will be a nuisance to guests.	-	Low	Low	Reversible	During project operation	Project site

Impact Area	Potential Impacts	Nature (+/-)	Magnitude	Probability of Occurrence	Reversibility/ Permanence	Impact Duration	Geographic Extent
The People	Operation of the resort will generate employment opportunities for local residents of El Nido and Taytay	+	Moderate to high	Moderate to high	Reversible	During project operation	El Nido and Taytay
	Operation of the resort will increase the income of the municipality in terms of business taxes, permits, etc.	+	Moderate to high	Moderate to high	Reversible	During project operation	Brgy. Villa Libertad and El Nido
	Income of resort employees will uplift their lives and will allow them to send their children to school	+	Moderate to high	Moderate to high	Reversible	During project operation	Brgy. Villa Libertad and El Nido

IMPACT MANAGEMENT PLAN MATRIX

Impacts	IMP	Method of Implementation	Schedule and Frequency of Implementation	Responsible Party	Cost of Mitigation and Enhancement	Guarantees
Construction Phase						
The Land						
Longshore sedimentation	Ensure that construction activity avoids the active shoreline	Comply with the provisions of the law (i.e. Philippine Water Code) with setback from beaches to ensure that built structures do not impede natural flow and cyclic action of water and sediments. Construction within zones of active geological processes such as beaches and river banks should consider the dynamics and/or instability of these zones. All civil structures intended for human habitation, high human traffic and constant use should be at least 10m higher than peak high tide level.	Before and during construction	TKPI and General Contractor	No additional cost – part of construction cost	Commitment of TKPI and Contractor
Soil erosion and siltation	Ensure that exposed earth materials are protected	All road cuts, excavation sites, soil mounds and rock piles should be covered with vegetation or	During construction	TKPI and General Contractor	No additional cost – part of construction cost	Commitment of TKPI and Contractor

Impacts	IMP	Method of Implementation	Schedule and Frequency of Implementation	Responsible Party	Cost of Mitigation and Enhancement	Guarantees
		appropriate surfacing against erosion if these will be left exposed to the elements for a long time.				
Impact of road widening on wetland which is the habitat of amphibians, reptiles and wetland birds	Retain the wetland	Construction activities should be planned in such a way as to avoid the wetland/marsh area, especially during landscaping and road/buggy path construction	During construction	TKPI and General Contractor	No additional cost – part of development/ construction cost	Commitment of TKPI and Contractor
Impact of increased human presence on wildlife	Prohibit wildlife hunting and poaching	Workers should be prohibited from hunting and poaching of wildlife. Access to areas that are fully vegetated should be prohibited in order to avoid contact with dangerous wildlife such as venomous snakes.	During construction	TKPI and General Contractor	No additional cost	Commitment of TKPI and Contractor
Landscaping using exotic species will affect existing biodiversity	Minimize use of exotic plants in landscaping	Use existing plants available in the surroundings for landscaping the resort grounds. This include the use of wildlings and germinated seeds of ipil, antipolo and beach plants like talisay, bitaog and botong.	Landscaping of resort grounds	TKPI and General Contractor	No additional cost	Commitment of TKPI and Contractor
The Water						
Construction activities may affect water quality	Proper environmental management during construction must be observed	Care must be taken during transport and delivery of construction materials Materials should not be dumped on the water but should be lifted and stored away from the beach Fuel storage area (15,000li) must be equipped with oil sump Silt traps must be installed to ensure that sediments are filtered before water is discharged into the sea Construction camp should be equipped with sanitary facilities The number of workers staying in the project site should be minimized in order to minimize impact on water quality	Daily during project construction	TKPI and General Contractor	No additional cost	Commitment of TKPI and Contractor

Impacts	IMP	Method of Implementation	Schedule and Frequency of Implementation	Responsible Party	Cost of Mitigation and Enhancement	Guarantees
Increased sediment deposition and turbidity will affect benthic organisms	Implement mitigating measures to minimize sedimentation and siltation	Implement slope stabilization measures Place erosion and and siltation ponds Deploy silt curtains during jetty construction Use prefabricated construction materials	During site preparation and hotel construction	TKPI and General Contractor	Part of site development cost	Commitment of TKPI and Contractor
Discharge of nutrient enriched freshwater runoff from vegetation clearing and landscaping activities	implement measures to address impact on coral communities	Revegetate denuded areas Minimize application of fertilizer	During site preparation and hotel construction	TKPI and General Contractor	Part of site development cost	Commitment of TKPI and Contractor
The Air						
Construction activities will generate dust	Dust suppression methods should be employed	Bare areas should be watered down especially during the dry months Piles of construction materials should be covered with bund walls and netting	During excavation, land grading and construction of hotel structures	TKPI and General Contractor	Part of site development cost	Commitment of TKPI and Contractor
Noise levels will increase as a result of construction activities	Minimize noise generation during project construction	All noisy construction equipment should be equipped with mufflers to minimize noise levels Noisy construction activities should be limited to daytime and should be avoided at night	During excavation, land grading and construction of hotel structures	TKPI and General Contractor	Part of site development cost	Commitment of TKPI and Contractor
The People						
Construction activities can result in work-related accidents	Ensure that workers follow health and safety standards	All workers should be provided with personal protective equipment Staff orientation and training on occupational health and safety should be conducted	Duration of construction activities	TKPI and General Contractor	Part of site development cost	Commitment of TKPI and Contractor
Construction activities may generate increase vehicular and boat traffic	Vehicular and boat traffic should be minimized in the project site and vicinity	TKPI should coordinate with the LGU and barangay officials Information on construction activities should be disseminated to the public Markers and buoys should be provided to serve as warning signs for local vehicles and vessels	Duration of construction activities	TKPI and General Contractor	Part of site development cost	Commitment of TKPI and Contractor
Operation Phase						
The Land						

Impacts	IMP	Method of Implementation	Schedule and Frequency of Implementation	Responsible Party	Cost of Mitigation and Enhancement	Guarantees
Removal of vegetation will affect wildlife habitat	Replanting of wildlife habitats	Notable vegetative habitats for wildlife should be replanted/relocated or reestablished to enhance the current levels of biodoversity after project completion. Landscape development should prioritize the use of native species of plants. These should include fruiting trees that will attract birds and therefore enhance the birdwatching activities in the resort hotel.	Landscaping of resort grounds during project operation	TKPI	Part of site development and maintenance cost	Commitment of TKPI
Trekking and hiking activities of resort guests may impact on wildlife	TKPI should enforce standard regulations on use of trails	The resort guests should be required to observe proper waste disposal, maintain low noise levels and abstain from collection of plants and animals. The number of persons joining a hike should be limited. Similar to what is being done in the other El Nido Resorts operated by Ten Knots, trekking leaflets shall be distributed to guests/participants to define guidelines to mitigate or minimize negative impacts of trekking and hiking on wildlife.	Daily during resort operations	TKPI	No additional cost	Commitment of TKPI
Use of insecticide will kill beneficial insects and other invertebrates important in plant pollination	Minimize use of chemical spray	Chemical spray should be used only when necessary. Alternatively, use of organic insecticide should be favored as it is more environment-friendly than commercial insecticide.	Daily during resort operations	TKPI	No additional cost	Commitment of TKPI
Resort operation will generate solid wastes	Proper solid waste management practices must be observed	Segregate wastes at source Use bulk reusable containers in transporting food and other supplies from Manila Use refillable containers for complimentary toiletries and half used rolls of toilet paper should not be replaced Extend lifespan of equipment through regular maintenance	Daily during resort operations	TKPI	No additional cost	Commitment of TKPI

Impacts	IMP	Method of Implementation	Schedule and Frequency of Implementation	Responsible Party	Cost of Mitigation and Enhancement	Guarantees
The Water						
Surface and groundwater contamination may occur from resort operations	Resort will not discharge wastewater directly into surface water bodies	TKPI will install a sewage treatment plant in Lio Tourism Estate similar to the other resorts it currently operates. Treated wastewater will be used for toilet flushing and for irrigating the resort grounds.	Daily during resort operation	TKPI	Part of operating cost	Commitment of TKPI
Increased sewage and spillage of petroleum based products will impact on corals	Implement measures on proper solid and liquid waste disposal	Enforce regulations on proper waste disposal Provide waste disposal facilities for petroleum products and solid wastes Wastewater treatment will be provided at the resort	Daily during resort operations	TKPI	No additional cost	Commitment of TKPI
Boat traffic and marine vessel grounding will affect coral communities	Provide markers so that boats and other vessels will affect shallow reef areas	Mark shallow reef areas with buoys and provide updated nautical charts/bathymetric map to captains of delivery barges Provide temporary anchoring buoys Allow delivery of materials/supplies only during good sea conditions	During resort operations	TKPI	No additional cost	Commitment of TKPI
The Air						
Operation of power generation equipment can create noise that will be a nuisance to guests	Suppress noise levels emitted by power generators	Generator sets shall be equipped with mufflers to minimize noise generation. The powerhouse will also be located away from guest facilities such as hotel rooms, restaurants and other common areas. Power generating equipment that have minimal noise emissions should be chosen. The generator sets shall be used until such time that stabilized power will be established and will remain as back up power source during power outages.	During resort operations	TKPI	No additional cost	Commitment of TKPI
The People						
Resort operation will create employment opportunities for local residents	TKPI should prioritize the hiring of qualified local workers.	TKPI can coordinate with local schools to provide training to students and local residents on hotel and resort operation. This will include training in	During resort operations	TKPI	No additional cost	Commitment of TKPI

Impacts	IMP	Method of Implementation	Schedule and Frequency of Implementation	Responsible Party	Cost of Mitigation and Enhancement	Guarantees
		housekeeping practices, laundry, food preparation, food service, etc. Note that there are no indigenous people in the project site as indicated in the Certificate of Non-Overlap from NCIP				

SUMMARY OF ENVIRONMENTAL MONITORING PLAN

Key environmental aspects per project phase	Potential impacts per environmental sector	Parameter to be monitored	Sampling and measurement plan			Lead person	Annual estimated cost	EQPL Management Scheme					
			Method	Frequency	Location			EQPL Range			Management Measure		
								Alert	Action	Limit	Alert	Action	Limit
Construction Phase				Over a period of 2 to 3 years									
Land	Construction activities may create sediment plumes	Sediment plume, wind, waves, current	Visual inspection	Only during episodes of strong rain	Rivers and creeks and beachfront	TKPI PCO/EO	No additional cost		Large coastal areas are affected by sediment plume			Determine source of plume and mitigate if necessary	
Water	Construction activities may affect water quality	Temperature, pH, salinity, DO, total coliform, fecal coliform, oil & grease, BOD	In situ measurement and collection of water samples for laboratory analysis	Twice a year – April and October	Sampling stations established during EIA study	TKPI PCO/EO	Php50,000		Increase in values of identified parameters / values exceed DENR standard values			Check source of water pollution and provide immediate corrective action	
	Construction activities will affect coral communities	Benthic cover, diversity and abundance of indicator reef species	Photo-transect	Quarterly - January, April, July and October	Sampling stations established during EIA study	TKPI PCO/EO or marine biologist	Php1M		Negative changes in marine indicator groups			Identify causes and make necessary corrective action	

Key environmental aspects per project phase	Potential impacts per environmental sector	Parameter to be monitored	Sampling and measurement plan			Lead person	Annual estimated cost	EQPL Management Scheme					
								EQPL Range			Management Measure		
			Method	Frequency	Location			Alert	Action	Limit	Alert	Action	Limit
Air	Construction activities will generate TSP and noise	TSP SO_2 NO_2 Noise	Ambient air and noise sampling	Twice a year – April and October	Sampling stations established during EIA study	TKPI PCO/EO and envi lab	Php200k		High increase in values of measured parameters			Identify causes and make necessary corrective action	
Operations													
Land	Wildlife Resort activities may impact on wildlife population	Species richness, relative abundance and diversity indices	Observations along established transect lines for birds, netting for bats and trapping for non-volant mammals	Twice a year during bird migration season (Octoberan d April)	Transects established during EIA study	TKPI PCO/EO	No additional cost if done internally		Decrease in species richness, relative abundance and diversity indices			TKPI should investigate the cause of the decrease in identified parameters. Appropriate measures should be undertaken to address the impact.	
Water	Resort operations will affect coral communities	Benthic cover, diversity and abundance of indicator reef species	Photo-transect	Twice a year – April and October	Sampling stations established during EIA study	TKPI PCO/EO or marine biologist	Php0.5M		Negative changes in marine indicator groups			Identify causes and make necessary corrective action	

2 PROJECT DESCRIPTION

2.1 PROPONENT PROFILE

The proponent of the Lio Tourism Estate is Ten Knots Philippines, Inc. (TKPI), a wholly-owned subsidiary of Ayala Land, Inc. TKPI is part of the Ten Knots Group which owns and operates the El Nido Resorts (Miniloc, Lagen, Pangulasian and Apulit island resorts), a group of eco-resorts located in El Nido and Taytay municipalities in northern Palawan. The resorts offer genuine, local hospitality and unique and enriching experiences amidst the beautiful natural landscape. El Nido Resorts has been operating responsibly and sustainably within an environmentally protected area, the El Nido-Taytay Managed Resource Protected Area (ENTMRPA). The resorts exercise stewardship over the natural environment and stress the importance of preserving nature to all its visitors.

Nissin Sugar Corporation of Japan and a Filipino group established TKPI in 1979, and subsequently constructed and started operating Miniloc Island Resort in 1982. TKPI developed Lagen Island Resort in 1998. In 2001, Asian Conservation Corporation acquired majority stake in Ten Knots, then fully acquired the company in 2006. TKPI acquired and started operating Apulit Island Resort in Taytay, Palawan in 2010. On the same year, Ayala Land, Inc. acquired majority stake in the Ten Knots group. Pangulasian Island Resort was re-opened in 2012. In 2013, ALI fully acquired the Ten Knots group.

A diagram showing the ownership history of the El Nido Resorts is shown in **Figure 1**.

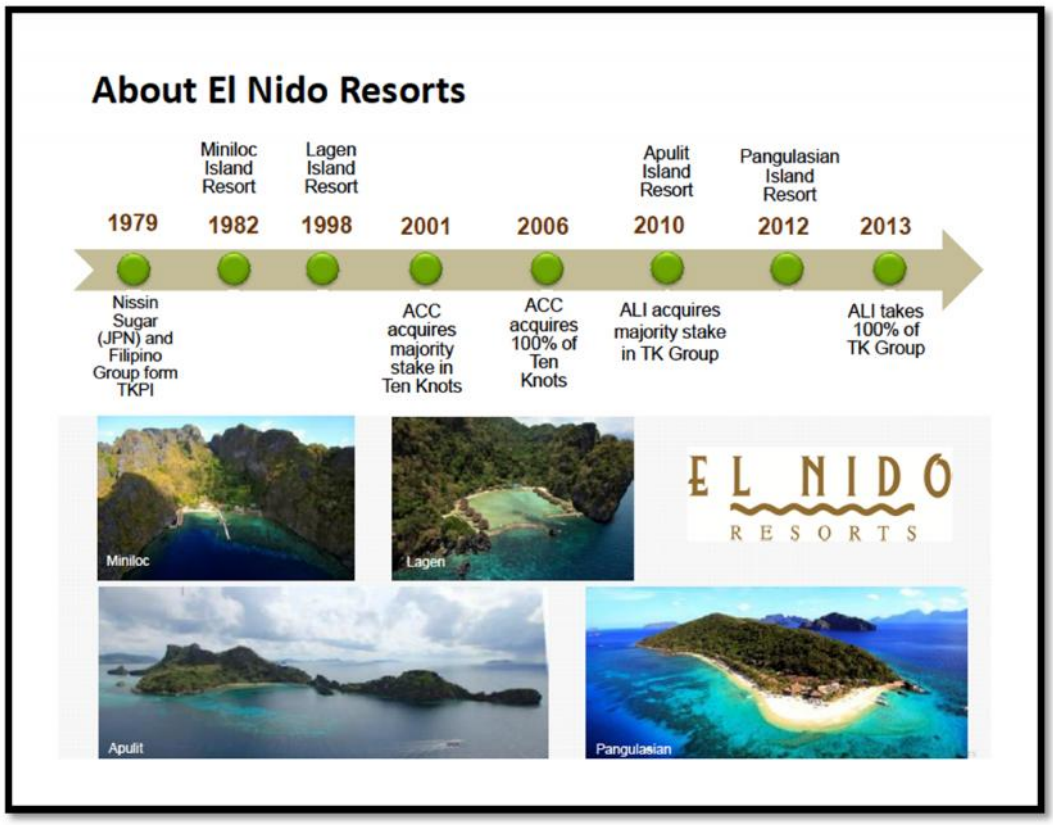


Figure 1. Ownership history of El Nido Resorts.

Throughout the operation of the El Nido Resorts from the opening of Miniloc Island Resort in 1982, TKPI has embarked on a quadruple bottom line: (1) financial growth; (2) environmental stewardship; (3) community engagement and (4) organizational development. Sustainable

operations are employed in the island resorts, through the use of zero-waste technology, particularly for water supply and wastewater management. TKPI is also active in biodiversity conservation, coastal cleanup activities, outreach and medical missions and support for environmental research. TKPI also supports local produce and livestock by acquiring food supply from local producers. Souvenirs for guests are also supplied by local cottage industries. Through these efforts, TKPI was able to sustain the growth of guest arrivals through the years.

As a testament to TKPI's sustainable tourism initiatives, it has won awards from various international award-giving bodies, some of which are shown in the figure below.

- Travel+Leisure USA : **"Best Places to Travel in 2014"**
- Travel+Leisure SEA : **"Best Places to Travel in 2014"**
- National Geographic : **"Best Spring Trips of 2014"**
- Facebook : **"Top 5 Brands by Engagement" (Jan & Mar)**
- LifestyleAsia.com : **"5 best eco resorts in Asia"**
- Smart Travel Asia : **"Top 25 Leisure Resorts in Asia" – Lagen Island**
- Travelite Magazine : **"Asia's Secret Beaches" – Lagen Island**
- Habitat for Humanity Phl : **Appreciation Award**
- Best of the Best: Philippines : **Book Feature**

Figure 2. Awards and citations endowed on El Nido Resorts.

In 2013, El Nido Resorts bagged the prestigious World Travel & Tourism Council's Tourism for Tomorrow Awards for Community Benefit. Last year, the resort group garnered multiple recognitions that include ASEAN Green Hotel Standards for Pangulasian Island, Sustainable Hotel Awards from Hotel Investment Conference of Asia Pacific (HICAP) and the Asia's Responsible Tourism Award from the World Travel Awards.

Under the stewardship of Ayala Land, Inc., one of the leading real estate developers of the Philippines, TKPI is expected to develop a master planned tourism destination in El Nido, Palawan. ALI is one of the developers in the country to adhere to sustainable practices and community engagement.

2.2 PROJECT LOCATION AND AREA

Lio Tourism Estate is an extension of the 24.8-hectare Lio Tourism Estate that was granted an Environmental Compliance Certificate on 27 February 2014. It is located in Barangays Villa Libertad and Pasadeña in the Municipality of El Nido in NW mainland Palawan. The site is located 430km southwest of Manila and 238km northwest of Puerto Princesa City.

Geographically, the site is located at center coordinates 11.219314 North latitude and 119.421442 East longitude.

The proposed Lio Tourism Estate site is located north-northwest of the Lio Airport, which would make it accessible to El Nido resort guests coming from the islands and mainland.

The fastest way to reach the project site from Manila is to take the 55-minute commercial flight of Island Transvoyager, Inc. (ITI). ITI has two to three round trips daily between El Nido and Manila. From the Lio Airport, Lio Tourism Estate can be reached through a jeepney or tricycle ride.

A longer route is to take a commercial flight from Manila to Puerto Princesa City, then take the commuter vans on a 5-hour land trip to El Nido. Other potential access points are the proposed San Vicente Airport in the Municipality of San Vicente and Sandoval Airport in the Municipality of Taytay.

The location map of the proposed Lio Tourism Estate is presented in **Figure 3**while the potential access points are shown in **Figure 4**.

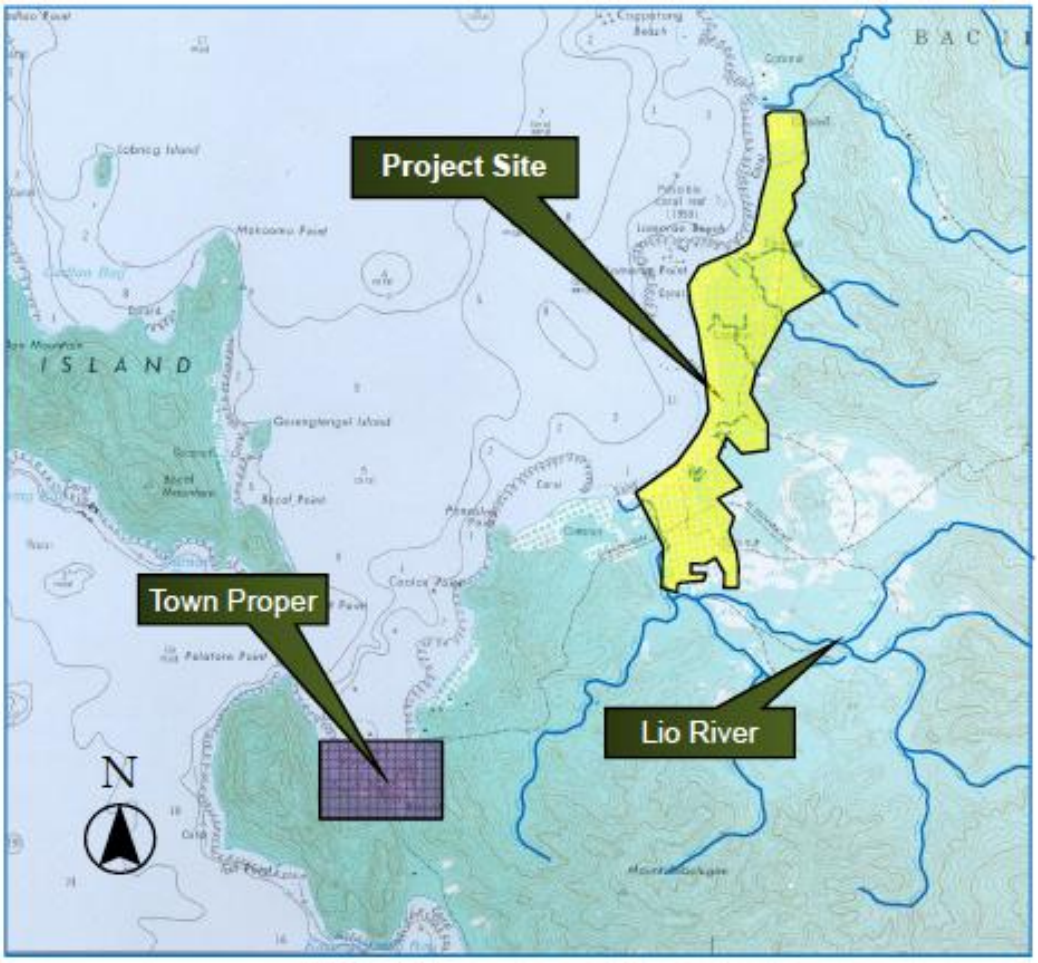


Figure 3. Location of Lio Tourism Estate relative to El Nido town proper.

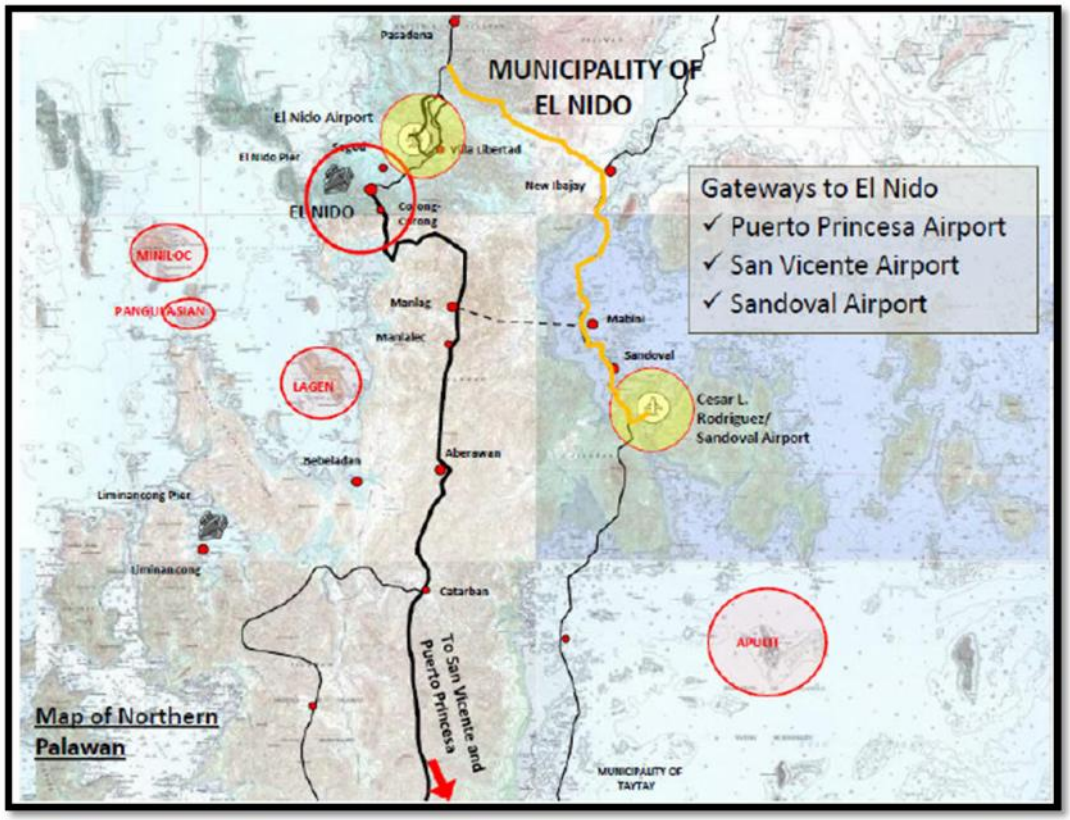


Figure 4. Potential access points to Lio Tourism Estate.

The primary impact area of Lio Tourism Estate is the 325-ha project site where activities during the construction and operation phases will be concentrated. The designated secondary impact areas are the host barangays of Villa Libertad and Pasadeña as well as the town proper of El Nido, as the socio-economic impacts of the project will be significant in these areas. The location of the primary and secondary impact areas is shown in **Figure 5**.

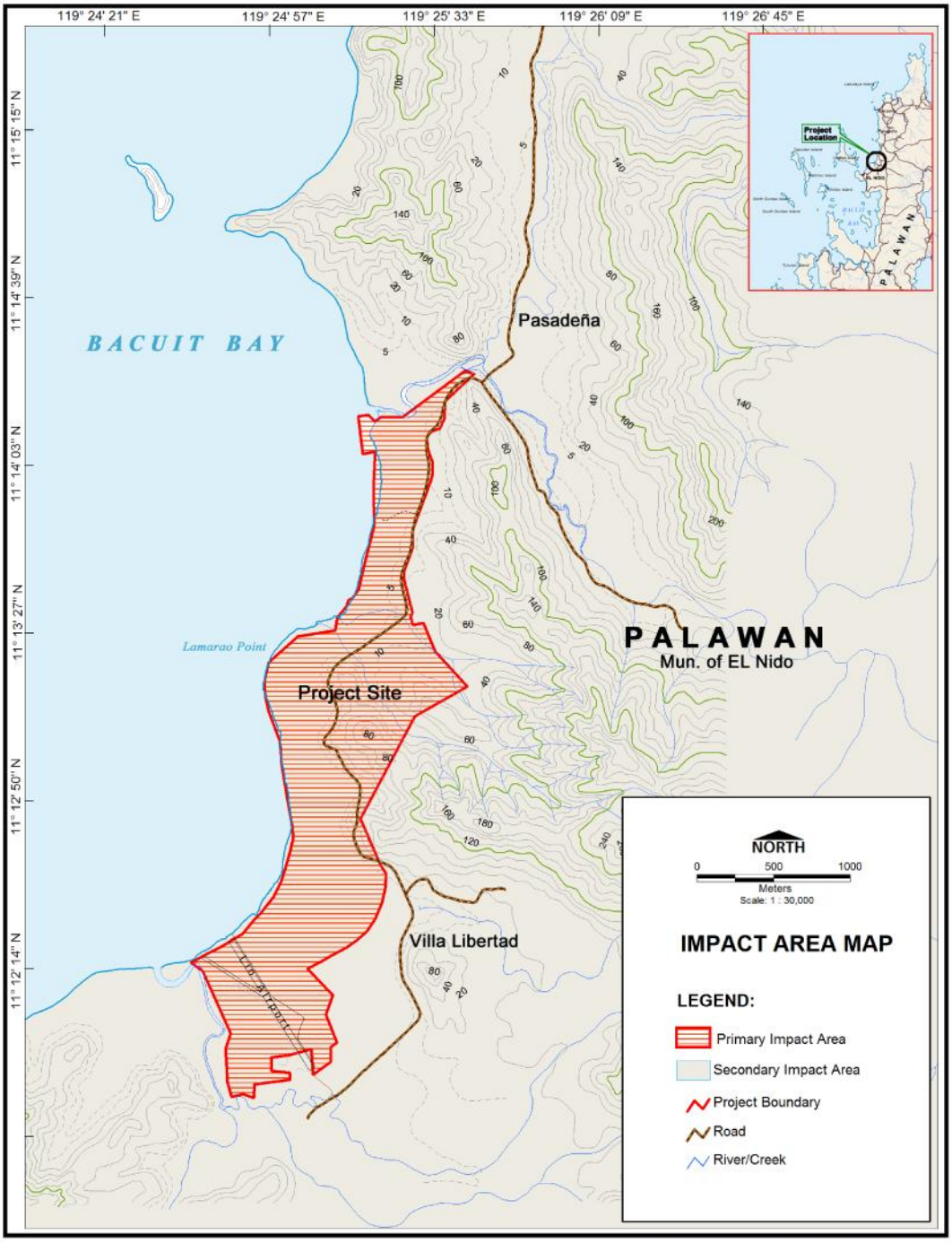


Figure 5. Location of primary and secondary impact areas.

2.3 PROJECT RATIONALE

The demand for tourist destinations in the Philippines has been increasing through the years. In 2012, foreign tourist arrivals reached a total of 5.27 million while domestic tourists accounted for 18.5 million (Source: DOT website). This represented a growth of 50% compared to the tourist arrivals in 2010. Palawan accounted for 3.6% or 189,200 of the total foreign tourist arrivals in the Philippines in 2012.

With the increasing demand for local tourist destinations, the Municipality of El Nido remains to be a top choice for those headed to NW Palawan. The projected tourist arrival in El Nido for 2014 is estimated at 78,000.

El Nido has been long known as a green destination through the efforts of the municipal government as well as Ten Knots Group, which operates three island resorts in the area. El Nido Resorts has received numerous awards from various international award-giving bodies. El Nido was recently named as the "Destination of the Year" by Asia CEO Awards, and "The Best Island in the World according to the recent list by Conde Nast Traveller.

Tourism is a mechanism for inclusive growth, as it generates jobs as well as provides livelihood for the tourism support industry, such as boat operators, food suppliers, and service providers. Through the development of Lio Tourism Estate, TKPI will provide an alternative destination in El Nido town, as well as generate employment and livelihood for local residents.

2.4 PROJECT ALTERNATIVES

The proposed site for Lio Tourism Estate has been owned by TKPI for more than 20 years. TKPI has kept it free from informal settlers by placing fences around the property and hiring guards to secure the area. Given that development in El Nido town is now highly saturated, TKPI saw the opportunity to provide an alternative beach resort in the town outskirts. The site's accessibility from the Lio airport is an added attraction for resort guests, as they will not have to travel far to reach their hotel accommodations.

Being located within the El Nido-Taytay Managed Resource Protected Area, one of the primary components of the National Integrated Protected Areas System, TKPI will ensure that Lio Tourism Estate will be sustainable and will minimize damage to the environment.

2.5 PROJECT COMPONENTS

Lio Tourism Estate is envisioned as a master-planned integrated, mixed use and ecologically sustainable tourism destination. The development will be home to hotels and resorts, commercial establishments and residential communities with world-class amenities that blend with the natural landscape. The project components are listed below.

Table 6. Major components of Lio Tourism Estate.

Infrastructure and Utilities	Project Components and Locators	Estate Facilities and Institutional Locators
• Airport Terminal • Apron and Taxiway • Jetty and Lounge • Road Development and Streetlights • Power Distribution System • Water Treatment Plants and Distribution System	• Hotel and Resorts • Lodging and Accommodation • Health and Wellness • Residential Communities • Bars, Restaurants, Cafés, Dining Shops • Commercial Tourist Establishments	• Educational and Training Institutions • Medical Facilities • Tourist Center • Eco-Center • Civic Space and Cultural Center • Plaza / Market

• Sewage Treatment Plant • Material Recovery Facility • Stormwater and Drainage System • Telecommunication and Cable Systems • Security Management System (i.e. perimeter fence, CCTV systems, security posts)	• Banks, Convenience Stores, Pharmacy, Etc.	• Parks / Open Space • Eco-Activity Areas • Estate Offices and Centralized Facilities • Estate Facilities (i.e. Police Station/Security Outpost/ Fire Station) • Transport Terminal and Shuttle Service • Staff Housing

2.5.1 Major Project Components

Lio Resort Town

The Lio Resort Town will be located a few minutes away from Lio Airport. It is a unique township development that will complement the rest of the Lio development. It will consist of bed and breakfast establishments, hotels/resorts, tourism-related establishments such as shops and restaurants, civic spaces, estate amenities and centralized facilities.

A conceptual plan of the Lio resort town is shown on **Figure 6** while the aerial perspectives are shown in **Figure 7**. A perspective of the beach promenade is shown in **Figure 8**.

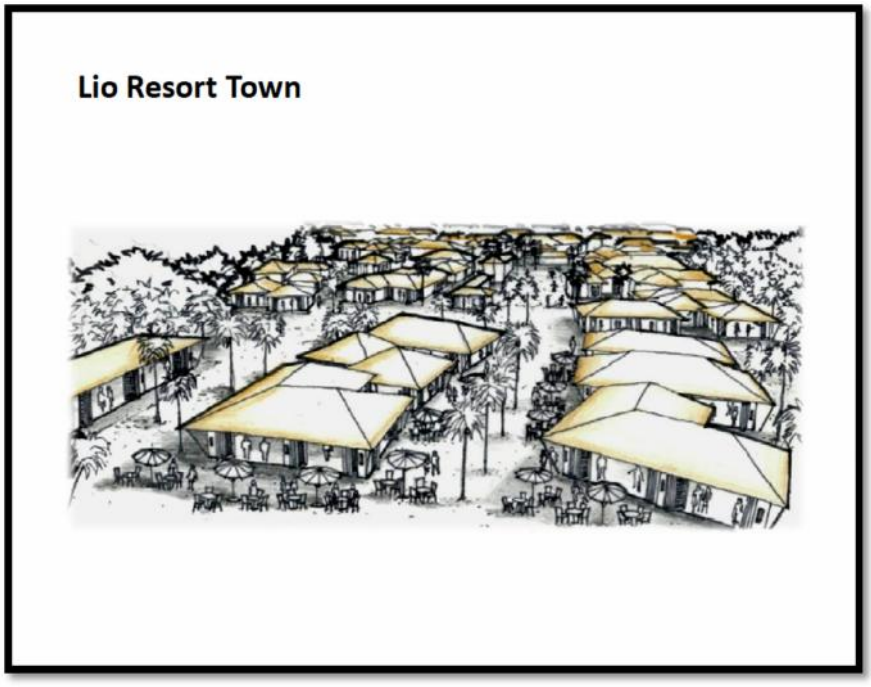


Figure 6. Conceptual plan of Lio Resort Town.

Figure 7. Aerial perspectives of the Lio Resort Town.

Figure 8. Perspective of the Lio Resort Town beach promenade.

The conceptual illustration of the other project components is provided in **Figure 9**.

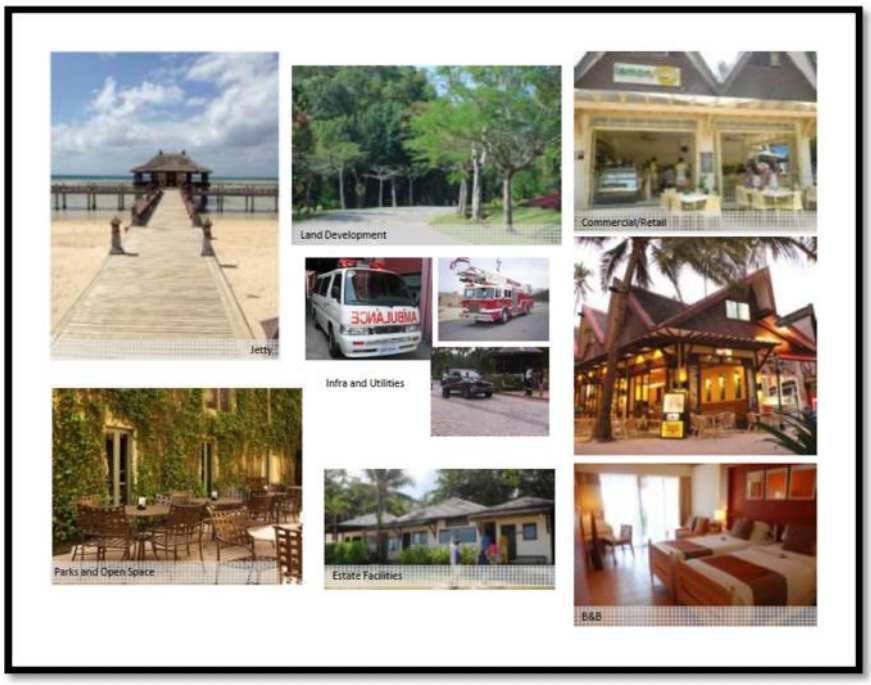


Figure 9. Conceptual illustration of the other project components.

Lodging and Accommodations

Lodging and accommodations will consist of bed and breakfast establishments, the concept of which is shown in **Figure 10**.

Figure 10. Conceptual photographs of lodging and accommodations.

Hotels and Resorts

Resort lots will be leased to international hotel and/or resort chains. Development guidelines will be provided to ensure that construction and operation of the hotels and resorts will be consistent with the quadruple bottom line of TKPI.

Conceptual photographs of the hotels and resorts that will be developed in Lio Tourism Estate are provided in **Figure 11**.

Figure 11. Conceptual photographs of hotels and resorts in Lio Tourism Estate.

2.5.2 Other support facilities (power/energy generating facility, water supply system)

The Lio Estate facilities will include the new airport terminal, jetty and lounge and infrastructure and utilities.

Infrastructure components will include road networks, pedestrian-friendly path walks and bike lanes. The road network system of Lio Tourism Estate will include a 13m wide spine road, 10m wide jetty road and 8m wide resort town roads. Internal roads will be 6m wide.**Figure 12** shows the proposed road network system within Lio Tourism Estate.

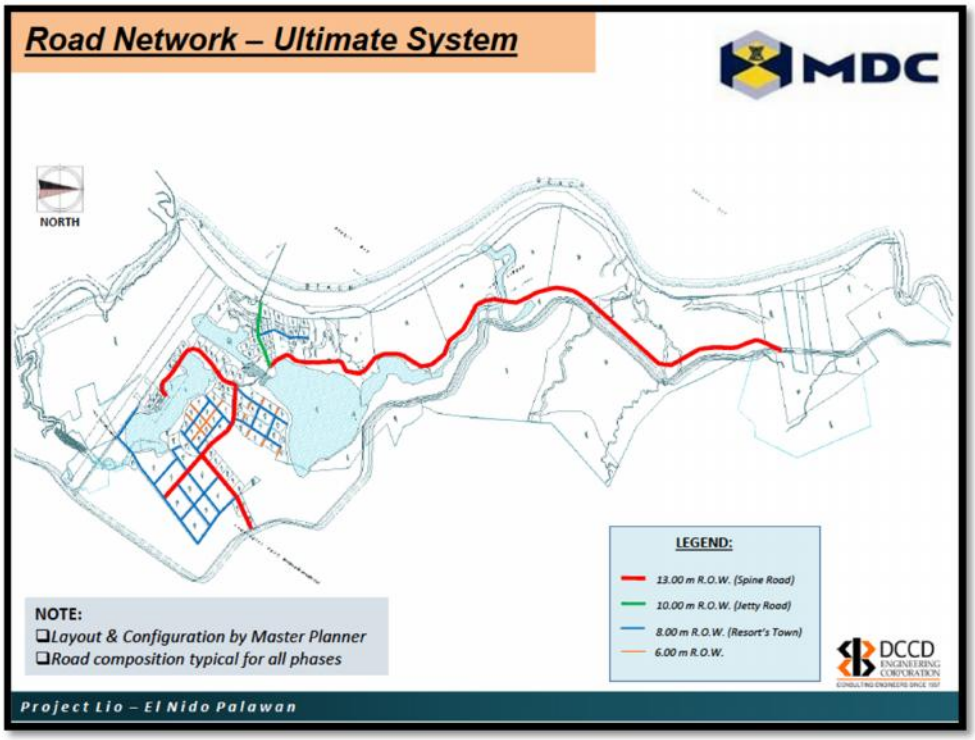


Figure 12. Proposed road network system within Lio Tourism Estate.

The utility components will include the following and described in succeeding sections:

- Power system (with provision for renewable energy)
- Water systems
- Drainage systems
- Storm water management systems
- Sewage treatment plant
- Material recovery facility
- Telecommunications and cable system
- Security management system (perimeter fence, CCTV, security posts, etc.)

The perspective of the new airport terminal and jetty is shown on **Figure 13**while examples of a desalination plant and sewage treatment plant are presented in **Figure 14.**

Figure 13. Perspective of the new airport terminal and jetty.

Figure 14. Desalination plant and STP.

2.5.3 Pollution control devices and corresponding facilities being served or connected

The pollution control devices that will be installed in the proposed Lio Tourism Estate include centralized and individual sewage treatment plants and the materials recovery facility. The sewage treatment plant will process all wastewater coming from the resorts and hotels as well as the commercial establishments. The processed wastewater effluent will be used for toilet flushing and lawn irrigation while the sludge will be used as organic fertilizer.

The material recovery facility will be used to sort the solid wastes generated by the project. Recyclable wastes will be sold to recyclers in El Nido and biodegradable wastes will be composted in Ten Knot's composting facility located nearby. Residual wastes will be disposed in the municipal disposal facility.

Practices and facilities that will be in place to ensure the sustainable operations of Lio Tourism Estate include the following:

- Water and energy conservation
- STP and desalination plant
- Waste management
- Rainwater catchment
- Opportunities for renewable energy (i.e., solar, hydropower, wind)
- Low impact guest activities
- Use of local materials for construction
- Hiring of local suppliers for food supply and hotel operations

2.5.4 Footprint of proposed layout of project facilities

Lio Tourism Estate will encompass a total development area of 325 hectares. It will consist of the resort town, resort lots, open space and airport terminal. Other parts of the property will be allotted for future development while the rest will remain as land bank of TKPI.

To ensure environmental protection, TKPI/ALI will prepare a master plan for a low-impact development. Additionally, low-rise structures and low-density development will be planned for. The master plan area is shown on **Figure 15**.

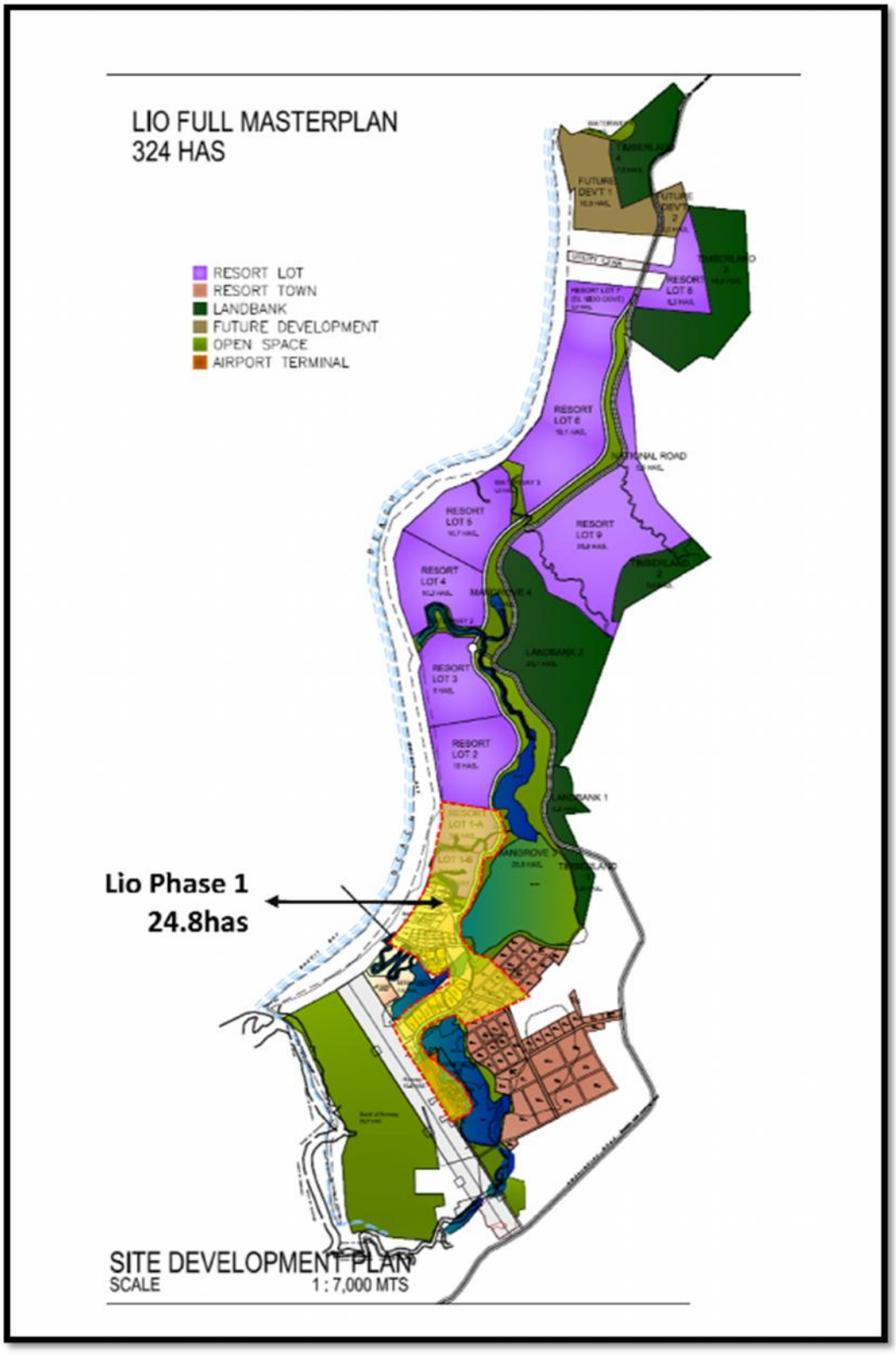


Figure 15. Master Development Plan of Lio Tourism Estate.

2.6 PROCESS/TECHNOLOGY OPTIONS

2.6.1 Construction Process

The construction methodology will consider the sensitive nature of the ecosystem. Pre-cast construction system shall be utilized in construction to minimize the debris on site.

2.6.2 Power generation and water supply system

Power Supply

Palawan Electric Cooperative (Paleco) supplies power to El Nido town. Power is available for 24 hours starting 4Q 2014 in the four Poblacion barangays and areas where the power lines have been put up primarily areas traversed by the provincial highway. Considering that the project size, TKPI is considering to generate its own power supply. The plan is to install a power substation with an estimated capacity of 40MVa. However, if Paleco is open to provide the power requirement then the project will connect to the local power grid.

Power will be distributed to the resort lots using underground power distribution duct lines while overhead power distribution lines will be provided along the main road system as well as the eastern periphery of the project site. The power distribution system within Lio Tourism Estate is shown on **Figure 16**.

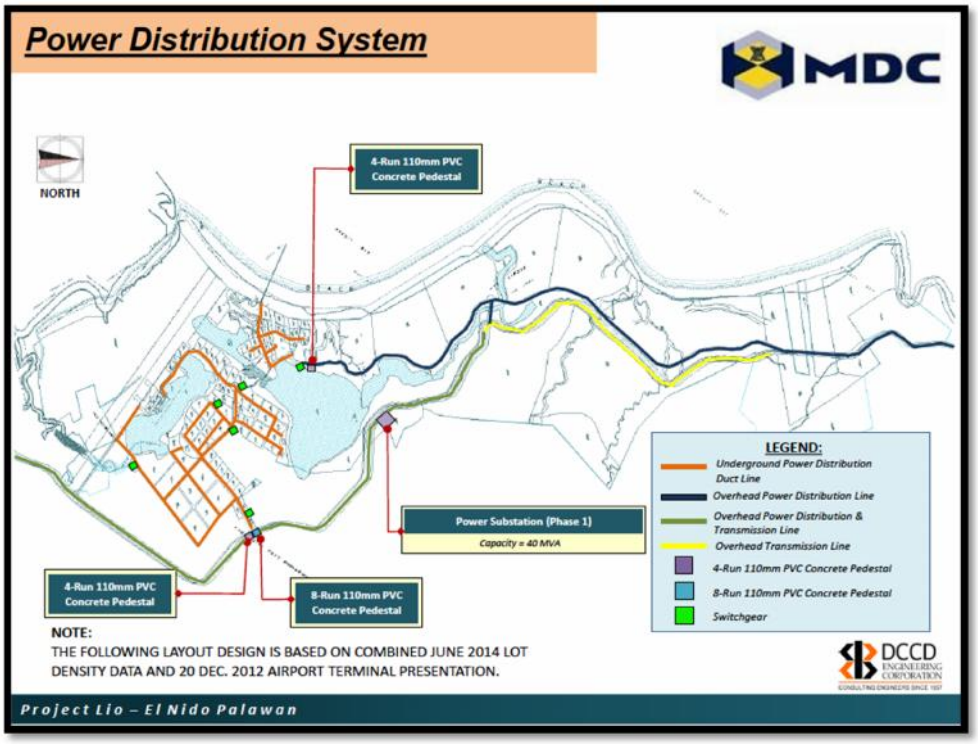


Figure 16. Power distribution system within the proposed Lio Tourism Estate development area.

Potable Water Supply

There is no water supply system in Barangays Villa Libertad and Pasadeña. Most households depend on deep wells and springs for water supply. The Project site being a waterlogged site and bounded by two (2) rivers (i.e. Lio River and Quinawangan River) has abundant water source.

The primary sources of the potable water requirements of Lio Tourism Estateare shallow wells and groundwater reservoirs supplemented with freshwater produced by a desalination plant. The estimated capacities of the potable water supply are listed below.

Table 7. Estimated capacities of the proposed water supply system for Lio Tourism Estate.

Potable Water Source	Capacity
Groundwater Reservoir (Phase 1)	2,110 cu m
Shallow wells (2 operational + 1 standby)	430 m^3/day
Groundwater Reservoir (Phase 2)	660 m^3/day
Shallow wells (5 operational + 1 standby)	430 m^3/day
Desalination Plant with BPS	1,055 cu m

The layout of the potable water supply system of Lio Tourism Estate is presented in **Figure 17.**

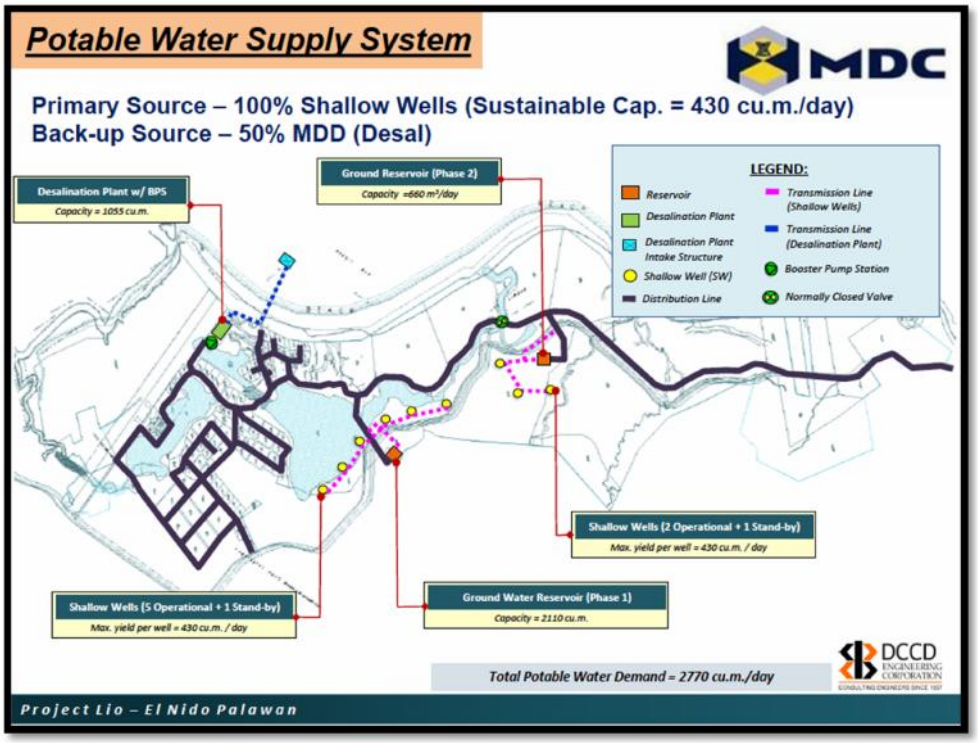


Figure 17. Potable water supply system within the proposed Lio Tourism Estate .

Non-potable Water Supply System

Non-potable water supply will include water used for flushing toilets, irrigation and other non-potable domestic water uses. Non-potable water will come from the product water of the sewage treatment plants and will be stored in two centralized clear water tanks and four individual clear water tanks. The location and capacities of these tanks are listed below while the layout is presented in **Figure 18**.

Table 8. Non-potable water supply for Lio Tourism Estate.

Non-potable water supply	Capacity	Location
Centralized water tank with BPS	727 m^3/day	Resort Town
Centralized water tank with BPS	504 m^3/day	Phase 2
Clear water tank	94 m^3/day	Resort Lot 1A
Clear water tank	141 m^3/day	Resort Lot 1B
Clear water tank	94 m^3/day	Resort Lot 2
Clear water tank	94 m^3/day	Resort Lot 3

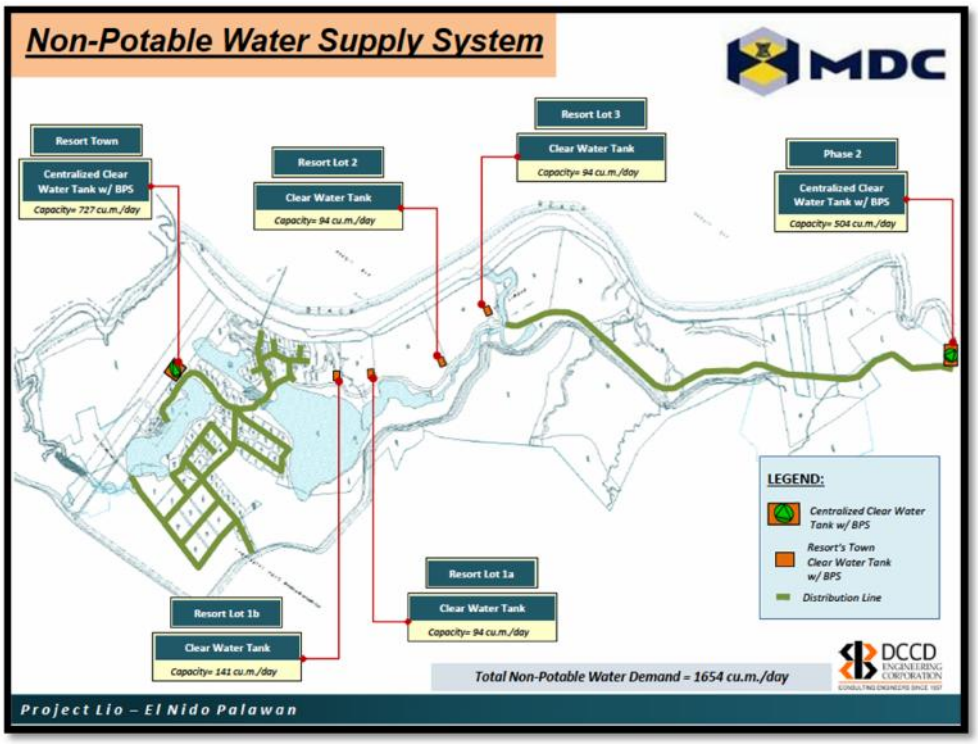


Figure 18. Non-potable water supply system within the Lio Tourism Estate development area.

2.6.3 Waste management systems

Solid Waste Management

Similar to the existing practice in the four operational TKPI island resorts, segregation of wastes at source will be done in the proposed Lio Tourism Estate. Color-coded waste bins will be provided in common areas and in the guest rooms. Sorting of wastes will be done at the material recovery facility, which will be designed to process 200kg of solid wastes per day. Recyclable wastes will be sold to recyclers in El Nido while biodegradable wastes will be composted in the TKPI composting facility. Residual wastes will be disposed in the municipal disposal site. **Figure 19** shows photographs of the existing solid waste management systems in the El Nido Resorts.

Figure 19. Solid waste management system of El Nido Resorts.

Wastewater Management

Centralized sewage treatment plants (STP) for black water and grey water will be installed for the Town Center and Phase 2 while individual STPs will be installed in each of the four resort lots. This will involve separate collection systems for black water and grey water. Black water will be collected from water closets, kitchen sinks and urinals while grey water will be collected from the shower, lavatory and condensate from air-conditioning systems. Both the black water and grey water will be piped to the respective chambers for primary and secondary treatment. Effluent from the primary and secondary treatments will be transferred to a tertiary treatment chamber and the final product water will be piped to clear water tanks for non-potable water supply.

The STPs will be either a sequential batch reactor or any applicable technology.

The schematic diagram of the sewerage system for Lio Tourism Estate is presented in **Figure 20** whilethe capacities of the STPs are tabulated below.

Table 9. Estimated capacities of sewage treatment plants.

Sewerage System	Capacity	Location	Product Water	Capacity
Centralized STP	909 m^3/day	Resort town	Clear water tank	727 m^3/day
STP No. 2	176 m^3/day	Resort Lot 1B		
STP No. 3	117 m^3/day	Resort Lot 1A		
STP No. 4	117 m^3/day	Resort Lot 2		
STP No. 5	117 m^3/day	Resort Lot 3		
Centralized STP	630 m^3/day	Phase 2	Clear water tank	504 m^3/day

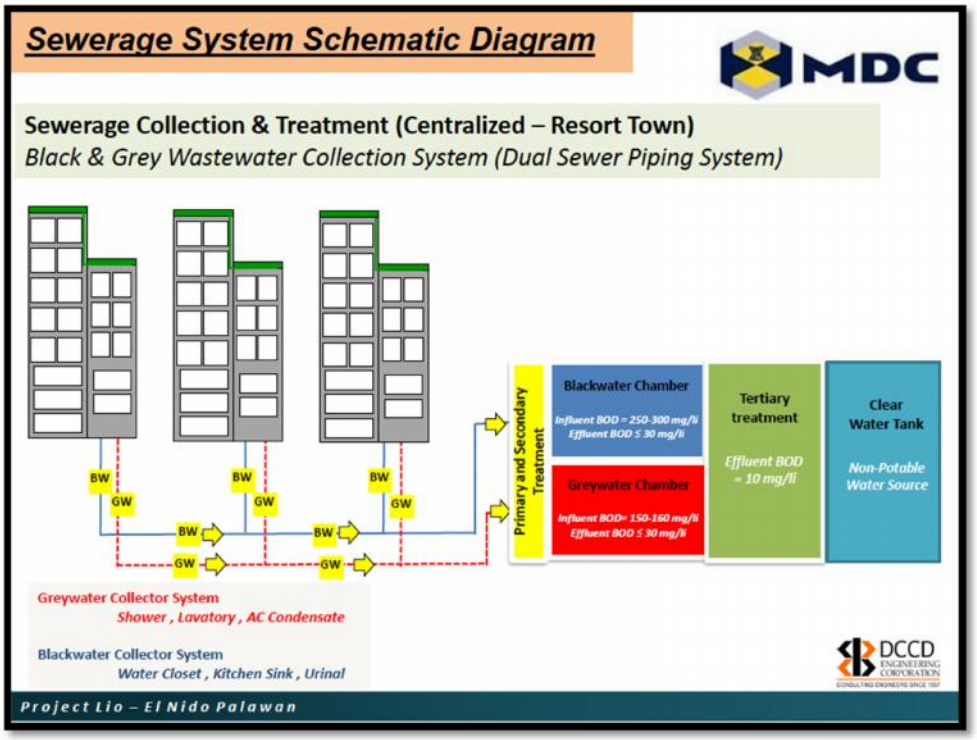


Figure 20. Schematic diagram of the sewerage system for Lio Tourism Estate.

Wastewater Treatment (Black water)

Separate sewer networks for black water and grey water directed to the STPs will be installed. Treated wastewater from the centralized STPs will be reused as supply for the non-potable water requirements of the development.

Schematic diagrams of the black water sewerage system and grey water sewerage system are shown in **Figure 21** and **Figure 22**, respectively**.**

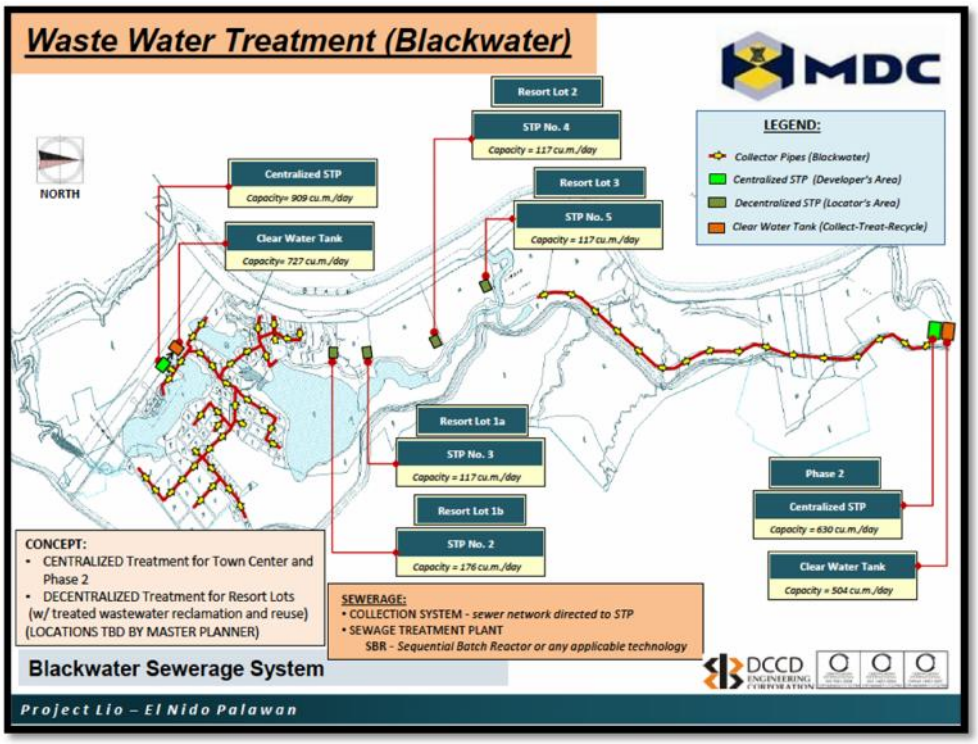


Figure 21. Black water sewerage system.

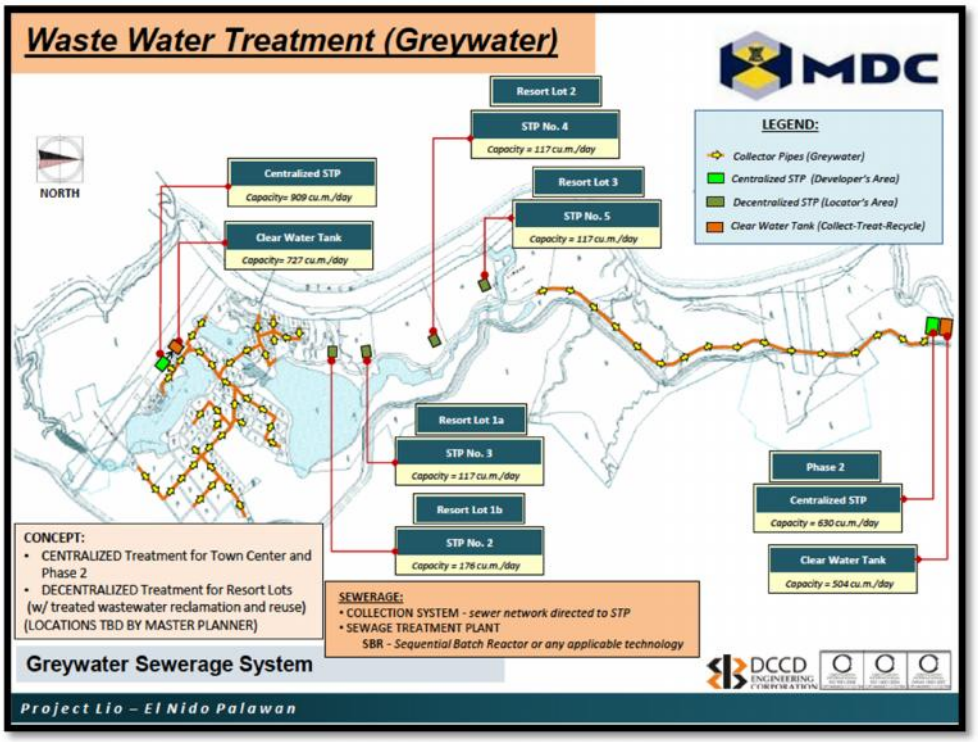


Figure 22. Grey water sewerage system.

Storm Drainage System

A system of de-siltation ponds will be installed throughout the development to prevent eroded materials from reaching the beach. The ponds will have a combined capacity of 5,396 m^3. These

will be supplemented with a drainage pumping station, a control weir/tide control gate and offsite inflow stations.

The schematic diagram of the storm drainage system is shown on **Figure 23**.

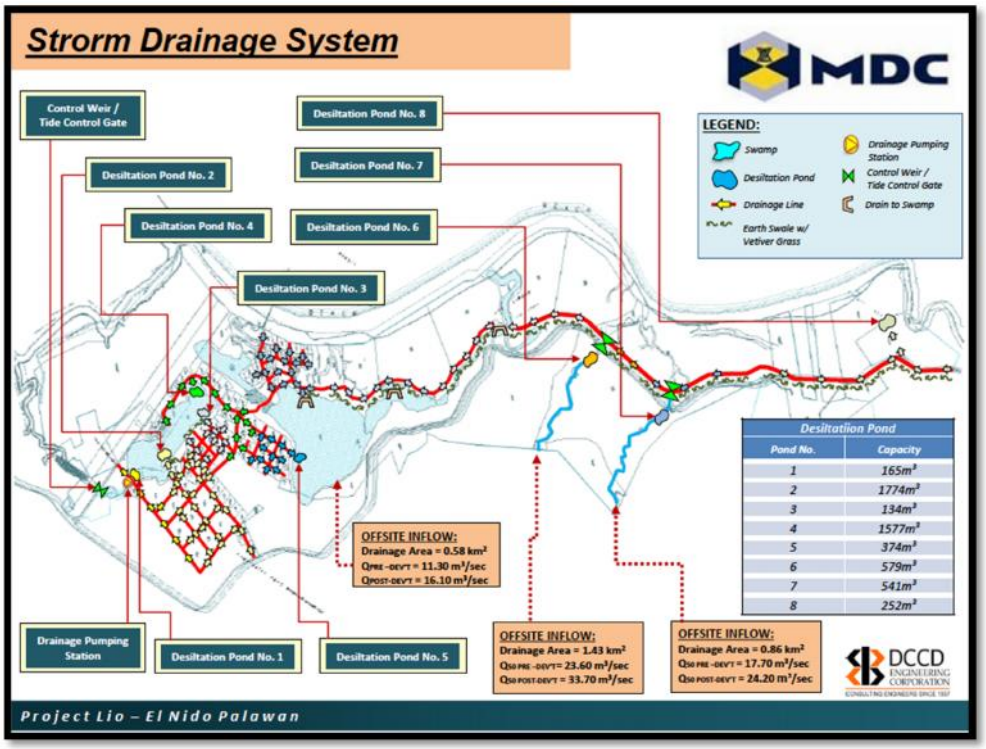


Figure 23. Storm drainage system.

2.7 PROJECT SIZE

The proposed Lio Tourism Estatedevelopment will be built on a total land area of 325 hectares. Phase 1 of the project, which was granted an ECC on February 2014, covers a land area of 24.8 hectares.

2.8 DEVELOPMENT PLAN, DESCRIPTION OF PROJECT PHASES AND CORRESPONDING TIMEFRAMES

2.8.1 Pre-Construction (planning, acquisition of rights to use land)

Activities during the pre-construction phase will include the following:

- Acquisition of necessary permits and endorsements such as the following:
  - Locational/zoning clearance
  - PAMB endorsement
  - El Nido council endorsement
  - Palawan Council endorsement
  - SEP clearance from the Palawan Council for Sustainable Development
  - ECC from the Department of Environment and Natural Resources
  - Building permit from the El Nido LGU
- Clearing of the construction area
- Excavation for building foundations

Development plans and construction drawings will also be prepared during this stage.

2.8.2 Construction Phase

The project shall be developed in phases subject to market conditions. Construction works will commence once pre-construction activities are completed. A general contractor and specialty contractors will undertake the construction works. Activities during this phase will involve the following:

- Civil works
- Installation of utilities (electrical, water distribution, sewerage system, storm drains, telecommunication lines)
- Interior and exterior finishing
- Landscaping

Civil works will include land clearing and site preparation and the construction of the various structures. A contractor chosen by Ten Knots will undertake the civil works. All construction materials will be sourced from within El Nido, if available. However, it is likely that most construction materials will be sourced from outside El Nido and will be brought to the site using a barge. Ten Knots will ensure that the contractor will undertake all civil works with minimum impact to the marine and terrestrial environment.

Landscaping materials will consist of indigenous and endemic planting materials. The use of exotic or imported plant species will be avoided in order to preserve the ecological integrity of the project site.

The construction phase will take about 18 to 24 months. This schedule will include the acquisition of permits and preliminary land development.

2.8.3 Operation Phase

Project operation will commence upon completion of Lio Tourism Estate.

The food requirement of the resort guests and staff will be sourced locally and from neighboring towns as well as from Metro Manila. Food processing for the proposed resort hotel as well as for the other Ten Knots resorts will be done at the F&B commissary that will be built as part of this project. Food wastes and trimmings will be disposed in the Ten Knots composting area while recyclable wastes will be stored in the Ten Knots material recovery facility. The residual wastes will be disposed in the municipal landfill.

Local service providers will provide services such as boat transfers, laundry, etc. Ten Knots will provide the utilities such as power and water supply as well as wastewater treatment and processing.

The resort will employ guest activity officers who will coordinate the recreational activities of the resort guests. The planned activities for hotel guests will include the following:

- Beachside (swimming and sun bathing) and pampering (spa) activities
- Eco-orientation and tours – hiking and trekking, bird watching
- Island hopping and water activities, e.g. snorkeling, diving and picnic lunches
- Non-motorized water activities, e.g. kayaking, surf paddling, hobbie cat sailing
- Team building outdoor activities
- Conference and seminars

2.8.4 Abandonment

Development of Lio Tourism Estatewill entail a high development cost. Thus, TKPI is expected to proceed with the project only when the necessary resources are in place. Once construction has

commenced, TKPI is expected to finish the development of the resort hotel and operate it once completed. However, should TKPI decide not to pursue the project at any time during project development, the site will be restored as much as possible to its pre-construction state. Any stockpile of construction material will be removed. Waste construction materials will be properly disposed in the municipal disposal site. Materials that can be recycled will be separated and will be sold to recyclers or used in other construction areas within El Nido.

2.9 MANPOWER

Lio Tourism Estate is expected to employ about 500 workers during the construction phase while 2,000 workers will be needed during the operation phase upon full build out. As much as possible, majority of workers for both project phases should come from the host barangay and municipality. Ten Knots may consider providing training programs for local residents to increase their competency for available jobs in Lio Tourism Estate.

	Construction Phase	Operation Phase	Abandonment Phase
Manpower requirement	500	2,000	
Expertise/skills needed	Proficient local workers	Hotel employees	
Nature and number of jobs available for:			
Men		About 70% of hotel employees will be sourced from El Nido and nearby towns	
Women			
IPs			
Preferred scheme for sourcing locally from host and neighboring LGUs and those from outside	TKPI will require the General Contractor to prioritize hiring or qualified local labor. Trainings will be provided to local residents to enable them to apply for jobs at the resort during project operation.		

2.10 INDICATIVE PROJECT INVESTMENT COST

The project is expected to cost around Php2 billion for land development, infrastructure and utilities. This does not include the cost of the development of locators and structures to be built within the Lio Tourism Estate.

3 ANALYSIS OF KEY ENVIRONMENTAL IMPACTS

3.1 LAND

3.1.1 Land Use and Classification

Lio Tourism Estate is located in the coastal area on the northern part of El Nido. The site is located in a relatively flat area that rises to steep slopes east of the municipal road. Elevation in the project site ranges from 0 to 80 m asl.

Several types of land uses were identified within the 325-hectare project site, including the following: (1) agricultural; (2) beach area; (3) brushland; (4) built up area; (5) coconut; (6) coconut with brushland; (7) grassland; (8) mangrove; (9) water body/marshland; (10) woodland; and (11) woodland mixed with brush land. Woodland mixed with brush land constitutes the largest land use within the project site while grassland constitutes the smallest land use. **Table 10** enumerates the land use distribution within the project site while **Figure 24** shows the land use map.

Table 10. Land Use Classification within the Lio Tourism Estate Project Site.

Land Use	Area (has)
Agricultural	11.21
Beach area	3.94
Brushland	33.63
Built up area	0.8
Coconut area	19.8
Coconut with brushland	7.7

Grassland	36.57
Marshland	0.39
Open/Grassland	0.22
Transportation/Utilities	6.34
Water body / marshland	2.56
Woodland	6.53
Woodland mixed with brushland	165.22

The coastal areas of the Municipality of El Nido including the project site is part of the El Nido – Taytay Managed Resource Protected Area (ENTMRPA), one of the eight priority protected areas of the National Integrated Protected Areas System (NIPAS) that was proclaimed by virtue of Presidential Proclamation No. 32 signed on 08 October 1998. The ENTMRPA occupies an area of 90,321 hectares consisting of 36,018 hectares terrestrial component and 54,303 hectares marine component. The highest peak within the protected area is in Cadlao Island at elevation 640m. The islands and the mainland within the protected area are dotted with tower karsts consisting of limestone.

The ENTMRPA encompasses 21 barangays, 18 of which are located within the municipality of El Nido and three located within the municipality of Taytay. The protected area is located on the northwestern side of mainland Palawan and includes the boundaries of the former marine reserve in Bacuit Bay. The Protected Area Management Board (PAMB) manages the ENTMRPA, and consists of members from the local government units (provincial, municipal and barangay), NGOs, relevant government agencies, IPs, women, POs and representatives of local businesses. The Palawan Council for Sustainable Development and the DENR jointly chair the PAMB.

The location of the El Nido – Taytay Managed Resource Protected Area in relation to the project site is presented in **Figure 25**.

Based on the municipal land use and zoning plan of El Nido, the project site is zoned for tourism.

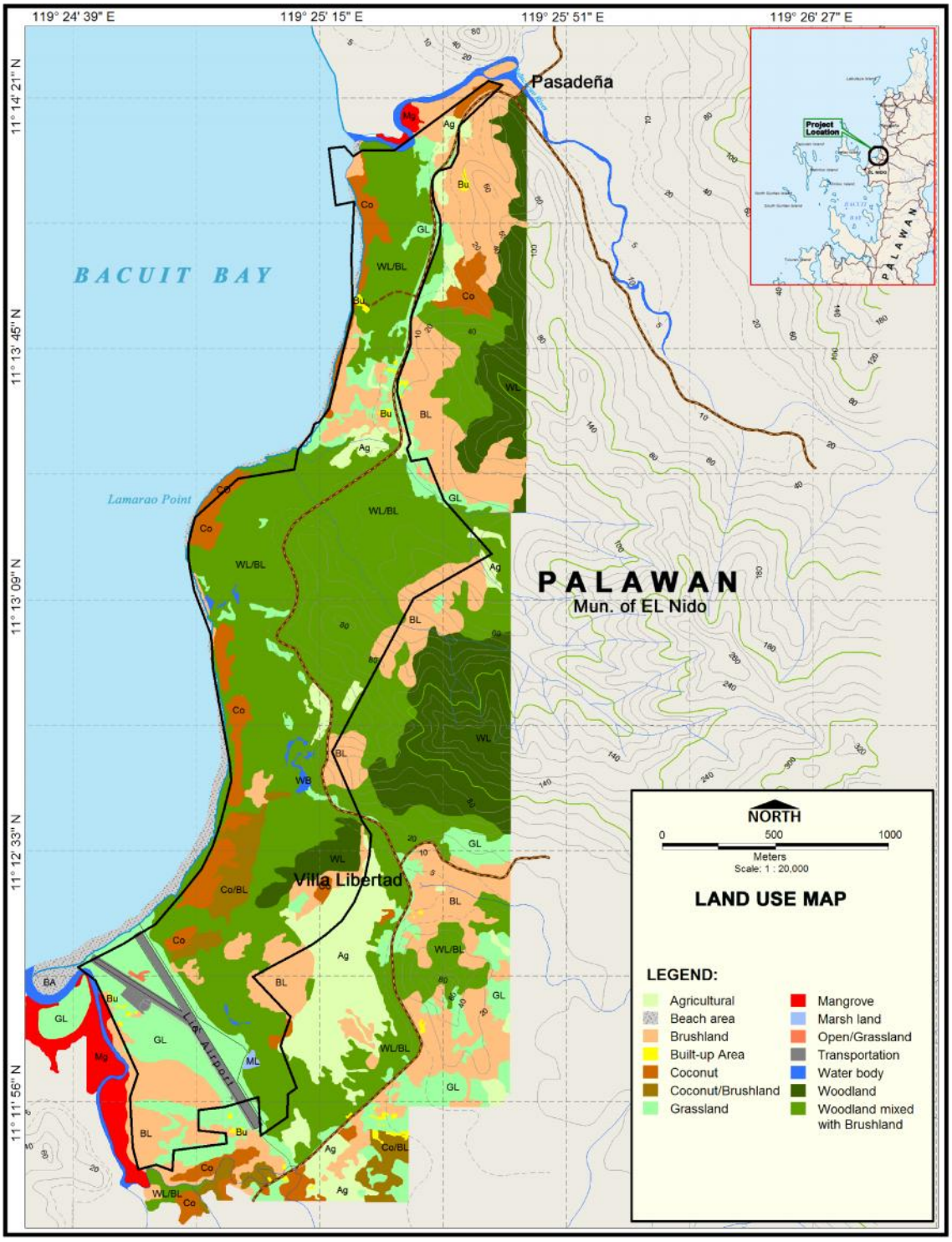


Figure 24. Land use map of the Lio Tourism Estate development area.

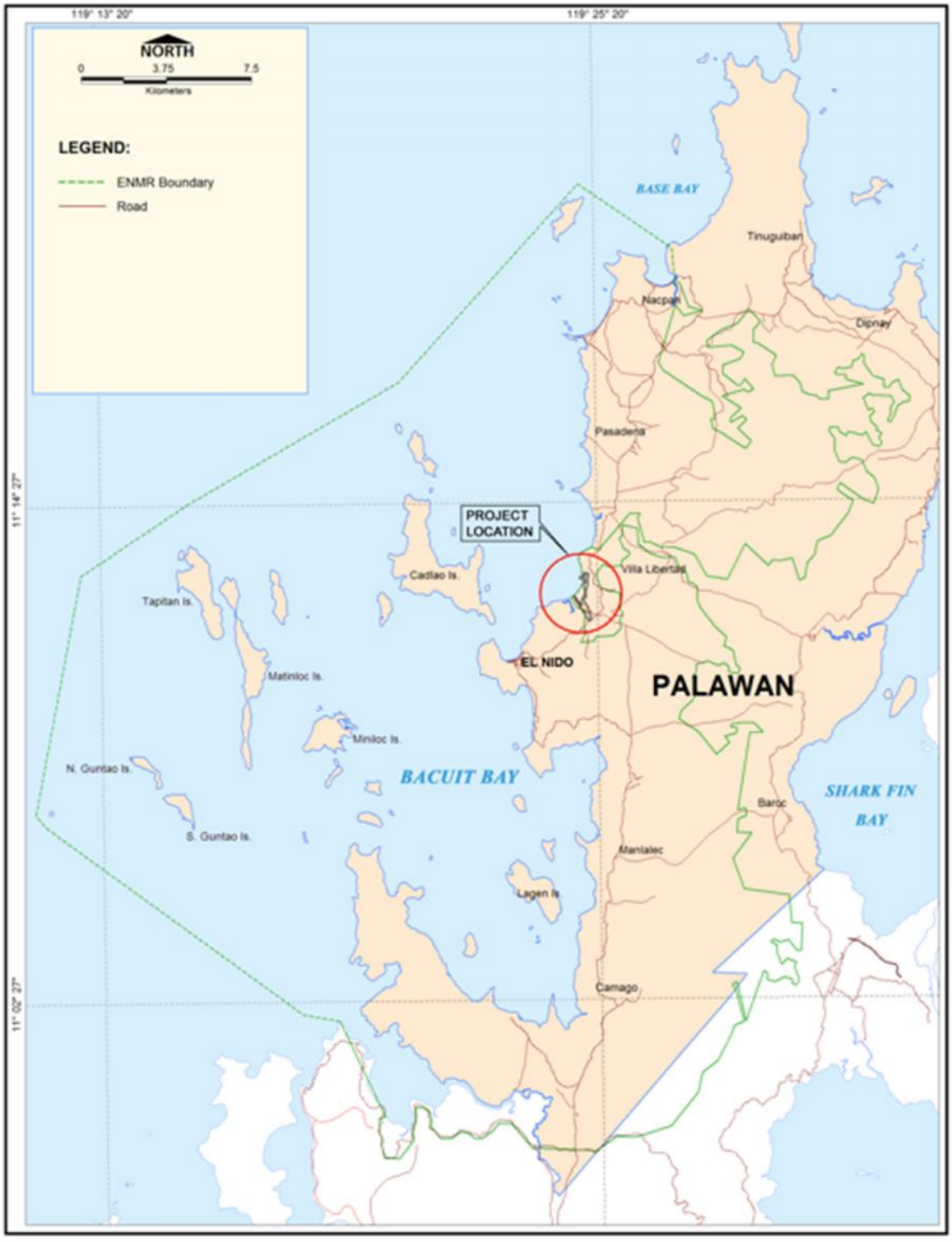


Figure 25. Location of El Nido-Taytay Managed Resource Protected Area with respect to location of Lio Tourism Estate.

Key Environmental Impacts

Inconsistencies/possible conflicts with existing land use/zoning and encroachment in ECAs

Tourism is one of the main industries in the Municipality of El Nido. The local government encourages eco-tourism, as long as it is done responsibly with natural resource conservation in mind. TKPI is among the pioneers in resort development in El Nido. It currently operates three island resorts in Bacuit Bay: Miniloc, Lagen and Pangulasian Island Resorts. TKPI is highly aware that tourism is dependent on the pristine beauty of El Nido's terrestrial and marine resources, thus it spearheads efforts to protect El Nido's fragile ecosystem.

With its track record in sustainable tourism, TKPI is in the best position to develop another eco-tourist resort in mainland El Nido. The proposed construction of Lio Tourism Estate in mainland El Nido is consistent with the municipality's thrust in tourism development. TKPI is expected to develop Lio Tourism Estate with conservation of natural resources in mind. TKPI has developed expertise in environmental stewardship and community engagement.

Projected change as a result of project implementation

Although TKPI is committed to maintain the natural environment as much as possible, project development is expected to alter land uses in the area. About 50% of the 325-ha project site will be allotted for built up areas with the rest of the land being retained as nature preserve areas and open space. The construction of Lio Tourism Estate is expected to bring impetus to land development in this side of El Nido.

The project will also result to an increase in land values in this part of El Nido.

3.1.2 Geology and Geomorphology

Lio Tourism Estate is located in Barangays Villa Libertad and Pasadeña in El Nido, Palawan. El Nido is bordered to the north by Linapacan Strait, to the east by Sulu Sea, and to the west by the Philippine Sea. The geologic features and geologic and natural hazards that may be present in the areaare discussed in the succeeding sections. Results of the geotechnical investigations were also incorporated in the report.

3.1.2.1 Topography

The project site is located in a generally wide and gently sloping beach area with coastal flats,headlands, rocky cliffs and massive limestone caverns. The terrain at the project site is flat on the western and southern sections with elevation ranging from 0 to 5m asl. Elevation rises to 10m asl near the municipal road. The terrain becomes sloping to moderately rugged to the east-northeast with elevation ranging from 20 to 80m asl. The major drainage systems on this side of El Nido include several intermittent creeks and two major rivers: Bulacacao River to the north and Lio River to the south. Both rivers drain to the west towards Bacuit Bay.

3.1.2.2 General Geology and Tectonic Setting

Three converging tectonic plates bound the Philippine archipelago, namely: the Eurasian Plate, Philippine Sea Plate and Indo-Australian Plate. The east-dipping Manila and Negros-Cotabato Trench systems bound the western side of the archipelago while the west-dipping Philippine Trench and East Luzon Trough structures form the eastern boundary. Active seismic movement along the Philippine Fault is a manifestation of the ongoing convergence of the three tectonic plates.The Philippine Fault is a left lateral strike slip fault originating in northwest Luzon and ends in southeast Mindanao. **Figure 26** shows the location of these tectonic structures.

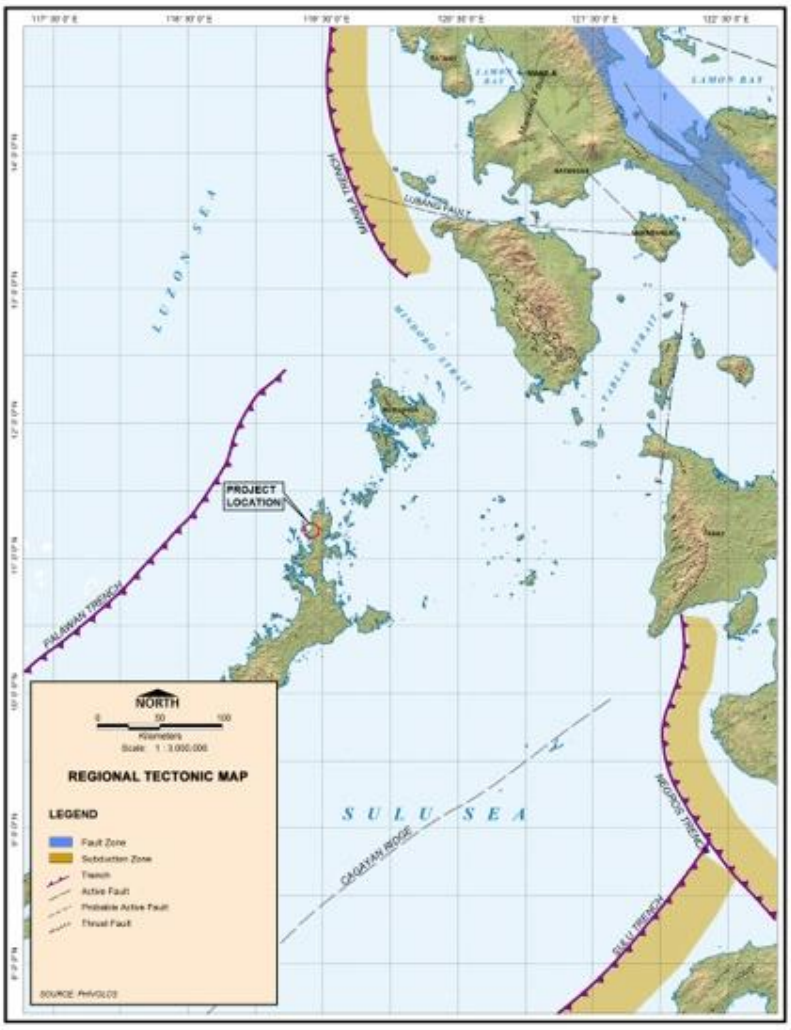


Figure 26. Tectonic Map of Northern Palawan and Vicinity.

The Philippines is subdivided into the mobile belt and the aseismic region. The mobile belt includes most of the archipelago from Tawi-tawi to Batanes and experiences periodic seismic movements or earthquakes. The aseismic region is relatively free of earthquakes and includes Palawan and its group of smaller islands.

Geologically, Palawan is further subdivided into the North Palawan Block and South Palawan Block (**Figure 27**) based on the noticeable structural and stratigraphic contrast between the two. North Palawan Block is considered as continental because its rocks show affinity with the crust of the Eurasian Plate. Apparently, the crust of northern Palawan drifted apart from the Eurasian continent during the opening of South China Sea about 45 million years ago. The oldest rocks in the Philippines are found in northeast Palawan and are dated as Permian to Carboniferous age. In contrast, an ophiolitic suite characterizes the South Palawan Block – these are oceanic materials that have been overthrust onto the continental crust. The boundary between the two terranes is found around Ulugan Bay in the central portion of Palawan, where outcrops on one side show the continental-derived materials while on the other side the ophiolitic sequence can be seen. To the east of Ulugan Bay, in the Dalrymple Point area, are exposed units of Palawan Ophiolite overthrusted onto the continental-derived units. The large fault that separates the two crustal blocks is known as the Sabang Thrust.

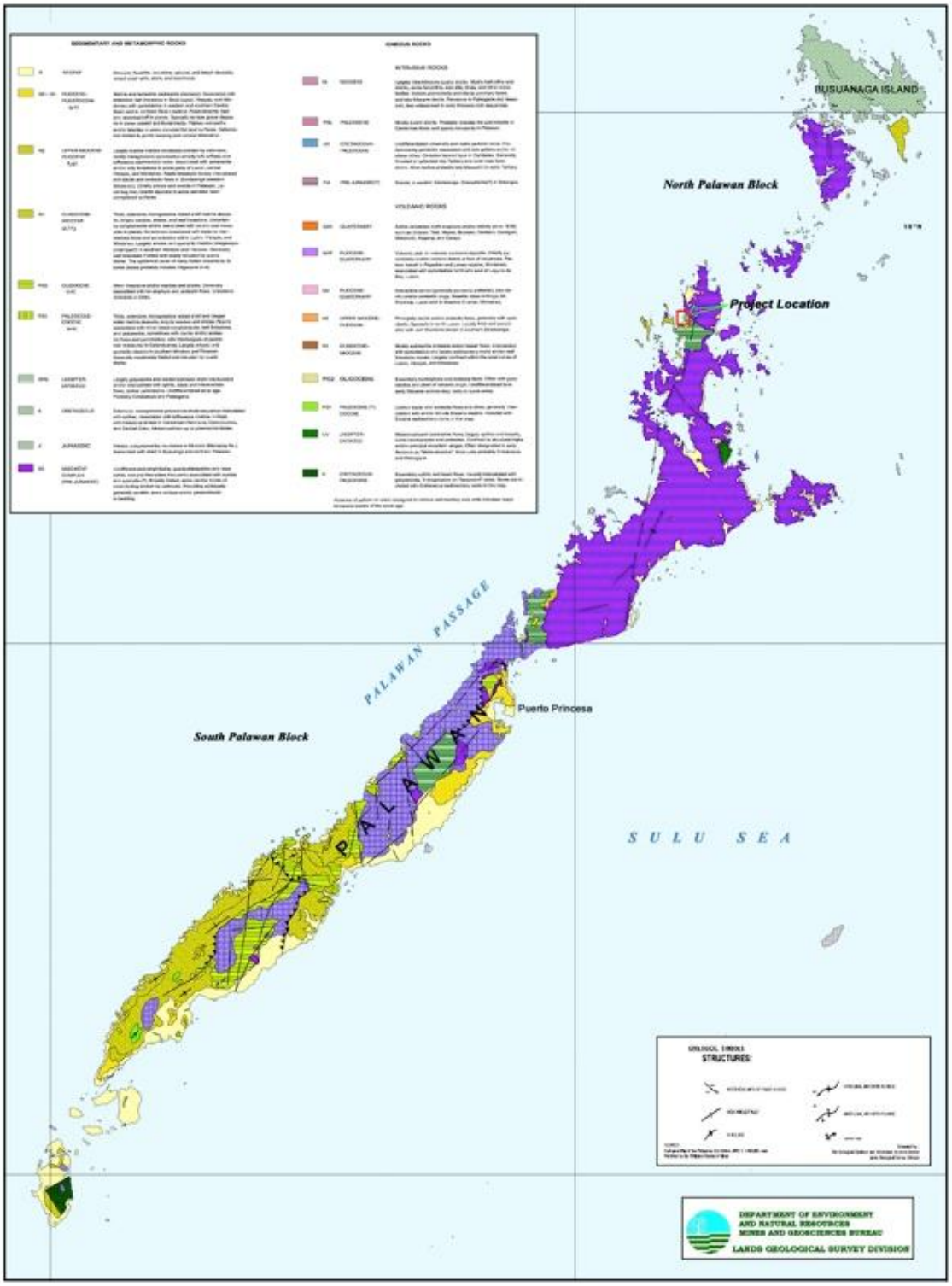


Figure 27. Map showing the geology of Palawan and the general location of Lio Property. Modified from DENR-MGB.

3.1.2.3 Stratigraphy of Northern Palawan

Figure 28 is a stratigraphic column of northern Palawan based on the published reports of Peña (2008) and MGB (1982). It shows the various rock units found in northern Palawan and their estimated ages. These rock units are briefly described below.

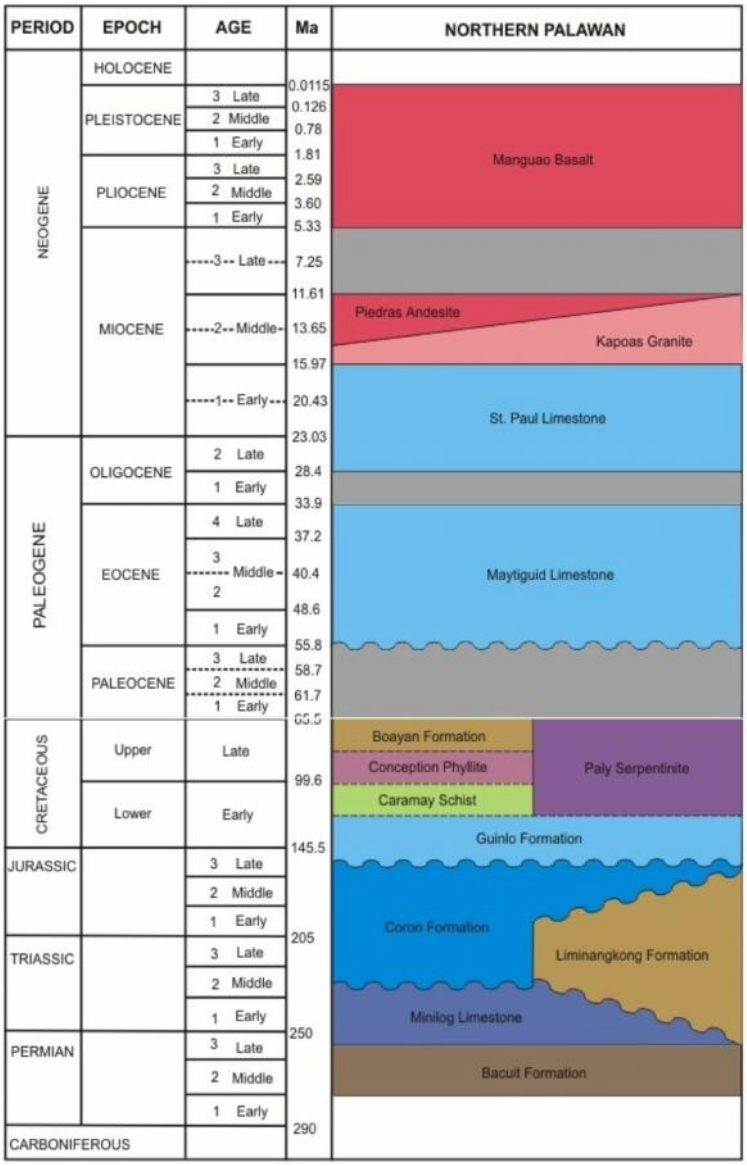


Figure 28. Stratigraphic Column of Northern Palawan.

Malampaya Sound Group

The Paleozoic Bacuit Formation and Minilog Formation and the overlying Mesozoic and Liminangcong and Guinlo Formations are collectively called the Malampaya Sound Group. Hashimoto and Sato (1973) named these formations for units partly exposed in northernmost Palawan, the Linapacan and Calamian Island groups.

The Bacuit Formation refers to the series of chert, shale, sandstones, conglomerates and limestone found in the northern coasts of Palawan. The Bacuit of present usage is confined to the brecciated sandstone, limestone, chert, altered tuff, calcareous sandstone and contorted alternation of

sandstone and slate exposed in Manmegmeg Bay. It is considered as the basal part of the Malampaya Sound Group and was assigned a Middle Permian age.

The Minilog Limestone is a fusulinid-bearing recrystallized limestone. The limestone is micritic, massive, partly bedded, dense, white to gray or black, partly recrystallized and oolitic. Hashimoto and Sato (1973) gave this formation Middle to Late Permian age.

The Liminangcong Formation overlies the Minilog with yet uncertain relationship. It consists of complexly folded and faulted hematite-bearing chert intercalated with black slate and reddish, bedded tuff. It is assigned a Late Permian to Late Jurassic age.

Overlying the Liminangcong is the Coron Formation, which consists dominantly of limestone with local interbeds of sandstone and shale. In places, carbonaceous clastic rocks are found within this unit.

The Guinlo Formation refers to clastic rocks exposed at Guinlo Point in the northwestern coast of Malampaya Sound. It is composed of weakly metamorphosed massive, coarse-grained sandstone. A Late Jurassic to Early Cretaceous age was given to this unit on the basis of its stratigraphic position.

Barton Group

Northern Palawan and its neighboring islands are predominantly made up of Upper Paleozoic to Lower Mezosoic rocks and their metamorphic equivalent. The Barton Group is considered as the oldest formation that is exposed in northern Palawan. The group mainly consists of a thick sequence of schists, phyllites, slates, graywackes, sandstones and shale with thin limestone lenses. The group is subdivided into Caramay Schist, Concepcion Phyllite and the Cretaceous Boayan Formation.

The Caramay Schist is stratigraphically located at the lowermost of the formation. It is composed of muscovite schist, graphite schist and quartzite. The Conception Phyllite is composed of phyllite, polymictic semi-schist, gray to pale brown slate and quartzite between phyllite layers. The Boayan Formation is a sequence of sandstone and mudstones and overlies the Conception Phyllite.

Maytiguid Limestone

The Maytiguid Limestone unconformably rests over the Liminangcong Formation. It is composed predominantly of light to dark gray limestone inter-bedded locally with carbonaceous shale.

St. Paul Limestone

The St. Paul Limestone was originally termed by De Villa (1941) for the massive, dark gray and finely crystalline limestone that is exposed along the shore of Saint Paul Bay in northern Palawan. It also crops out at Ulugan Bay and near Tugbuan in the Babuyan map quadrangle. Fine-grained claystone and mudstone flanking the limestone pinnacles are also believed to be coeval to the limestone. Hashimoto and Sato (1973) considered this limestone unit to unconformably overlie rocks ranging in age from Early Cretaceous to Late Eocene.

The St. Paul Limestone is assigned a Late Oligocene to Early Miocene age based on stratigraphic position and paleontological age determinations (Hashimoto and Sato, 1973).

Kapoas Granite

The Kapoas Granite was introduced by de Villa (1941) referring to exposed granitic intrusive rocks in Mt. Kapoas located south of the Malampaya Sound. Two varieties have been distinguished: clear normal biotite granite and a variety with dark patches or schlieren. Both dominantly contain pale grey, finely granular, interlocking, and occasionally staniferous quartz. Other granitic intrusions that are associated with the Kapoas Granite include quartz monzonite, granodiorite and

quartz diorite. Different ages have been assigned – Early Eocene by De Villa, Late Jurassic by BMG, Early Oligocene by UNDP, and Late Eocene to Early Oligocene by MMAJ-JICA.

Piedras Andesite

This unit outcrops at Piedras Point and intrudes the surrounding ultramafic rocks. It is made up of dense hornblende andesite containing some quartz. It is probably Middle Miocene in age.

Manguao Basalt

Reyes (1971) originally named this formation as Manguao Volcanics. It is composed of basalt lava flows that crops out around Lake Manguao in Taytay, northern Palawan. The basalt is fine-grained, granular in texture partly vesicular with some vitric components. The phenocrysts are dominantly olivine and occur in association with intergranular pyroxenes. The Manguao is well exposed along stream valleys and in topographically low areas. A probable Pleistocene age was assigned to the unit.

3.1.2.4 Local Geology

Five formations are identified in the vicinity of Bacuit (El Nido) municipality, namely: Bacuit Formation, Minilog Formation, Coron Formation, Kapoas Granodiorite, and Quaternary Alluvium.

The Bacuit Formation is composed of deep marine sedimentary units such as chert, shales and sandstones, and shallow marine units such as conglomerates and limestones. These rocks cover a large part of the El Nido area, including the hills and ridges surrounding the project site. The Minilog Formation is the micritic but massive limestone occurring as isolated hills and peaks of possible Permian age. The outcrop of this unit is found on the point that extrudes to the sea southwest of the project site. The Coron Formation is another limestone unit but has local interbeds of sandstone and shale. It occurs in small peaks and ridges in the hills to the east of the area. The Kapoas Granite occurs as the large high peaks found in the northeast of Minilog, composed of granitic and granodioritic intrusives underlying Mt. Kapoas.

Among these rocks, two formations (Bacuit and Quaternay Alluvium) are observed within the Lio Property. The Quaternary Alluvium consists of unconsolidated sand and silt beach deposits and fluvial sediments derived from the rivers traversing the property of Lio. The thickness of the soil horizon varies from 12 to 16m as shown in the borehole data. Below the Quaternary Alluvium is the Bacuit Formation largely found further south and in the eastern sections of the Lio project site. The Bacuit Formation underlies the rugged and mountainous portions in the vicinity of Bacuit. **Figure 29** shows the geologic map of the Lio property and its vicinity.

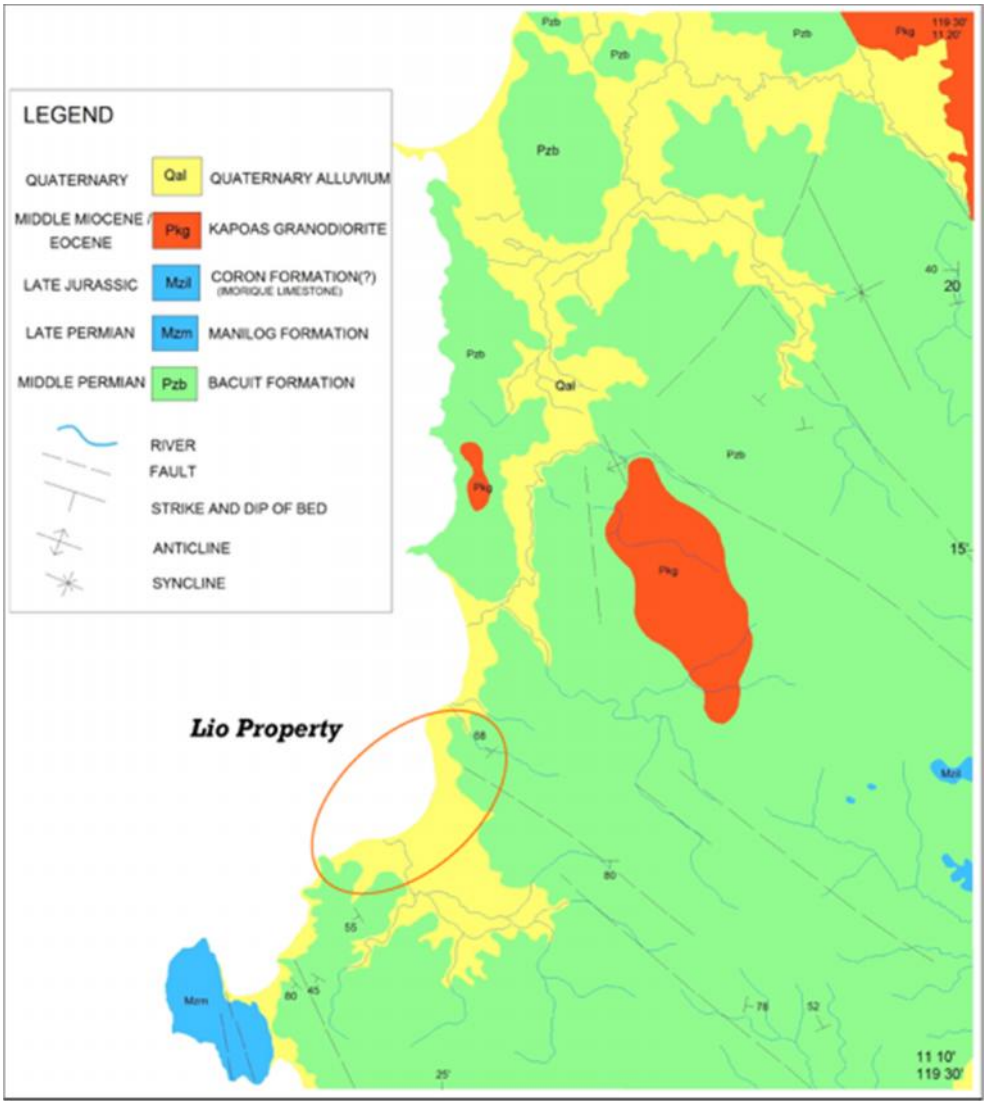


Figure 29. Geologic Map of the Lio Project Site.

3.1.2.5 Structures

The geologic structures found near northern Palawan include the Manila Trench on the north and the Negros Trench on the east. The southern trace of Manila Trench borders the northwest Mindoro shores and appears to merge with the NW-trending thrust faults on central Mindoro. To its southern shores, the thrust faults of Mindoro appear to merge with the northern end of the Negros Trench. Thus, from a viewpoint of tectonic boundary, northern Palawan is bordered by the Manila Trench and the Negros Trench and by the thrust faults of Mindoro, which links these two tectonic structures. This border separates Palawan from Luzon and the Visayas, and serves as the border between the seismically active mobile belt, and the seismically quiet landmass of Palawan.

A few faults have been mapped in the periphery of the project area. These are the NW-trending faults that are prominent on the Bacuit Formation, but have not been traced into the project site. These faults appear to be old and inactive, and are apparently part of the structures that have formed during the shifting and collision of Palawan into Mindoro, and thus may represent the old deformational structures of the island.

Because of the absence of any active seismicity or any evidence of Pleistocene and later faulting, no active faults have been identified in Palawan (c.f., map of active faults by PHIVOLCS, 2000). On a regional scale, three faults have been interpreted in the northern portion of Palawan based on the terrain. One is a north-south fault that branches to another southwest trending fault with trace that appears to terminate to the southern flank of an anticline. The fold of axis of the anticline is trending towards the northeast-southwest direction.

3.1.2.6 Key Potential Impacts and Mitigations

The project development will not result to changes in surface physiography and geomorphology nor will induce any geologic hazards. The only impact seen is earth excavation materials during construction of access roads and building structures, which will be only temporary. In general, the existing situation will be monitored and proper slope protection and drainage system will be installed and maintained.

Expected geological and geomorphological impacts due to development

Changes in coastal landform

The coastal terrain at the site is developed from river action, the wave, tidal and current action, and coral growth. River and shoreline processes transported and deposited the loose sand and earth materials that are found in the flat area where the development is proposed. Wave action and currents winnow back and forth and redistribute the sediments near the shore to deeper portions of the sea. Likewise, the longshore currents move these sediments to other coves along the shore.

Underwater, corals form in areas where the rocks crop out or where the current and wave action is low. The corals generate limestone and calcareous debris that form reefs and biohermal coral growths. When these are uplifted, these corals and reefs form the limestone units that we now observe as prominent hills and steep slopes. Coral and reef formation is one of the most prominent geological processes that have contributed to the geological formation of the land under Palawan.

In the hills surrounding the project site are the old rocks, which have survived the long history of uplift, deformation, erosion and other geological processes. These rocks now serve as the source of the eroded soil and rock materials, which we now see as sediments in the coastal areas.

The proposed development is mostly on the flat terrain near the beach. Wave action is most prominent in the shore where sediments are constantly in motion. Likewise, near the streams and creeks, constant sediment movement occurs particularly during heavy rainfall. The flat area where development of residential and commercial facilities is likely, no dynamic geological process is expected. The most noticeable change that is to be anticipated is the excavation for the roads/access routes, the buildings and possible recreational facilities that may be constructed.

The excavation of earth materials is therefore the most significant source of impact that is expected at the site. The effect of excavation is temporary, however, and will cease within a few months or a year after the development activities have been completed. This assessment assumes that slope protection measures and proper drainage systems are installed and maintained.

Land Subsidence

In the limestone areas, karst terrain is expected to be present. However, since the limestone is found outside of the proposed development zone, no caves or karst ground is expected in the proposed project site.

Excavation and construction near beaches and streams should take into consideration the vulnerability of loose sediments to adjust by slumping and piping. The process is most pronounced in the water-saturated loose sediments near the shore and riverbanks.

Inducement of subsidence and landslides & other geo-hazards

Landslides are to be expected in steep areas, particularly during heavy rainfall. The project area is not prone to any landslides because of its low relief. Near the river or in sites where erosion or excavation may create over-steepening of the slope, landslide may occur. Other landslide may also result from the undercutting of slopes as a result of road development, excavation, or even stream erosion.

Tsunami

The western coast of the Philippines is exposed to tsunami that may originate from the South China Sea. There has been several instances that tsunami was created in the western coast of Luzon due to earthquakes generated by the Manila Trench. Historically, however, there has been no report of tsunami on the western coast of Palawan. There are no active tectonic plate boundaries, or faulting on the southern portions of the South China Sea that may cause tsunami. Likewise, the tsunami reports on the western coast of Luzon has all occurred in the northern portions of the Manila Trench, rather nearer to the area of Taiwan, and thus may not pose any significant threat of producing any tsunami at northwest Palawan.

Storm Surge

Storm surge may occur during typhoons and monsoon weather disturbances bringing waves into the shore with massive force and frequency. While some parts of the country were greatly affected by extreme storm surges during the passage of Typhoon "Yolanda", storm surge was not reported in El Nido.To protect the site against storm surge, permanent structures shall follow the prescribed easements from the shore and waterways of 20 meter to 40 meters from the highest tide line and behind the tree lines.

3.1.3 Pedology

Palawan soils are generally classified into three major groups: (1) lowland soils, which are usually alluvial, (2) upland soils and (3) beach sand. Both the lowland soils and beach sand occur in the project site and vicinity. Lowland soils are normally encountered near the rivers and creeks and in the inland portions of the project site while beach sand is encountered in the coastal areas.

Based on the geotechnical investigation conducted at the project site, sub-surface materials include poorly graded sand, silty sand, silty gravel, clayey silt, gravel and sandy silt. Coral fragments were also found in some boreholes. Description of these sub-surface materials is provided below.

Subsurface material	Description
Poorly graded sand	Brown, poorly graded sand, sometimes with silt and/or shell fragments, non plastic
Silty sand	Brown silty sand with coral fragments, non-plastic
Sandy silt	Reddish brown to gray sandy silt with shell fragments and hard, low plasticity
Clayey silt	Reddish brown clayey silt, sometimes with gravel and with medium plasticity
Silty gravel	Gray silty gravel with sand and corals, very loose, non-plastic
Gravel	Brown gravel with sand

<u>Key Potential Impacts on Soils in the Project Site</u>

The project is not expected to have an impact on soil quality and fertility as well as on erodibility potential and bank stability. Increased susceptibility to erosion may be experienced during the

construction period. However, the contractor is expected to provide sedimentation and siltation ponds to minimize the discharge of silted runoff into Bacuit Bay.

During the operation phase, siltation ponds will also be strategically constructed within the project site to prevent silted runoff from reaching the beach.

3.1.4 Terrestrial Biology

3.1.4.1 Terrestrial Flora

The transect walk method employed during the 25ha EIA in early 2012 was used in this study to characterize the terrestrial floral component of the 300ha project site. Meter tape, Global Positioning System (GPS) and Record Sheet were used to perform the survey activity. The access road and the passable trails in the site were used as route of the survey.

At the survey route, the types of vegetation were identified (**Plate 1**). Similarly, the components bordering the left and right portion of the survey route were systematically recorded and identified to species level (**Plate 1**).

Plate 1. Species identification along the survey route *(left)* and example of an existing trail in the project site (right).

At the same time, Sampling Plot method was also utilized and randomly distributed in the study site in order to determine the abundance/density and frequency of the plant species. A total of 50 10m x 10m plots were undertaken to represent the total area of the study site. Coordinates of every sample plots were also recorded.

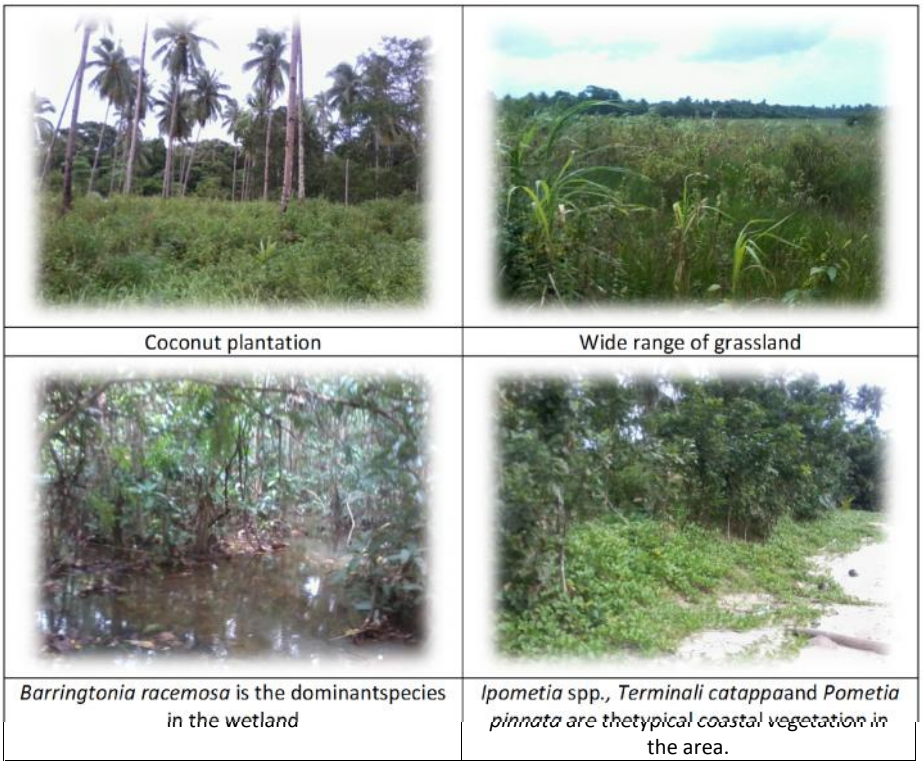
Abundance and density measurements were likewise undertaken and the methods and discussion are presented in the subsection below.

The objective of this flora assessment was to form a species checklist from the collected data indicating the common name, family name, life forms, importance and conservation status of the species. The IUCN Red List (DAO 2007-01) was used to determine the conservation status of the plant species in the area. Photographs of some species and vegetation type were taken as documentation to the narrative report.

Results and Discussion

The transect walk method commenced from the northern boundary of the property via the access road to the beach area, then progressively proceeded south through the beach passing through the coconut and kasoy plantation, then through the coconut plantation and woodland to the beach area, then through the beach to wetland and passing through the Mangium and Kasoy plantation, woodland and grassland up to the access road adjacent to the LIO Airport which is the

southern boundary of the study site (**Figure 30).** The representative floral types observed in the project area are presented in **Plate 2**.



Coconut plantation	Wide range of grassland
Barringtonia racemosa is the dominantspecies in the wetland	*Ipometia* spp., *Terminali catappa*and *Pometia pinnata* are thetypical coastal vegetation in the area.

Plate 2. Representative floral types observed in the project site.

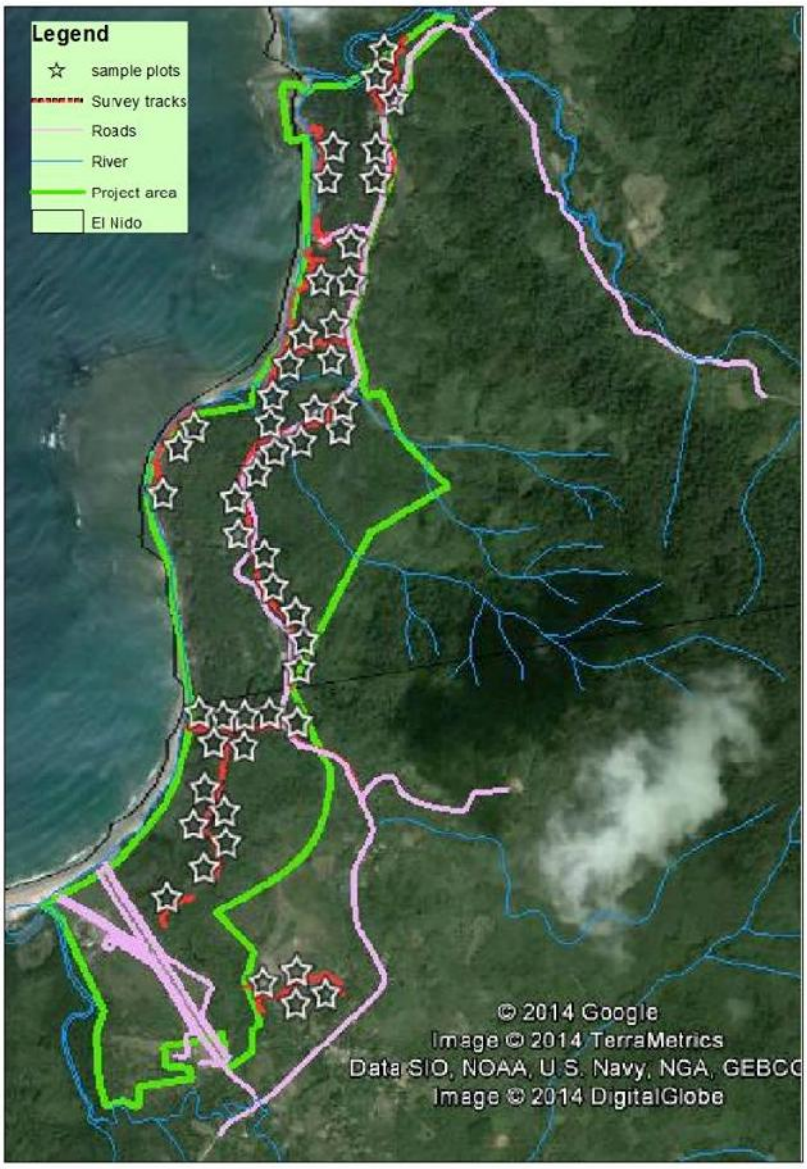


Figure 30. Location of terrestrial flora survey tracks and sample plots.

Composition and Diversity. A total of 133 species under 115 genera belonging to 46 families were recorded. Family Fabaceae is most represented with 24 species, followed by Moraceae with eight species, Malvaceae with seven species, and Euphorbiaceae and Poaceae with six species each (**Table 11**). The rest of the families are represented by one to five species each. Of the total number of plant species recorded, two are considered threatened as listed in the Red List of Threatened Plants as shown in **Table 15**. The two threatened species are both economically important trees, which have declined in natural population due to their sought-after premium wood quality.

Table 11. List of plant species recorded in the study site

Family	Species	Common Name	Life Form	Importance	CS[1]
Amaryllidaceae	*Crinum asiaticum*	Beach lily	Herb	Biomass	NT
Anacardiaceae	*Anacardium occidentale*	Kasoy	Tree	Fruit	NT
Anacardiaceae	*Buchanania arborescens*	Balinghasai	Tree	Ecological	NT
Anacardiaceae	*Dracontomelon edule*	Lamio	Tree	Ecological	NT
Anacardiaceae	*Mangifera indica*	Mangga	Tree	Fruit	NT
Anacardiaceae	*Semecarpus cuneiformis*	Ligas	Tree	Ecological	NT
Annonaceae	*Cananga odorata*	Ilang-ilang	Tree	Ecological	NT
Apocynaceae	*Alstonia macrophylla*	Batino	Tree	Ecological	NT
Apocynaceae	*Cerbera manghas*	Cerbera	Tree	Ecological	NT
Apocynaceae	*Ervatamia pandacaqui*	Pandakaki	Shrub	Ecological	NT
Apocynaceae	*Plumeria acuninata*	Kalachuchi	Tree	Ornamental	NT
Apocynaceae	*Wrightia pubescens*	Lanete	Tree	Ecological	NT
Araceae	*Alocassia macrorhizza*	Biga	Herb	Ecological	NT
Araceae	*Philodendron spp.*	Philodendron	Vine	Ecological	NT
Araliaceae	*Polyscias nudosa*	Malapapaya	Tree	Matchstick	NT
Arecaceae	*Calamus spp. 1*	Calamus	Palm	Biomass	NT
Arecaceae	*Calamus spp. 2*	Calamus	Palm	Cane	NT
Arecaceae	*Caryota cumingii*	Pugahan	Palm	Biomass	NT
Arecaceae	*Cocos nucifera*	Niog	Palm	Wood/Fruit	NT
Asteraceae	*Chromolaena odorata*	Hagonay	Shrub	Ecological	NT
Asteraceae	*Mikania cordata*	Uoko	Vine	Ecological	NT
Asteraceae	*Wedelia biflora*	Hagonoy dagat	Shrub	Ecological	NT
Burseraceae	*Canarium asperum*	Pagsahingin	Tree	Ecological	NT
Celtidaceae	*Trema orientalis*	Anabiong	Tree	Ecological	NT
Clusiaceae	*Callophyllum inophyllum*	Bitaog	Tree	Ecological	NT
Clusiaceae	*Cratoxylum cochinchinense*	Muogon	Tree	Ecological	NT
Clusiaceae	*Cratoxylum sumatranum*	Kansilay	Tree	Ecological	NT
Clusiaceae	*Garcinia rubra*	Kamandiis	Shrub	Ecological	NT
Combretaceae	*Terminali catappa*	Talisay	Tree	Landscape	NT
Convolvulaceae	*Ipomea aquautica*	Kangkong	Creeper	Ecological	NT
Convolvulaceae	*Ipomea pes caprae*	Lambayong	Creeper	Ecological	NT
Costaceae	*Costus specious*	Tubang usa	Herb	Ecological	NT
Crassulaceae	*Kalanchoe pinnata*	Kataka-taka	Herb	Ornamental	NT
Cyperaceae	*Cyperus spp.*	Cyperus	Herb	Ecological	NT
Dilleniaceae	*Dillenia monantha*	Dillenia	Tree	Ecological	NT
Dilleniaceae	*Tetracera scandens*	Katmon baging	Vine	Ecological	NT
Ebenaceae	*Diospyrus maritima*	Malatinta	Tree	Ecological	NT
Ebenaceae	*Diospyrus myrmecocalyx*	Anang gulod	Tree	Ecological	NT
Ebenaceae	*Diospyrus pilosanthera*	Bolon-eta	Tree	Ecological	NT
Euphorbiaceae	*Breynia spp.*	Breynia	Shrub	Ecological	NT
Euphorbiaceae	*Glochodin sp.*	Glochodin	Tree	Ecological	NT
Euphorbiaceae	*Jathropa curcas*	Tubang bakod	Shrub	Oil	NT
Euphorbiaceae	*Macaranga tanarius*	Binunga	Tree	Ecological	NT
Euphorbiaceae	*Mallotus ricinoides*	Hinlaumo	Tree	Ecological	NT
Euphorbiaceae	*Melanolepis multiglandulosa*	Alim	Tree	Ecological	NT
Fabaceae	*Acacia mangium*	Mangium	Tree	Wood	NT
Fabaceae	*Albizzia falcataria*	Falcata	Tree	Wood	NT
Fabaceae	*Albizzia lebbeck*	Langil	Tree	Ecological	NT
Fabaceae	*Bauhinia spp.*	Bauhinia vine	Vine	Ecological	NT

[1] Conservation status based on IUCN Red List and DAO 2007-01: NT = Not threatened; VU = vulnerable; EN = endangered

Family	Species	Common Name	Life Form	Importance	CS[1]
Fabaceae	*Caesalpinia pulcherrima*	Caballero	Shrub	Ecological	NT
Fabaceae	*Callopogonium sp.*	Callopogonium	Vine	Ecological	NT
Fabaceae	*Cassia alata*	Acapulco	Shrub	Medicinal	NT
Fabaceae	*Cassia fistula*	Golden shower	Tree	Ecological	NT
Fabaceae	*Cassia fruticosa*	Antsoan	Tree	Ecological	NT
Fabaceae	*Cassia tora*	Balatong aso	Shrub	Ecological	NT
Fabaceae	*Centrosema pubescens*	Centro	Vine	Ecological	NT
Fabaceae	*Delonix regia*	Fire tree	Tree	Ecological	NT
Fabaceae	*Desmodium umbellatum*	Malapigas	Tree	Ecological	NT
Fabaceae	*Erythrina orientalis*	Dapdap	Tree	Ecological	NT
Fabaceae	***Instia bijuga***	**Ipil**	**Tree**	**Wood**	**EN**
Fabaceae	*Leucaena leucocephala*	Ipil-ipil	Tree	Biomass	NT
Fabaceae	*Mimosa pudica*	Makahiya	Herb	Ecological	NT
Fabaceae	*Moghania strobilefera*	Payang-payang	Shrub	Ecological	NT
Fabaceae	*Mussaenda philippica*	Kahoy dalaga	Shrub	Ecological	NT
Fabaceae	*Peltophorum pentandrum*	Siar	Tree	Ecological	NT
Fabaceae	*Pongamia pinnata*	Bani	Tree	Ecological	NT
Fabaceae	*Pterocarpus indicus*	Narra	Tree	Wood	NT
Fabaceae	*Samanea saman*	Rain tree	Tree	Wood	NT
Fabaceae	*Tamarindus indica*	Sampaloc	Tree	Fruit	NT
Flagellariaceae	*Flagellaria indica*	Baling uai	Liana	Ecological	NT
Lauraceae	*Litsea sebifera*	Sablot	Tree	Ecological	NT
Lauraceae	*Persia gratissima*	Avocado	Tree	Fruit	NT
Lecythidaceae	*Barringtonia asiatica*	Botong	Tree	Ecological	NT
Lecythidaceae	*Barringtonia racemosa*	Putat	Tree	Ecological	NT
Lythraceae	*Lagerstroemia speciosa*	Banaba	Tree	Medicinal	NT
Malvaceae	*Ceiba pentanda*	American Kapok	Tree	Ecological	NT
Malvaceae	*Hibiscus tiliaceus*	Malubago	Tree	Ecological	NT
Malvaceae	*Kleinhovia hospita*	Tan-ag	Tree	Ecological	NT
Malvaceae	*Pterospermum diversifolium*	Bayok	Tree	Ecological	NT
Malvaceae	*Thespesia populnea*	Banalo	Tree	Ecological	NT
Malvaceae	*Triumfera rhomboidea*	Kulot-kulutan	Shrub	Ecological	NT
Malvaceae	*Urena lobata*	Mangkit	Shrub	Ecological	NT
Melastomaceae	*Melastoma malabathricum*	Malatungaw	Shrub	Ecological	NT
Melastomaceae	*Memecylon spp.*	Memecylon	Tree	Ecological	NT
Meliaceae	*Azadirachta indica*	Neem tree	Tree	Biomass	NT
Meliaceae	*Sandoricum koetjape*	Santol	Tree	Fruit	NT
Meliaceae	*Sweitenia macrophylla*	Mahogany	Tree	Wood	NT
Moraceae	***Artocarous blancoi***	***Antipolo***	***Tree***	***Wood***	***VU***
Moraceae	*Artocarpus altilis*	Kamansi	Tree	Fruit	NT
Moraceae	*Artocarpus heterophyllus*	Nangka	Tree	Fruit	NT
Moraceae	*Artocarpus odoratissimu*	Marang banguhan	Tree	Fruit	NT
Moraceae	*Ficus balete*	Balete	Tree	Ecological	NT
Moraceae	*Ficus benjamina*	Salisi	Tree	Ornamental	NT
Moraceae	*Ficus nota*	Tibig	Tree	Ecological	NT
Moraceae	*Ficus septica*	Hauili	Tree	Ecological	NT
Moringaceae	*Moringa oleifera*	Malunggay	Tree	Medicinal	NT
Myrsinaceae	*Ardisia pyramidalis*	Aunasin	Tree	Ecological	NT
Myrtaceae	*Psidium guajava*	Bayabas	Tree	Fruit	NT
Myrtaceae	*Syzygium cumuni*	Duhat	Tree	Fruit	NT
Myrtaceae	*Syzygium samarangense*	Makopa	Tree	Fruit	NT
Oleandraceae	*Nephrolepis biserrata*	Nephrolepis	Fern	Ecological	NT
Pandanaceae	*Pandanus exaltata*	Pandan Layugan	Shrub	Ecological	NT

Family	Species	Common Name	Life Form	Importance	CS[1]
Pandanaceae	*Pandanus tectorius*	Pandan dagat	Shrub	Ecological	NT
Passifloraceae	*Passiflora foetida*	Passiflora	Vine	Ecological	NT
Phyllanthaceae	*Antidesma ghaesembilla*	Binayuyu	Tree	Fruit	NT
Poaceae	*Bambusa vulgaris*	Kawayan kiling	Grass	Biomass	NT
Poaceae	*Imperata cylindrica*	Cogon	Herb	Biomass	NT
Poaceae	*Oplismensus opposifolius*	Kurawraw	Herb	Ecological	NT
Poaceae	*Paspalum conjugatum*	Carabao grass	Grass	Ecological	NT
Poaceae	*Saccharum spontaneum*	Talahib	Herb	Ecological	NT
Poaceae	*Setaria palmifolia*	Ayas-as	Grass	Ecological	NT
Pteridaceae	*Acrostichum aureum*	Lagolo	Fern	Ecological	NT
Rubiaceae	*Guettarda speciosa*	Guettarda	Tree	Ecological	NT
Rubiaceae	*Ixora philippinensis*	Phil. Santan	Shrub	Ecological	NT
Rubiaceae	*Morinda citrifolia*	Nino	Tree	Ecological	NT
Rubiaceae	*Nauclea orientalis*	Bangkal	Tree	Ecological	NT
Sapindaceae	*Dodonaea viscosa*	Kasirag	Shrub	Ecological	NT
Sapindaceae	*Guioa subapiculata*	Malasikag	Tree	Ecological	NT
Sapotaceae	*Chrysophyllum caimito*	Caimito	Tree	Fruit	NT
Schizaeaceae	*Lygodium flexuosum*	Nito	Fern	Ecological	NT
Sterculiaceae	*Commersiona bartamia*	Kakaag	Tree	Ecological	NT
Sterculiaceae	*Sterculia ceramica*	Malakalumpang	Tree	Ecological	NT
Taccaceae	*Tacca palmata*	Tacca	Herb	Ecological	NT
Verbenaceae	*Gmelina arborea*	Gmelina	Tree	Wood	NT
Verbenaceae	*Hyptis suovalens*	Suob kabayo	Herb	Ecological	NT
Verbenaceae	*Lantana camara*	Lantana	Shrub	Ecological	NT
Verbenaceae	*Premna odorata*	Alagau	Tree	Ecological	NT
Verbenaceae	*Premna serratifolia*	Alagau dagat	Tree	Ecological	NT
Verbenaceae	*Stachytarpheta jamaicensis*	Kandi-kandilaan	Herb	Ecological	NT
Verbenaceae	*Vitex pubescens*	Hairy leaf Molave	Tree	Ecological	NT
Vitaceae	*Leea spp.*	Leea	Shrub	Ecological	NT
Zingiberaceae	*Hedychium coronarium*	Kamia	Herb	Ecological	NT
Zingiberaceae	*Kolorawtia elegans*	Tagbak	Herb	Ecological	NT

Table 12presents the nine life forms recorded in the study area. Creepers are represented by *Ipomea aquatica* (Kangkong) and *Ipomea pes caprae* (Lambayong). Ferns are represented by *Acrosticum aureum* (Lagolo), *Lygodium flexuosum* (Nito) and *Nephrolepis biserrata* (Nephrolepis). Grasses are represented by *Bambusa vulgaris* (Lawayan Kiling), *Paspalum conjugatum* (Carabao grass) and *Setaria palmifolia* (Ayas-as). Liana is represented by *Flagellaria indica* (Baling uai). Palms are represented by two species of *Calamus*, *Caryota cumingii* (Pugahan) and *Cocos nicifera* (Niog).

Table 12. Life forms recorded in the study site, El Nido, Palawan

Life Form	Number of species
Tree	78
Shrub	21
Herb	14
Grass	3
Palm	4
Fern	3
Vines	7
Creeper	2
Liana	1
Total	**133**

Distribution/Origin. Distribution of the plant species categorized into three namely: Indigenous, Exotic/Introduced and Endemic. Of the total number of species recorded, 74 species are classified as indigenous with 40 introduced/exotics species (**Table 13**). Only three endemic tree species were recorded: *Artocarpus blancoi* (locally known as *antipolo*), *Mussaenda philippica* (locally known as *kahoy dalaga*), and *Premna odorata* (locally known as Alagau) (**Plate 3**).

Plate 3. *Mussaenda philippica* (Kahoy dalaga, left), *Premna odorata* (Alagau, right) and *Artocarpus blancoi* (Antipolo) are the three endemic tree species observed in the project site.

Endemic species are organisms that are native to or found only in a particular place, country, or region and not in any other part of the world. In contrast, exotic species are organisms that are introduced to a particular area/locality, which did not thrive there originally. The organisms are usually identified as foreign/alien species.

Table 13. Distribution of plant species recorded in the study site.

Family	Species	Common Name	Life Form	Distribution/ Origin[2]
Amaryllidaceae	*Crinum asiaticum*	Beach lily	Herb	EX
Anacardiaceae	*Anacardium occidentale*	Kasoy	Tree	EX
Anacardiaceae	*Buchanania arborescens*	Balinghasai	Tree	IN
Anacardiaceae	*Dracontomelon edule*	Lamio	Tree	IN
Anacardiaceae	*Mangifera indica*	Mangga	Tree	EX
Anacardiaceae	*Semecarpus cuneiformis*	Ligas	Tree	IN
Annonaceae	*Cananga odorata*	Ilang-ilang	Tree	IN
Apocynaceae	*Alstonia macrophylla*	Batino	Tree	IN
Apocynaceae	*Cerbera manghas*	Cerbera	Tree	EX
Apocynaceae	*Ervatamia pandacaqui*	Pandakaki	Shrub	IN
Apocynaceae	*Plumeria acuninata*	Kalachuchi	Tree	EX
Apocynaceae	*Wrightia pubescens*	Lanete	Tree	IN
Araceae	*Alocassia macrorhizza*	Biga	Herb	EX

[2] IN = introduced; EX = exotic; EN = endangered

Family	Species	Common Name	Life Form	Distribution/ Origin[2]
Araliaceae	*Polyscias nudosa*	Malapapaya	Tree	IN
Arecaceae	Calamus spp. 1	Calamus	Palm	IN
Arecaceae	Calamus spp. 2	Calamus	Palm	IN
Arecaceae	Caryota cumingii	Pugahan	Palm	EX
Arecaceae	Cocus nucifera	Niog	Palm	EX
Asteraceae	*Chromolaena odorata*	Hagonay	Shrub	IN
Asteraceae	*Wedelia biflora*	Hagonoy dagat	Shrub	EX
Burseraceae	*Canarium asperum*	Pagsahingin	Tree	IN
Celtidaceae	*Trema orientalis*	Anabiong	Tree	IN
Clusiaceae	*Callophyllum inophyllum*	Bitaog	Tree	IN
Clusiaceae	*Cratoxylum cochinchinense*	Muogon	Tree	IN
Clusiaceae	*Cratoxylum sumatranum*	Kansilay	Tree	IN
Clusiaceae	*Garcinia rubra*	Kamandiis	Shrub	IN
Combretaceae	*Terminali catappa*	Talisay	Tree	IN
Costaceae	*Costus specious*	Tubang usa	Herb	EX
Crassulaceae	*Kalanchoe pinnata*	Kataka-taka	Herb	IN
Cyperaceae	*Cyperus spp.*	Cyperus	Herb	IN
Dilleniaceae	*Dillenia monantha*	Dillenia	Tree	EX
Ebenaceae	*Diospyrus maritima*	Malatinta	Tree	IN
Ebenaceae	*Diospyrus myrmecocalyx*	Anang gulod	Tree	IN
Ebenaceae	*Diospyrus pilosanthera*	Bolon-eta	Tree	IN
Euphorbiaceae	*Breynia spp.*	Breynia	Shrub	IN
Euphorbiaceae	*Glochodin sp.*	Glochodin	Tree	IN
Euphorbiaceae	*Jathropa curcas*	Tubang bakod	Shrub	IN
Euphorbiaceae	*Macaranga tanarius*	Binunga	Tree	IN
Euphorbiaceae	*Mallotus ricinoides*	Hinlaumo	Tree	IN
Euphorbiaceae	*Melanolepis multiglandulosa*	Alim	Tree	IN
Fabaceae	*Acacia mangium*	Mangium	Tree	EX
Fabaceae	*Albizzia falcataria*	Falcata	Tree	IN
Fabaceae	*Albizzia lebbeck*	Langil	Tree	EX
Fabaceae	*Caesalpinia pulcherrima*	Caballero	Shrub	EX
Fabaceae	*Cassia alata*	Acapulco	Shrub	EX
Fabaceae	*Cassia fistula*	Golden shower	Tree	EX
Fabaceae	*Cassia fruticosa*	Antsoan	Tree	EX
Fabaceae	*Cassia tora*	Balatong aso	Shrub	EX
Fabaceae	*Delonix regia*	Fire tree	Tree	EX
Fabaceae	*Desmodium umbellatum*	Malapigas	Tree	EX
Fabaceae	*Erythrina orientalis*	Dapdap	Tree	IN
Fabaceae	*Instia bijuga*	Ipil	Tree	IN
Fabaceae	*Leucaena leucocephala*	Ipil-ipil	Tree	IN
Fabaceae	*Mimosa pudica*	Makahiya	Herb	IN
Fabaceae	*Moghania strobilefera*	Payang-payang	Shrub	IN
Fabaceae	***Mussaenda philippica***	**Kahoy dalaga**	**Shrub**	**EN**
Fabaceae	*Peltophorum pentandrum*	Siar	Tree	EX
Fabaceae	*Pongamia pinnata*	Bani	Tree	IN
Fabaceae	*Pterocarpus indicus*	Narra	Tree	IN
Fabaceae	*Samanea saman*	Rain tree	Tree	EX
Fabaceae	*Tamarindus indica*	Sampaloc	Tree	EX
Lauraceae	*Litsea sebifera*	Sablot	Tree	IN
Lauraceae	*Persia gratissima*	Avocado	Tree	EX
Lecythidaceae	*Barringtonia asiatica*	Botong	Tree	IN
Lecythidaceae	*Barringtonia racemosa*	Putat	Tree	IN
Lythraceae	*Lagerstroemia speciosa*	Banaba	Tree	IN
Malvaceae	*Ceiba pentanda*	American Kapok	Tree	EX
Malvaceae	*Hibiscus tiliaceus*	Malubago	Tree	EX
Malvaceae	*Kleinhovia hospita*	Tan-ag	Tree	IN
Malvaceae	*Pterospermum diversifolium*	Bayok	Tree	IN
Malvaceae	*Thespesia populnea*	Banalo	Tree	IN

Family	Species	Common Name	Life Form	Distribution/ Origin[2]
Malvaceae	*Triumfera rhomboidea*	Kulot-kulutan	Shrub	IN
Malvaceae	*Urena lobata*	Mangkit	Shrub	IN
Melastomaceae	*Melastoma malabathricum*	Malatungaw	Shrub	IN
Melastomaceae	*Memecylon spp.*	Memecylon	Tree	IN
Meliaceae	*Azadirachta indica*	Neem tree	Tree	IN
Meliaceae	*Sandoricum koetjape*	Santol	Tree	IN
Meliaceae	*Sweitenia macrophylla*	Mahogany	Tree	EX
Moraceae	***Artocarous blancoi***	**Antipolo**	**Tree**	**EN**
Moraceae	*Artocarpus altilis*	Kamansi	Tree	EX
Moraceae	*Artocarpus heterophyllus*	Nangka	Tree	EX
Moraceae	*Artocarpus odoratissimu*	Marang banguhan	Tree	EX
Moraceae	*Ficus balete*	Balete	Tree	EX
Moraceae	*Ficus benjamina*	Salisi	Tree	IN
Moraceae	*Ficus nota*	Tibig	Tree	IN
Moraceae	*Ficus septica*	Hauili	Tree	IN
Moringaceae	*Moringa oleifera*	Malunggay	Tree	IN
Myrsinaceae	*Ardisia pyramidalis*	Aunasin	Tree	IN
Myrtaceae	*Psidium guajava*	Bayabas	Tree	EX
Myrtaceae	*Syzygium cumuni*	Duhat	Tree	EX
Myrtaceae	*Syzygium samarangense*	Makopa	Tree	EX
Pandanaceae	*Pandanus exaltata*	Pandan Layugan	Shrub	EX
Pandanaceae	*Pandanus tectorius*	Pandan dagat	Shrub	EX
Phyllanthaceae	*Antidesma ghaesembilla*	Binayuyu	Tree	IN
Poaceae	*Imperata cylindrica*	Cogon	Herb	IN
Poaceae	*Oplismensus opposifolius*	Kurawraw	Herb	EX
Poaceae	*Saccharum spontaneum*	Talahib	Herb	IN
Rubiaceae	*Guettarda speciosa*	Guettarda	Tree	IN
Rubiaceae	*Ixora philippinensis*	Phil. Santan	Shrub	IN
Rubiaceae	*Morinda citrifolia*	Nino	Tree	IN
Rubiaceae	*Nauclea orientalis*	Bangkal	Tree	IN
Sapindaceae	*Dodonaea viscosa*	Kasirag	Shrub	IN
Sapindaceae	*Guioa subapiculata*	Malasikag	Tree	IN
Sapotaceae	*Chrysophyllum caimito*	Caimito	Tree	EX
Sterculiaceae	*Commersiona bartamia*	Kakaag	Tree	IN
Sterculiaceae	*Sterculia ceramica*	Malakalumpang	Tree	IN
Taccaceae	*Tacca palmata*	Tacca	Herb	IN
Verbenaceae	*Gmelina arborea*	Gmelina	Tree	IN
Verbenaceae	*Hyptis suovalens*	Suob kabayo	Herb	IN
Verbenaceae	*Lantana camara*	Lantana	Shrub	IN
Verbenaceae	***Premna odorata***	**Alagau**	**Tree**	**EN**
Verbenaceae	*Premna serratifolia*	Alagau dagat	Tree	EX
Verbenaceae	*Stachytarpheta jamaicensis*	Kandi-kandilaan	Herb	IN
Verbenaceae	*Vitex pubescens*	Hairy leaf Molave	Tree	IN
Vitaceae	*Leea spp.*	Leea	Shrub	EX
Zingiberaceae	*Hedychium coronarium*	Kamia	Herb	IN
Zingiberaceae	*Kolorawtia elegans*	Tagbak	Herb	IN

Economically important Species. Of the total number of species recorded, some 35 species are considered economically important either due to its fruit, wood, biomass and their combination as presented in **Table 14**.

Table 14. Economically important species recorded in the study area

Family	Species	Common Name	Life Form	Importance
Amaryllidaceae	*Crinum asiaticum*	Beach lily	Herb	Biomass
Anacardiaceae	*Anacardium occidentale*	Kasoy	Tree	Fruit
Anacardiaceae	*Mangifera indica*	Mangga	Tree	Fruit
Araliaceae	*Polyscias nudosa*	Malapapaya	Tree	Matchstick
Arecaceae	*Calamus spp. 1*	Calamus	Palm	Biomass
Arecaceae	*Calamus spp. 2*	Calamus	Palm	Cane
Arecaceae	*Caryota cumingii*	Pugahan	Palm	Biomass
Arecaceae	*Cocus nucifera*	Niog	Palm	Wood/Fruit
Euphorbiaceae	*Jathropa curcas*	Tubang bakod	Shrub	Oil
Fabaceae	*Acacia mangium*	Mangium	Tree	Wood
Fabaceae	*Albizzia falcataria*	Falcata	Tree	Wood
Fabaceae	*Cassia alata*	Acapulco	Shrub	Medicinal
Fabaceae	***Instia bijuga***	**Ipil**	**Tree**	**Wood**
Fabaceae	*Leucaena leucocephala*	Ipil-ipil	Tree	Biomass
Fabaceae	*Pterocarpus indicus*	Narra	Tree	Wood
Fabaceae	*Samanea saman*	Rain tree	Tree	Wood
Fabaceae	*Tamarindus indica*	Sampaloc	Tree	Fruit
Lauraceae	*Persia gratissima*	Avocado	Tree	Fruit
Lythraceae	*Lagerstroemia speciosa*	Banaba	Tree	Medicinal
Meliaceae	*Azadirachta indica*	Neem tree	Tree	Biomass
Meliaceae	*Sandoricum koetjape*	Santol	Tree	Fruit
Meliaceae	*Sweitenia macrophylla*	Mahogany	Tree	Wood
Moraceae	***Artocarous blancoi***	**Antipolo**	**Tree**	**Wood**
Moraceae	*Artocarpus altilis*	Kamansi	Tree	Fruit
Moraceae	*Artocarpus heterophyllus*	Nangka	Tree	Fruit
Moraceae	*Artocarpus odoratissimu*	Marang banguhan	Tree	Fruit
Moringaceae	*Moringa oleifera*	Malunggay	Tree	Medicinal
Myrtaceae	*Psidium guajava*	Bayabas	Tree	Fruit
Myrtaceae	*Syzygium cumuni*	Duhat	Tree	Fruit
Myrtaceae	*Syzygium samarangense*	Makopa	Tree	Fruit
Phyllanthaceae	*Antidesma ghaesembilla*	Binayuyu	Tree	Fruit
Poaceae	*Bambusa vulgaris*	Kawayan kiling	Grass	Biomass
Poaceae	*Imperata cylindrica*	Cogon	Herb	Biomass
Sapotaceae	*Chrysophyllum caimito*	Caimito	Tree	Fruit
Verbenaceae	*Gmelina arborea*	Gmelina	Tree	Wood

Conservation Status of Existing Plants. Of the total number of plant species recorded, two are considered threatened as listed in the Red List of Threatened Plants as shown in **Table 15** and **Plate 4**. The two threatened species are both economically-important trees which have declined in natural population due to their sought-after premium wood quality.

Table 15. Threatened species recorded in the study site.

Family	Species	Common Name	Life Form	Importance	Conservation Status
Moraceae	*Artocarpus blancoi*	Antipolo	Tree	Wood	Vulnerable (IUCN Red List)
Fabaceae	*Instia bijuga*	Ipil	Tree	Wood	Endangered (IUCN Red List)

Plate 4. ***Instia bijuga*** **(ipil) and** ***Artocarpus blancoi*** **(antipolo) are considered threatened species.**

DENR DAO 2007-01 defines the different conservation categories for threatened species as: "Endangered Species refers to a species or subspecies that is not critically endangered but whose survival in the wild is unlikely if the causal factors continue operating. Vulnerable Species is one that is neither critically endangered nor endangered but is under threat from adverse factors throughout its range, facing high risk of extinction in the wild in the medium- term future and is likely to move to the endangered category in the future."

Abundance/Density. Density measurement was undertaken using 50 sample plots (10m x 10m) distributed in the study site (**Appendix 3**). Only 7 and 2 individuals of Antipolo (*Artocarpus blancoi*) and Ipil (Intsia *bijuga*) respectively, was recorded/listed in 1 sample plot. The computed density for Antipolo is three trees per hectare and for Ipil is one tree per hectare. In order to measure the density of the plant species and the density of trees per hectare, the following formula will be used:

$$D = \frac{N\ .o\ \ in\ \ \ /ti}{T\ \ \ \ n\ .o\ \ li} X\ 100\%$$

$$D\ \frac{ti}{he} = \frac{N\ .o\ \ in\ \ \ in\ sc\ \ \ \ p}{A\ \ \ o\ \ sc\ \ le\ p} X\ T\ \ \ \ p$$

Frequency. Frequency measurement was undertaken using the sample plots and the presence of plant species distributed in the study site. The computed frequency of the plant species is shown in **Appendix 4**. In order to measure the frequency of the plant species, the formula below will be used:

$$f = \frac{Pi\ \ \ \ \ o\ \ si\ \ \ \ \ in\ a}{T\ \ \ sc\ \ \ p}$$

and then,

$$\frac{f}{N} = \frac{Fi\ \ \ \ \ o\ \ si}{T\ \ \ F\ \ \ cy} X\ 100\%$$

Key Potential Impacts and Mitigation

Pre-Construction Phase

Loss of plant individuals and habitat – Pre-construction activities such as site clearing, earth grading, creation of access road for the vehicles and other earth works prior to construction will entail the loss of plant individuals by clearing of trees, shrubs and other plants which are along the alignment. Loss of plants could also mean loss of habitat for the vertebrates and invertebrate animals such that they will just transfer to nearby vegetation that will not be affected by the clearing. This impact could be minimal, as it will only occur in the proposed construction site.

Keeping the clearing of vegetation to a minimum and only when necessary can help mitigate this impact. Plants that have been cut should be replaced and replanted with individuals of the same species using nursery-raised seedlings/wildlings to ensure higher field survival.

Construction Phase

Temporary impact on plant productivity – Dusts created especially from running vehicles could smother the leaves of the nearby plants, which could somehow affect their photosynthetic activity. The impact could be temporary as wind blow and rainfall could keep the dust from accumulating on the plant's foliage.

Impact to existing freshwater wetlands - The project site contains freshwater wetlands that were observed in the east middle section and near the Lio Airport runway at the southern end of the property. While the proposed development is concentrated in the northern part of the property, these two wetland locations should be spared from development for its ecological role as important habitat of wildlife, among others, and integrated in the over-all design of the hotel complex as wetland/natural area where guests can do bird watching and boating. If road network will be constructed in these areas, large culverts should be used so as not to block the flow of water.

Operation Phase

Impact on plant pollinators – Use of chemical insecticide during actual operation phase may kill beneficial insects and other invertebrates important in plant pollination and biological control of its pests and diseases. The impact is minimal as spraying will be done within the vicinity of the hotel. This could be mitigated by making the chemical spray to a minimum and only when necessary. Alternatively, the use of organic insecticide should be favored as it is more environment-friendly than commercial insecticide.

Impact of exotic species for landscaping to existing biodiversity – The operation of the hotel would require landscaping its surroundings that inevitably would entail the use of exotic plants. Exotic species could escape the hotel premises if not regulated and impact the local biodiversity in the area. Minimal use of exotic plants can mitigate this impact. Use of existing plants available in the surroundings should be done, especially the threatened Ipil (*Intsia bijuga*) and Antipolo (*Artocarpus blancoi*) and other beach plants like beach lily, Talisay, Dodonaea, Bitaog and Botong. Wildlings and germinated seeds of these threatened and other species can be used in planting the hotel surroundings.

3.1.4.2 Terrestrial Fauna

Objectives of the Study

This study was conducted to assess the terrestrial wildlife of Lio Tourism Estate, specifically: 1) to survey terrestrial wildlife animals inhabiting the perimeter of the development project in Lio, El Nido, Palawan; 2) compare the relative abundance of terrestrial wildlife among study sites; 3) identify possible impacts of the development project to wildlife animals; and 4) provide mitigating measures for the conservation of terrestrial wildlife animals within the project site.

Sampling Sites

The terrestrial wildlife survey was conducted from 01 to 04 August 2014 in five different sites within the limits of Lio Tourism Estate. The sites were selected based on three criteria: (1) areas where project development activities will be undertaken (primary impact areas); (2) areas adjacent to project development (secondary impact areas); and (3) areas with highest possibility of encountering wildlife species (**Table16**).

Table 16. List of sites surveyed for wildlife in Lio, 1 to 4 August 2014.

Site	Description
Site 1	Located at the northernmost part of the 300-ha land area, starting from the mangroves near the bridge between the residential and fishing area, and going to the secondary forest and grassland near the road. Most areas within this site is flooded during rainy season which is why a substantial part of the site has areas of wetland vegetation, while the remaining parts are a mix of secondary forest and grassland.
Site 2	This site consists of a mix of agroforest and grassland adjacent to Lio Cove Resort, El Nido. The sampling site started close to the shore near the coconut plantation and ended at near the barracks of the security guards in Lio Cove Resort. Numerous cashew, mango, and coconut trees are found on the site. A section of the area was observed to be flooded during the conduct of the survey.
Site 3	This site is located at the farm area of Lio Cove Resort that included a freshwater pond for breeding Tilapia (*O. niloticus*). The vegetation of this site is a mix of secondary forest and agricultural area with plantations of bananas, papaya, and other crops.
Site 4	This site is adjacent to site 3, starting from the security post called "C1" (as what the locals call it) and ending at an intersection in a mango plantation. Majority of the parts are a mix of primary and secondary forest.
Site 5	This site is located at the El Nido Airport near the river. This consists of a mangrove area and grassland near the runway with numerous shrubs and bush.

Almost all sites satisfy the above-mentioned criterion on primary impact areas. Areas in each sampling sites were selected strategically based on its value as sites of high wildlife diversity. **Figure 31** shows the location of the wildlife study sites.

Methodology

Birds. Bird census was carried out for all the sampling sites by walking through a transect line. Birds were observed and identified with the aid of binoculars and camera. In each of the sampling sites, all birds that were seen or heard were noted. Species name, number of individuals, and location/site where the bird species observed were recorded. Sound recorder was also used to record birdcalls that were not identified on site. Except in site 5 (near Lio Airport), a mist net (6 and 2 m long, 4 shelves, 35mm mesh) was deployed in to capture cryptic species that were difficult to observed during the transect counts. These nets were left opened until the following day. Nomenclature and classification of observed and captured species were identified using Kennedy et al (2000). Threatened status followed the IUCN 2000 Red List for Threatened Animals Hilton-Taylor (2004). Specimens caught were photographed for future reference.

Mammals. Cage/live traps were used to capture non-volant mammals. These traps were baited with roasted coconut coated with peanut bitter and placed in different locations (i.e. under root tangles, in front of burrow entrances and along the runway). For volant mammals, mist nets were used and placed across trails and streams, and at edges of clearing adjacent to forest. Nets were left opened until the following day. Captured individuals were photographed, identified and released after recording. Information of other large mammals was obtained from the local guides during the fieldwork. Nomenclature and classification followed Heaney et al (1998) and threatened status follows IUCN 2000 red List for Threatened Animals Hilton-Taylor (2004).

Amphibians and Reptiles. There was no standardized method used for the survey of herpetofauna. Instead, hand capturing and opportunistic sampling were employed for all the study sites. Microhabitats such as forest floor, decaying logs, epiphytes and bodies of water were closely examined. Sampling periods were conducted during the afternoon and occasionally done after servicing the nets and traps. Interviews with the locals and local guides were also conducted to supplement the data. Nomenclature and classification were based on Alcala & Brown (1998) for

frogs, and Alcala (1986) and Crombie (1986) for reptiles. Threatened status follows IUCN 2000 red List for Threatened Animals Hilton-Taylor (2004).

Freshwater Wildlife. Freshwater animals were surveyed at the pond (11.212134°, 119.420692°). Again, there was no standardized method employed for this sampling. Instead, an improvised seine (mosquito) net (70 x 180 x 150 cm) was used to capture freshwater fauna. The net was submerged vertically into the water by holding both the bottom and top edges of the net. Captured fishes and other aquatic animals (i.e. shrimps and mollusks) were photographed and identified to the lowest possible taxa using mongabay.com (2004) and Schilthuizen et al. (2011) respectively.

Data Analysis

Birds. Biodiversity indices that take into account both species richness and relative abundance of each species in the community were computed in the study. Community diversity was calculated using the Shannon-Weiner (H) Index:

$$D = \sum_{i=1}^{S} \frac{n_i(n_i - 1)}{N\,(N-1)}$$

n – number of individuals per species

N – total number of individuals of all species

The following parameters were also used to determine the degree of species diversity in each sampling site:

1. **Species Richness index** simply refers to the number of species in sampling site
2. **Dominance (D) index**:

$$H = -\sum_{j=1}^{S} p_i \ln p_i$$

Pi – fraction of the entire population made up of species *i*

S – numbers of species encountered

3. **Evenness (e) index**:

$$E = e^{H} / S$$

H – Shannon-Weiner index
S – number of species encountered

The qualitative basis of alpha diversity values was compared with the Fernando Biodiversity Scaling system (1998):

RELATIVE VALUES	SHANNON-WEINER INDEX (H')
Very High	3.5 - 4.00
High	3.0 - 3.49
Moderate	2.5 - 2.99
Low	2.0 - 2.49
Very Low	1.0 - 1.99

Mammals. Relative abundance was used to analyze mammalian patterns for each study site. Relative abundance refers to the number of individuals of a given species divided by the total number of individuals of all species found. The discussion will be limited to just the presence/absence of mammals and their habitat associations.

Amphibians, Reptiles and Freshwater Wildlife. Amphibians, Reptiles and freshwater community data were not analyzed statistically. For this section, the discussion will be limited to just the presence/absence of aquatic animals and their habitat associations.

Note:
Data and results from the **previous study** on the Lio Tourism Estate was used to compare the relative abundance of wildlife animals of all study sites/transects prior to the extension of the Lio Tourism Estate.

Diversity, Distribution and Conservation Status

From four days of survey using multiple survey techniques, a total of 82 species of terrestrial vertebrates (or wildlife) were recorded within the area of Lio Tourism Estate in El Nido, Palawan. This total was comprised of 65 species of birds, five mammals, four amphibians, and eight reptiles (**Figure 31**). At least 19.5% of all recorded species are endemic to the Philippines.

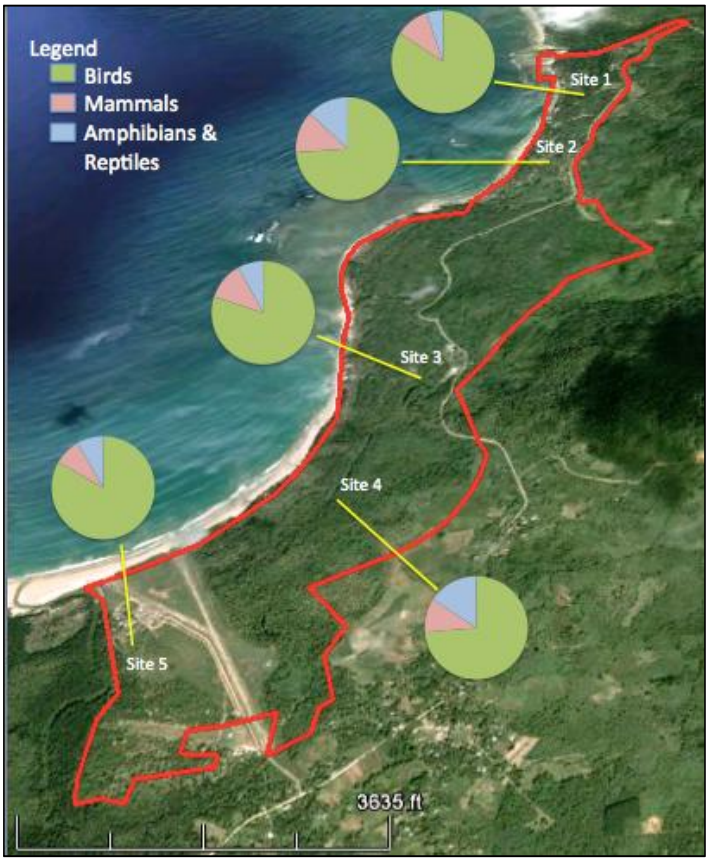


Figure 31. Summarized species richness of birds, mammals, amphibians and reptiles in Lio Tourism Estate, El Nido, Palawan.

A. Birds

A total of 200 individuals belonging to 65 species of birds were recorded during transects across the five sampling sites (**Table17**). At least 48 species are non-endemic resident breeders, whereas 10 species are endemic to the Philippines. Moreover, at least nine species are considered as restricted to Palawan Island, namely the Ashy-headed Babbler (*Trichastoma cinereiceps)*, Blue-headed Racquet-tail (*Prioniturus platenae)*, Blue Paradise-Flycatcher (*Terpsiphone cyanescens)*, Chesnut-breasted Malkoha (*Phaenicophaeus curvirostris harringtoni)*, Palawan Flowerpecker (*Prionochilus plateni)*, Palawan Hornbill (*Anthracoceros marchei)*, Palawan tit (*Periparus amabilis)*,

Sulphur-bellied Bulbul (*Hypsipetes palawanensis)*, and Yellow-throated Leafbird (*Chloropsis palawanensis)*. Most endemic species were recorded at Sites 3 and 1 with five and four species present, respectively. The presence of these endemic species was most likely because of the adjacent forested area and areas, which are seldom visited by the local populace. Site 3 is a mountain with lush secondary forest that is not easily accessible, while there is an isolated land at the opposite side of the river in Site 1.

Table 17. Alphabetical list of all species of birds observed in Lio Tourism Estate, El Nido Palawan.

Species	Common Name	Count	Distribution	IUCN Status	Site Observed					
					Seastems 2014	1	2	3	4	5
Aegithina tiphia	Common iora	14	Resident	LC	X	X	X	X	X	
Alcedo meninting	Blue-eared kingfisher	2	Resident	LC				X		
Anthracoceros marchei	Palawan hornbill	2	Endemic	VU					X	
Anthreptes malacensis	Plain throated sunbird	4	Resident	LC		X			X	
Artamus leucorynchus	White breasted wood swallow	1	Resident	LC				X		
Bubulcus ibis	Cattle egret	2	Migrant	LC	X			X		
Butorides striatus	Little heron	1	Migrant	LC						X
Caloenas nicobarica	Nicobar pigeon	1	Resident	NT		X				
Centropus bengalensis	Lesser coucal	4	Resident	LC		X				X
Centropus sinensis	Greater coucal	3	Resident	LC	X	X	X			
Cettia vulcania	Sunda bush warbler	1	Resident	LC	X	X				
Chalcophaps indica	Common emerald dove	1	Resident	LC					X	
Chloropsis palawanensis	Yellow throated leafbird	4	Endemic	LC	X	X		X	X	
Cisticola juncidis	Zitting cisticola		Resident	lc	x					
Collocalia esculenta	Glossy swiftlet	6	Resident	LC		X			X	
Collocalia fuciphaga	Edible-nest Swiftlet	6	Resident	LC		X	X			
Copsychus niger	White-vented shama		Endemic	LC	X					
Copsychus saularis	Oriental magpie robin	2	Resident	LC		X				
Corvus enca	Slender billed crow	16	Resident	LC	X			X	X	
Corvus macrorhynchos	Large billed crow	9	Resident	LC				X		
Coturnix chinensis	Blue breasted quail	1	Resident	LC						X
Criniger bres	Grey cheeked bulbul	4	Resident	LC		X		X		
Dicaeum pygmaeum	Pygmy flowerpecker		Endemic	LC	X					
Dicrurus hottentosus	Spangled drongo	2	Resident	LC		X				
Dicrurus leucophaeus	Ashy drongo	3	Resident	LC	X		X		X	

Species	Common Name	Count	Distribution	IUCN Status	Site Observed					
					Seastems 2014	1	2	3	4	5
Dinopium javanense	Common flameback woodpecker	2	Resident	LC			X			
egretta intermedia	Intermediate egret	1	Migrant	LC				X		
Egretta sacra	Eastern reef-egret	1	Resident	LC			X			
Eurystomus orientalis	Dollarbird	1	Resident	LC	X			X		
Gallus gallus	Red junglefowl	5	Resident	LC	X	X				
Geopelia striata	Zebra dove	1	Resident	LC	X	X				
Gorsachius melanolophus	Malayan night heron	1	Resident	LC				X		
Gracula speciosa	Hill myna		Resident	LC	X					
Halcyon capensis	Stork-billed kingfisher	2	Resident	LC		X				
Halcyon chloris	White collared kingfisher	7	Resident	LC		X	X	X		
Halcyon smyrnensis	White throated kingfisher	1	Resident	LC						X
Hirundo rustica	Barn swallow	1	Resident	LC	X	X				
Hirundo tahitica	Pacific swallow	2	Resident	LC	X	X		X		
Hypothymis azurea	Blue-naped monarch	5	Resident	LC		X				
Hypsipetes palawanensis	Sulphur bellied bulbul	3	Endemic	LC			X			
Lanius cristatus	Brown shrike	2	Migrant	LC					X	
Lonchura malacca	Chestnut munia	1	Resident	LC			X			
Lonchura punctulata	Scaly breasted munia	6	Resident	LC	X					X
Macropygia phasianella	Reddish cuckoo dove	2	Resident	LC						X
Megalurus palustris	Striated grassbird	2	Resident	LC		X		X		
Megalurus striatus	Striated grassbird		Resident	LC	X					
Megapodius cumingii	Tabon scrubfowl	2	Resident	LC	X			X		
Mulleripicus pulverulentus	Great Slaty woodpecker	2	Resident	VU			X			
Muscicapa griseisticta	Grey streaked flycatcher	4	Migrant	LC			X			
Nectarinia calcostheta	Copper-throated Sunbird	1	Resident	LC		X				
Nectarinia jugularis	Olive-backed Sunbird	4	Resident	LC	X	X	X	X		
Nectarinia sperata	Purple-throated Sunbird	1	Resident	LC	X				X	
Oriolus chinensis	Black-naped Oriole		Resident	LC	X					
Orthotomus sericeus	Rufous tailed tailorbird	2	Resident	LC	X	X				X
Pachycephala cinerea	Mangrove whistler	1	Resident	LC			X			
Parus amabilis	Palawan tit		Endemic	NT	X					
Passer montanus	Eurasian tree sparrow	1	Resident	LC	X	X				
Periparus amabilis	Palawan tit	1	Endemic	NR				X		

Species	Common Name	Count	Distribution	IUCN Status	Site Observed					
					Seastems 2014	1	2	3	4	5
Phaenicophaeus curvirostris harringtoni	Chestnut breasted malkoha	4	Endemic	LC	X	X				
Phylloscopus trivirgatus	Mountain leaf flyeater	4	Resident	LC					X	
Prioniturus platenae	Blue headed racquet tail	1	Endemic	VU				X		
Prionochilus plateni	Palawan flowerpecker	8	Endemic	LC			X	X	X	
Ptilinopus leclancheri	Black chinned fruit dove	2	Near Endemic	LC		X	X			
Pycnonotus atriceps	Black-headed bulbul		Resident	LC	X					
Pycnonotus plumosus	Olive winged bulbul	11	Resident	LC	X	X				
Sterna sp.	Tern		N/A	LC	X					
Streptopelia bitorquata	Island collared dove	4	Resident	LC			X			X
Streptopelia chinensis	Spotted dove	2	Resident	LC	X				X	
Streptopelia tranquebarica	Red turtle dove	3	Resident	LC						X
Terpsiphone cyanescens	Blue paradise flycatcher	1	Endemic	LC		X				
Treron curvirostra	Thick billed green pigeon	1	Resident	LC					X	
Treron spp.	Green pigeon		Resident	LC	X					
Treron vernans	Pink necked green pigeon	1	Resident	LC			X			
Trichastoma cinereiceps	Ashy headed babbler	3	Endemic	LC				X		
Turnix suscitator	Barred button quail	1	Resident	LC						X

A total of five bird species recorded are migrants. This included the Cattle Egret (*Bubulcus ibis*), Little Heron (*Butorides striatus*), Intermediate Egret (*Egretta intermedia*), Brown Shrike (*Lanius cristatus*), and Grey-streaked Flycatcher (*Muscicapa griseisticta*).

Across the five sites, Site 1 has the highest number of avian species with 30 species recorded, and Site 5 has the least with 10 avian species and no endemics observed. As mentioned before, the adjacent forest and less human disturbance in Site 1 may be the reason why birds are abundant. Site 5 is near the runway at the airport, which has high disturbance, and this can be accounted for the low species richness and the absence of endemic species. It is also possible that birds are driven away from the airport due to their hazardous effect to incoming and outgoing aircrafts. Site 3 has 20 species of birds and many Palawan endemic species. This is in spite of the fact that the area is agricultural area with moderate disturbance. Sites 2 and 4 have 17 and 14 avian species respectively, with three endemic species present in both areas. These sites are agro-forested land with mango, coconut, and cashew as the most commonly planted cash crop. In general, it can be said that the species richness and endemicity of birds is associated with the type of vegetation and degree of disturbance in a particular area.

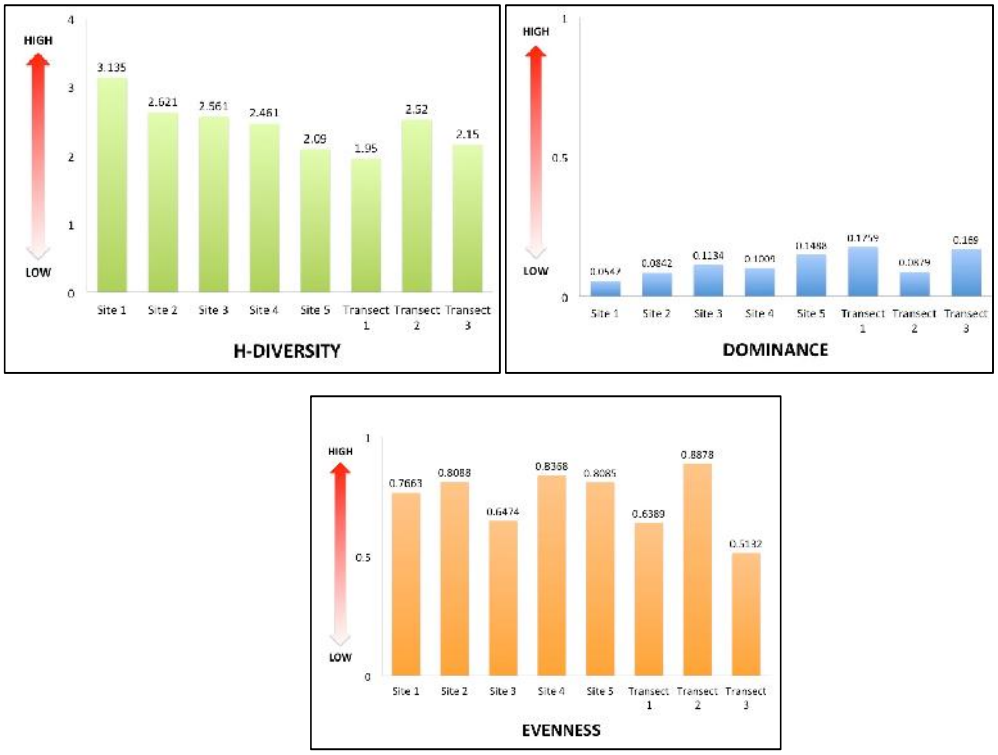


Figure 32. Comparison of diversity indices among five sites and three transect areas (from previous study).

The diversity of the five sites ranges from relatively moderate to very high. This is greatly influenced by the high indices from Sites 2 to 4 (2.461 – 2.621) and Site 1 having the highest diversity index of 3.135. This is because Sites 1 to 4 has high species richness and relative abundance resulting in the area being highly diverse. Site 5 has the lowest index because of the low species diversity. Adding the data from the previous study, the average diversity index for the five sites and three transects is at 2.436 that indicates a low but near moderate diversity. These diversity index values indicate that a moderately high number of species is concentrated within the confines of Lio Tourism Estate (**Figure 32**).

Dominance values of all sites are relatively low (0.0547 – 0.1488) which indicates that numerical dominance is not confined to two or three species. Comparing the data from the previous study, all transects also have low dominance values. The average dominance value of the five sites and three transects is at 0.11685 which was relatively low indicating that there were no species that are dominant in numbers present in the area (**Figure 32**).

Evenness values of the site ranges from 0.6474 – 0.8368, which indicates relatively even abundances among recorded species. These values indicate that the abundances of the species present in Lio, El Nido, Palawan is relatively evenly distributed (**Figure 32**).

B. Mammals

From mist-netting, trapping, and ocular evidences, a total of five species of mammals were recorded in all five sampling sites (**Table 18**). This total is comprised of three species of bats and two species of rodents. The two rodents are considered as endemics: the Palawan Montane Squirrel (*Sundasciurus rabori*) and Palawan Spiny Rat (*Maxomys panglima*). The three bat species are considered as residents, namely the Common Rousette Bat (*Rousettus amplexicaudatus*), Lesser Short-nosed Fruit Bat (*Cynopterus brachyotis*), and the Long-tongued Nectar Bat (*Macroglossus minimus*).

Table 18. Alphabetical list of all species of mammals observed in five sites in Lio Tourism Estate, El Nido Palawan.

Species	Common Name	Count	Distribution	IUCN Status	Site Observed					
					Seastems 2014	1	2	3	4	5
Cynopterus brachyotis	Lesser short-nosed fruit bat	62	Resident	LC	X	X	X	X	X	
Macroglossus minimus	Long-tongued nectar bat	3	Resident	LC	X	X				
Maxomys panglima	Palawan Spiny Rat	1	Endemic	LC	X	X				
Sundasciurus rabori	Palawan Montane Squirrel	16	Endemic	LC		X		X	X	X
Sundasciurus sp. juvencus	Northern Palawan tree squirrel		Endemic	Not yet assessed	X					
Rousettus amplexicaudatus	Common Rousette	2	Resident	LC				X		
Rattus exulans	Polynesian rat		Widespread	LC	X					
Tupaia palawanensis	Palawan tree-shrew		Resident	VU	X					

For the duration of the survey, only one rodent was captured at Site 1. The low capture rates are attributed to the heavy rains at night. This rendered the traps less effective because there is a decrease of faunal movement to harvest food resources (Jimenez et al., 2010; Datiko and Bekele, 2013). A total of 67 individuals of bats representing three species were captured in mist nets. Netting success ranged from 0.75 bat per net-night (Site 1) to 16.75 bats per net-night (at Sites 2, 3, and 4). The low capture rate in Site 1 was again attributed to nighttime rains. In contrast, high capture rates in Sites 2, 3, and 4 could be attributed to the site being a foraging area of the fruit bats.

C. Amphibians and Reptiles

A total of four species of amphibians, two of which were endemics, and eight species of reptiles with two endemics, were recorded in the five sampling sites (**Table 19**). The two endemic amphibians, Philippine Toad (*Ingerophrynus philippinicus*) and Forked-tongue Frog (*Limnonectes acanthi*) were recorded at Sites 1 and 3, respectively. The recorded amphibians were strongly associated to the open areas and early secondary growth forest with wetland areas.

The eight species of reptiles were comprised of six residents, and two endemic species. The two endemics, the Palawan Water Monitor Lizard (*Varanus palawanensis*) and Malayan Box Turtle (*Cuora amboinensis*) were recorded in the mangrove areas in Sites 5 and 1, respectively. All resident reptiles were associated with the residential and agricultural areas.

Table 19. Alphabetical list of all species of amphibians and reptiles observed in Lio Tourism Estate, El Nido Palawan.

Species	Common Name	Count	Distribution	IUCN Status	Site Observed					
					Seastems 2014	1	2	3	4	5
Cuora amboinensis	Malayan box turtle	1	Resident	VU	X	X				
Dendrolephis caudolineatus	Bronze tree snake	1	Resident	Not evaluated			X			
Draco palawanensis	Palawan Fying Lizard	1	Endemic	Not evaluated					X	
Eutropis rudis	Brown mabuya	1	Resident	Not evaluated					X	
Eutropis sp.	Skink		N/A	LC	X					
Fejervarya cancrivora	Asian Brackish frog	1	Resident	LC		X				
Fejervarya cf. vittegera	Luzon wart frog			Not evaluated	X					
Gekko gecko	Tokay gecko	2	Resident	Not evaluated	X		X	X		
Hemidactylus frenatus	Common house gecko	1	Resident	LC		X				
Ingerophrynus philippinicus	Philippine toad	3	Endemic	LC		X				
Lamprolepis smaragdina	Emerald tree skink	1	Resident	Not evaluated				X		
Lamprolepis sp.	Tree Skink		N/A	LC	X					
Limnonectes acanthi	Fork-tongued frog	1	Vulnerable	Endemic				X		
Occidozyga laevis	Common puddle frog	3	Resident	LC	X	X	X			
Ophiophagus hannah	King cobra		Widespread	VU	X					
Varanus palawanensis	Palawan water monitor lizard	8	Endemic	Not evaluated				X	X	X
Varanus salvator	Variable Monitor Lizard		Widespread	LC	X					

LC – Least Concern; NT – Nearly Threatened; VU – Vulnerable; NR – Not Recognized

D. Freshwater Animals

A total of eight freshwater animals (both vertebrates and invertebrates) were recorded at the pond in Site 3. It includes three types of mollusks, four bony fish (two species are still unidentified), and one unidentified shrimp. The Halfbeak (Hemiramphidae) and the two unidentified fish are suspected to be marine species. It is still unknown how these suspected marine fishes migrated to the pond (**Table 20**).

Table 20. Alphabetical list of all observed freshwater wildlife in site 3.

Family/Species	Common Name	Distribution	IUCN Status	Site Observed
Thiara sp.	Thiarid	NA	NA	3
Melanoides sp.	Melania	NA	NA	3
Ampullaridae	Apple Snail	NA	NA	3
Hemiramphidae	Halfbeak	NA	NA	3
Oreochromis niloticus	Nile Tilapia	Resident	LC	3
-	Unknown fish 1	NA	NA	3
-	Unknown fish 2	NA	NA	3
-	Unknown shrimp	NA	NA	3

E. Conservation Status and Noteworthy Species

At least 17 species present in the project area were chosen as noteworthy by virtue of several characteristics: (1) restricted to Palawan Island Complex, (2) listed as globally threatened by IUCN, and (3) heavily exploited for food or pets. Twelve species of birds are noteworthy of which nine are endemic to Palawan whereas four species are classified as threatened species. The Blue-headed Racquet-tail, Great Slaty Woodpecker (*Mulleripicus pulverulentus*), and Palawan Hornbill are classified as Vulnerable (VU) by the IUCN. Additionally, the Nicobar Pigeon (*Caloenas nicobarica*) is classified as Near-Threatened (NT). These noteworthy avian species were recorded at Sites 1 to 4.

Among the mammals, the Palawan Spiny Rat (*M. panglima*) and Palawan Montane Squirrel (*S. rabori*) are Palawan endemic species while the Common Rousette Bat (*R. amplexicaudatus*) is heavily hunted for food.

The four herpetofauna species, Philippine Toad, Fork-tongued Frog, Palawan Flying Lizard, and Palawan Water Monitor Lizard (already mentioned) are also noteworthy species because these are endemic species; in particular, the last two reptiles are narrow endemics in Palawan Island Complex. Another noteworthy species is the Malayan Box Turtle (*C. amboinensis*) as it is classified as Vulnerable (VU) by the IUCN, and is also being hunted, together with the Palawan water monitor lizard, either as food or as pet.

According to Whittaker (2007), most of the island species are endemic. Based on the results of this study, Lio Tourism Estate site, which is a small portion of the Palawan Island, caters to a lot of endemic terrestrial wildlife. However, their status is very critical due to habitat degradation and human activities. With this, possible impacts of the development of the Lio Cove Resort were identified and assessed and mitigating measures were recommended to conserve the terrestrial and freshwater wildlife in the Lio Tourism Estate site.

Key Potential Impacts on Terrestrial Fauna

Activity: Improvement of access roads

Improvement of roads mainly involves the clearing of adjacent vegetation and this will result to loss of habitat for wildlife animals. A trail was observed in Site 4 that starts from the pond and ends in the Airport that is currently used for tourist adventure. Several wildlife animals were recorded in this site including the Palawan flowerpecker, the vulnerable Palawan Hornbill, Yellow throated leafbird, Palawan Montane Squirrel, Palawan Flying Lizard and Palawan water monitor lizard. Removal of trees that serve as habitat will result to wildlife displacement.

Road rehabilitation involves excavation of soil, re-paving, cement or asphalt reinforcement that will result to dust accumulation. Extreme suspension of dust particles may cause respiratory problem of wildlife animals that could possibly lead to displacement and for less mobile organisms, death. Also, construction of roads entails movement and activities of heavy vehicles that generates noise that could possibly displace wildlife organisms.

Activity: Airport development

Improvement of the airport involves clearing of the remaining grassland vegetation and this entails the use of exhaust-emitting vehicles, accumulation of dust from road construction (that affects the wildlife which is already mentioned) and noise generation. The combined effects can result to wildlife displacement.

Mangrove area and river were seen at the southern part of the Lio Tourism Estate where important wildlife was observed including the endemic Palawan Montane Squirrel and Palawan Water Monitor Lizard. Soil excavation, dust from drilling and emitted exhaust may increase level of dust accumulation that will result to stockpiling of soil and gravel materials. Siltation may form when

heavy rain carries the accumulated dust and stockpiled soil and will make its way to the river. This can destroy riparian habitats that can be considered as their foraging and breeding grounds. .

Activity: Construction of new buildings

Development of Lio Tourism Estate involves the construction of additional buildings and this requires clearing of vegetation, noise generation of vehicles and equipment and dust accumulation that may result to siltation and respiratory impairment of wildlife animals. The cumulative effects may result to wildlife displacement and death.

Construction debris may come in the form of dust (affects respiratory organ) and rocks. These rocks can be deleterious that can result to injury to wildlife animals

Activity: Construction of leisure area

Construction of leisure area like parks, gardens, golf course, swimming pools, roads or even parking area and these may require large area of land. Clearing of vegetation may result to loss of nesting habitats for birds, or even worst, wildlife displacement, migration and mortality. Use of heavy vehicles during the construction phase may generate noise and dust accumulation.

3.2 WATER

3.2.1 Hydrology/Hydrogeology

Natural Drainage Systems

There are several rivers in the vicinity of the Lio project site but only two are perennial, Bulacacao River north of Lamuro Beach and Lio River south of Lio Airport (**Figure 33**). Bulacacao River has a watershed area of approximately 3,294.49ha while Lio River has a watershed area of about 2,596.31ha. A smaller river called Batbat River along with numerous small creeks and waterways drain the project site and discharge into Bacuit Bay.

The riverbed and banks upstream of Bulacacao River are dominated by gravel with some portions of the riverbank covered with thick vegetation that can retain sediments. However, human activities upstream can offset the role of vegetation in protecting the watershed. Rice farming is practiced along the flanks of the river and at the slopes of the mountain. Gravel extraction done along the riverbanks also loosen the soil and enhance the transport of fine materials into the river and eventually offshore.

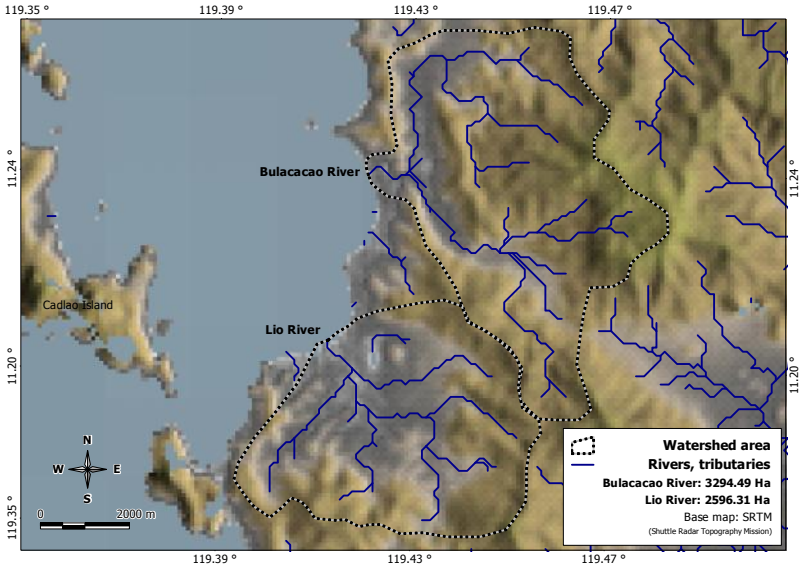


Figure 33. Watershed Map of Bulacacao and Lio Rivers (Source: Siringan et al 2010).

Small intermittent creeks were observed north and south of the Lio project site. These creeks are 0.5 to 2m wide and about 10cm deep. These creeks are intermittent that dry out during the summer months and during extended rain-free periods.

The proposed Lio Tourism Estate is not expected to result to change in drainage morphology. TKPI is expected to maintain the wetland areas within the property to preserve their ecological value.

Groundwater

Geo-resistivity survey conducted at the project site reveal the presence of an aquifer consisting of deep-seated layers of dry rock units. The aquifer was found to have low to high yield potential and with variable permeability.

Due to the absence of a piped distribution water supply system, residents of the two impact barangays (Villa Libertad and Pasadeña) source their water from dug wells and springs. At least 13 wells were identified during the water resources study conducted in 2012, the location of which is listed below.

Table 21. Well data collected during the water resources study in the project site (DCCD 2012).

Well No.	Owner	Location	Depth (mbg)	SWL (mbg)	Nos. User Household	Usage *	Remarks
1	El Nido Cove Resort	Pasadeña	9			W	Jet Type Pump
2	El Nido Cove Resort	Pasadeña	9	2		W	Centrifugal Pump
3	El Nido Cove Resort	Pasadeña	9		4	D, W	Hand Pump
4	Lio Property	Pasadeña	4	1.5		W	Dug Well, Piggery
5	Lio Property	Villa Libertad	1		2	D, W	Dug Well
6	Lio Property	Villa Libertad	1.5	0.3		Ir	Dug, Well
7	Roberto Zata	Villa Libertad	2.2	1.1	15	D, W	Dug Well
8	Fernando Garcellano	Villa Libertad	0.4		10	W	Dug Well/Spring
9	Neria Bacunes	Villa Libertad	5.5		20	D, W	Dug Well/Hand Pump
10	Bgy. Gov't.	Villa Libertad	4.2	2.1			Abandoned
11	Rogelio Valdez	Villa Libertad	5.3	3	8	W	Dug Well
12	Juanito Castillo	Villa Libertad	1.9	0.4	20	D, W	Dug Well
13	Primo Cabutihan	Villa Libertad	1.5		15	D, W	Dug Well

* D-Drinking W-Washing Ir- Irrigation

Water Balance Analysis

Total annual groundwater recharge into the Lio Property is computed at 3.2 MCM or 365 m^3/hr. Additional recharge can be obtained from the marshland or lagoon located in the property. The water balance computation is provided below.

Sub-Basin ID	Water Balance Components				
	MEAN RAINFALL (mm/yr)	ACTUAL EVAPO. (mm/yr)	EFFECTIVE RAINFALL (mm/yr)	DIRECT RUN-OFF (mm/yr)	GRD. WATER RECHARGE (mm/yr)
CA1	2,613	1,331	1,282	1,006	277
CA2	2,613	1,333	1,280	1,001	280
CA3	2,613	1,333	1,280	1,001	280
CA4	2,613	1,329	1,284	1,011	274
CA5	2,613	1,441	1172	909	264
CA6	2,613	1,329	1,284	1,011	274
CA7	2,613	1,332	1,281	1,003	278
CA8	2,613	1,332	1,281	1,003	278

The water balance analysis for runoff also reveals that maximum flow rates occur during the month of August while low stream flows were generated for the months of November to May.

3.2.2 Oceanography

Bacuit Bay forms the eastern boundary of the project site. It is a 150-sq km bay that includes five major islands and nine smaller islands located on the shelf outside the bay. There are three submarine terraces within Bacuit Bay: (1) a near-shore submarine terrace that is 0.5km wide and 8m deep; (2) a 2-km wide and 18-m deep second terrace; and (3) third terrace extending out of the bay entrance at a depth of 40m. Due to its oceanographic characteristics, there is low water exchange in and out of Bacuit Bay (Sabater 2004).

Wind driven currents dominate water transport in Bacuit Bay. Wind speeds between 1.7 to 5.8 mps create surface currents between 0.137 to 0.330 mps in the same direction.

Tidal variation within the bay is approximately 1.5m. The lack of narrow channels results in relatively sluggish tidal currents during the outgoing tides and calm wind conditions.

The dominant wind patterns in Bacuit Bay include the southwest monsoon (habagat), northeast monsoon (amihan), daplak (northerly wind) and salatan (southerly wind). The daplak is dominant from October to March while the salatan is dominant from July to September. These wind patterns affect wave movement in Bacuit Bay. Strongest wave movements are experienced in November while sea condition is relatively calm from April to June.

Long shore currents

The shifting mouth of the Lio River is an evidence of the shift in the direction of the prevailing longshore current along Lio coast. During the northeast monsoon, the longshore current along the southern segment of the Lio coast is towards the southwest. The long shore current shifts in direction towards the northeast during the southwest monsoon. At the northern segment of Lio Coast at Lamarao Point, the longshore current is to the northeast south of the point and to the southwest north of the point during the northeast monsoon. This convergence of longshore currents probably enhances the deposition of sediments along this segment of the shoreline. Long shore current is towards the northeast in Lamarao Point during the southwest monsoon.

Figure 34 presents the energy profile of Lio Coast. As shown on the map, low wave energy is experienced in Lio coast. The highly sorted sediments found on the beach of Lio coast are also evidence of the low wave energy in the area.

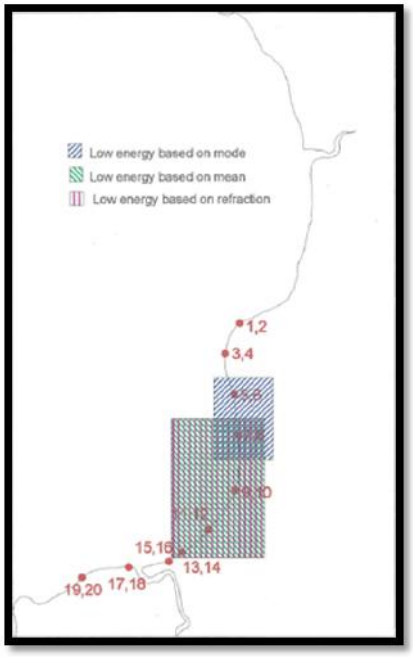


Figure 34. Energy Profile of Lio Coast

The abundance of sand-sized fractions in water depths greater than 2m indicates that these sediments can be transported efficiently by the coastal currents. The general scarcity of silt and clay-sized particles in the bottom sediments is a possible result of the low fine-grained sediment load of the river. The coincidence of the southwesterly winds with the higher precipitation in the area favors the northerly transport of fine-grained sediments.

Bathymetry near the Lio project site

Bathymetric surveys were conducted in Bacuit Bay on January 2010. The survey results indicate that the bathymetry essentially follows the coastline of Lio. However, there is an abrupt drop in slope near the jetty as seen by the 1-fathom (~1.8m) and 3-fathom (~5.5m) contours that are very close to the 0-m shoreline. Slope is gradual at Pancalan, Lamarao and Cagpatang Points due to the presence of coral reefs. The recent bathymetric data was found to be deeper and steeper compared to the 1950 NAMRIA bathymetric map. However, it could not be determined if this change in bathymetry is due to long-term or seasonal change. **Figure 35** presents the bathymetric map of Lio. The map shows the relatively gentle gradient of the beach in Lio with only about 2-m depth several meters offshore.

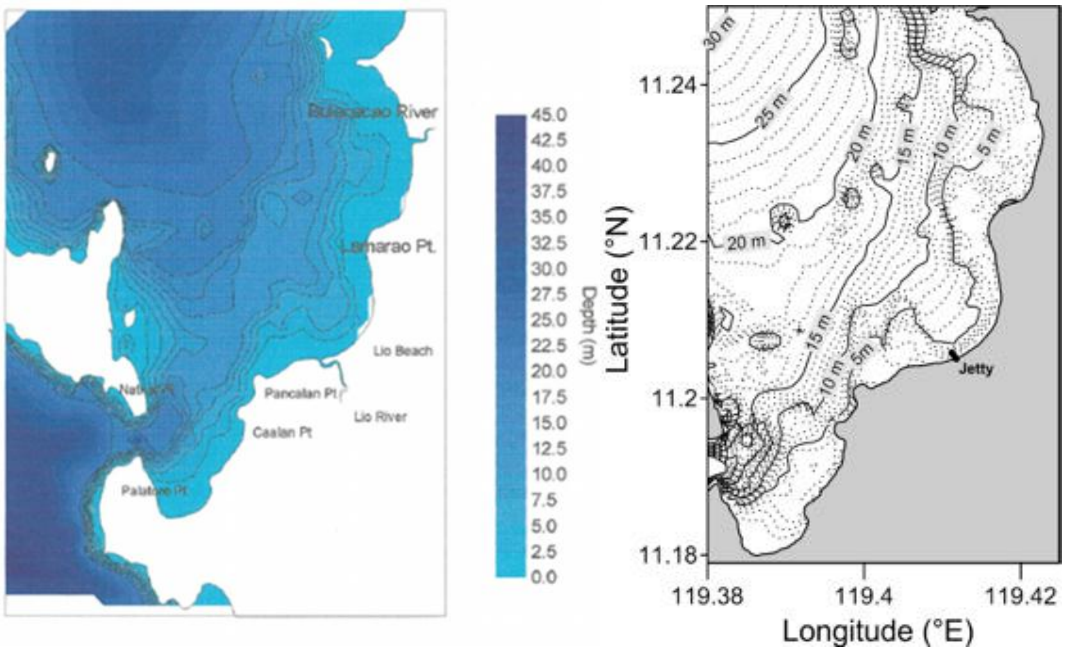


Figure 35. Bathymetric Maps of Lio

Wave Modeling for near shore areas of Bacuit Bay

Wave modeling was done for Bacuit Bay on January 2010 (**Figure 36**) to determine the wave conditions in the area during both monsoonal and daplak conditions, determine the potential impact on coastal sediment stability and transport, and determine the relative wave energy distribution along the Lio coast for jetty site selection.

The beaches of Lamarao and Lio are more exposed to waves coming from the north and episodes of large waves reaching the area occur and are known locally as “daplak”. This is not associated with monsoonal forcing but by the arrival of large swells most likely generated by typhoons or severe storms further north near Luzon. Comparison between monsoonal wind-generated waves show the simulated waves during the NE monsoon are much larger compared to that of the SW monsoon. Cadlao Island shields the coasts of Lio and Lamarao from the SW monsoon and also blocks the waves coming from the southwest. The small channel separating Cadlao Island from the mainland is the only place where waves from the southwest can enter into the Lio area.

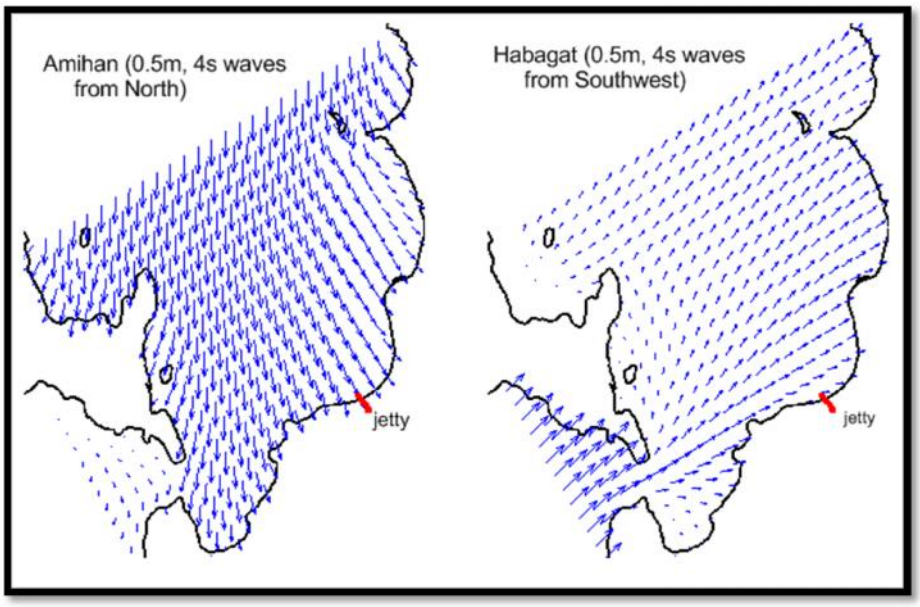


Figure 36. Simulated wave directions (arrows) and wave heights (size of arrows) using the coarse grid wave model forced by monsoonal winds.

Figure 37 shows a closer look at the wave propagation near the Lio coast. Areas of high orbital velocity indicate areas where there is a strong interaction between the incoming wave and the shallow bottom. Wave refraction is also observed in areas near fringing reefs, such as the area in the northern part of Lio beach. The areas along the coast with diverging wave propagation paths represent areas with relatively lower wave energy densities resulting in smaller wave heights. The sheltered part of the coast also coincides with the smallest beach slope resulting in waves breaking over a much wider width of the shore and with the finest grain size distribution.

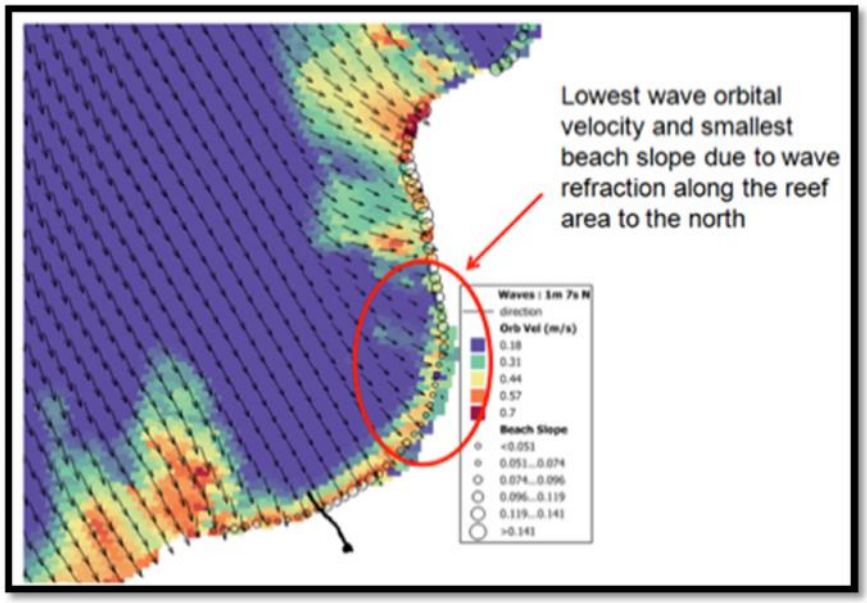


Figure 37. Wave orbital velocity (contours) and wave directions (arrows) during northeast monsoon simulation (7 s wave period, 1m wave amplitude at open boundary, 5ms^{-1} wind speed from NE. Scaled circles along the coast represent beach slope.

The wave model was also used to simulate waves for changing wind directions and the direction of imposed incoming waves coming from offshore areas. Three directions were chosen and are shown in **Figure 38**. Note that the Lio area is most sheltered if the winds are coming from the northeast and most exposed when wind and waves are coming from the northwest. However, in all cases, the area along the coast, which has the lowest significant wave height, is consistently the area just south of the reef in the northern part of Lio Beach. This area is the same area identified earlier as the area most likely to be the most sheltered during the northeast monsoon season. Increasing the wind forcing from 2 to 10 ms^{-1} shows this same area having the smallest wave height (**Figure 39**).

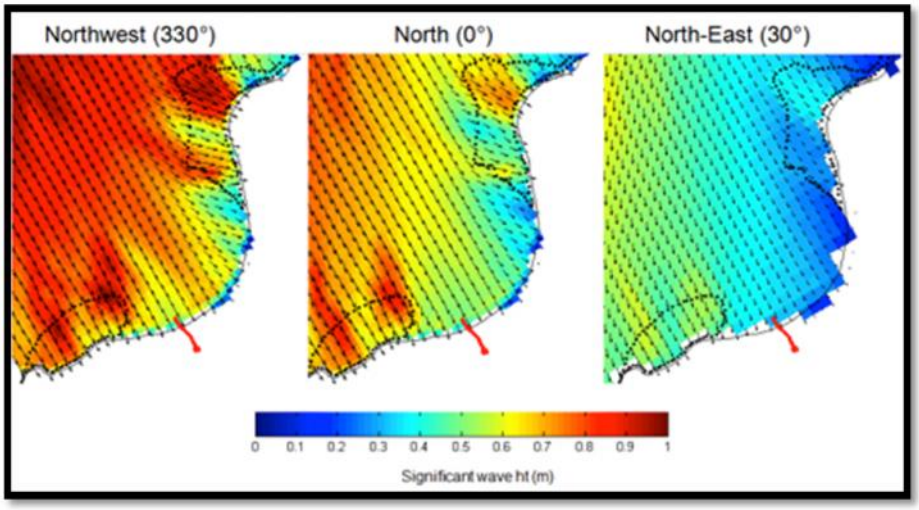


Figure 38. Simulated significant wave height for different wind and wave directions. Simulations are driven by 5ms^{-1} wind speeds, and 7 s period and 1 m amplitude waves prescribed at the open boundary.

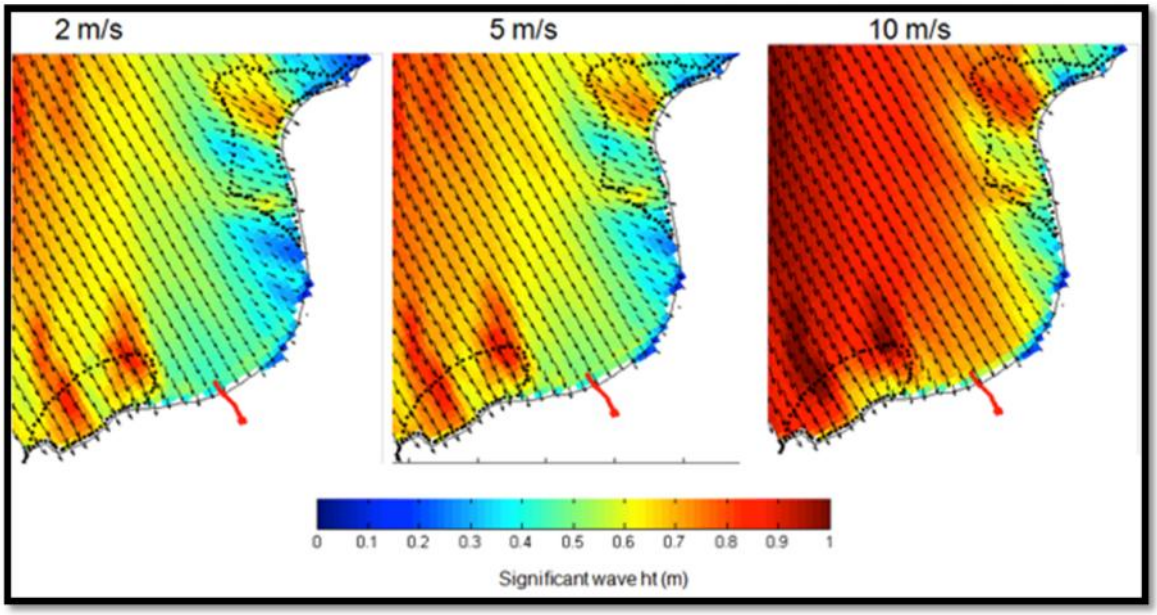


Figure 39. Simulated significant wave height for different wind speeds. Simulations are driven by wind, and 7 s period and 1 m amplitude waves prescribed at the open boundary.

3.2.3 Water Quality

Water samples were obtained from three marine water-sampling stations and three surface water sampling stations on 03 August 2014. Additionally, one groundwater and one surface water sample was obtained on 14 August 2014. The water samples were submitted to CRL Environmental Laboratory for microbiological and physico-chemical analysis. Laboratory analytical methods are listed below while the location of sampling stations is shown on **Figure 40.**

Parameter	Analytical Method
Total coliforms	Multiple tube fermentation technique
Fecal coliforms	Multiple tube fermentation technique
Biological oxygen demand	Azide modification Winkler
Oil and grease	Petroleum ether extraction
Nitrate	Colorimetry – Brucine
Phosphate	Stannous chloride method

In situ measurements using handheld water quality testing equipment were done for the following parameters: pH, conductivity, salinity, resistivity, dissolved oxygen and temperature.

3.2.3.1 Surface Water

Surface water samples were obtained from creeks and rivers encountered in the project site and vicinity. The samples were mislabeled as GW when they were submitted to the laboratory so the sample ID is maintained in the report to be consistent with the sample IDindicated in the laboratory results. The obtained values were compared to DENR standard for Class D water as the creeks and rivers are used for agriculture in some parts of the barangays. Results of sampling conducted during the 2012 EIA are also presented (shaded cells).Based on the laboratory results (see **Table 22, Appendix 5**), except for DO and total coliforms, all parameters are within the DENR standard for Class D water. DO in Stations GW-2 and GW-4are below the minimum standard value while total coliform values in all stations exceeded the maximum standard value. Coliform contamination is attributed to anthropogenic and natural sources. Stations GW-1, GW-3 and GW-4 are located within built-up areas that are possible sources of coliform contamination while Station GW-2 is located within a wooded area inside the project site. Coliform contamination of surface water in this station can be attributed to animal wastes.

Table 22. Surface water quality data for Lio Tourism Estate (August 2014).

Parameters	Units	GW-1	GW-2	GW-3	GW-4					DENR Std*
Description of sampling station		Populated area near old hanging bridge	Within vegetated area in Lio project site	Lio River near Lio airport	River near El Nido Cove	Pond	Intertidal Inlet	Piggery	Upstream River	
Latitude		11.237414	11.225900	11.203483	11.23089	11.211530	11.207400	11.215310	11.219430	
Longitude		119.42490	119.42180	119.41256	119.42303	119.420430	119.415540	119.420890	119.423760	
pH		7.80	6.89	7.41	8.42	6.78	7.09	6.57	6.91	6.5 – 8.5
Conductivity	uS/cm	140.00	62.86	16.25	72.65	303.4	33.72	169.1	61.36	-
TDS	ppt	72.44	33.96	884.60	38.60	0.291	3.186	0.172	61.36	1,000
Salinity	ppt	0.40	0.40	0.60	0.07	0.27	4.86	0.15	0.05	-
Resistivity	Ohms	3.79	8.14	313.4	6.988	1751	1378	2900	8523	-
DO	mg/L	5.61	4.65	5.13	4.23	4.59	3.36	2.75	4.10	5.0 (min)
Temperature	^{0}C	25.70	26.30	26.20	25.7	26.30	26.60	27.60	26.10	3^{0}C inc
Total coliforms	MPN/100mL	3,500	2,400	4,300	5,400					1,000
Fecal coliforms	MPN/100mL	-	-	-	47					100
BOD	mg/L	1	<1	<1	2					5.0
Oil and grease	mg/L	<0.3	0.3	<0.3	0.4					1.0
Nitrate	mg/L	0.4	<0.006	0.6	0.06					10
Phosphate	mg/L	<0.006	<0.006	<0.006	0.01					0.1

* Class D – water used for agriculture, irrigation, livestock watering, etc.

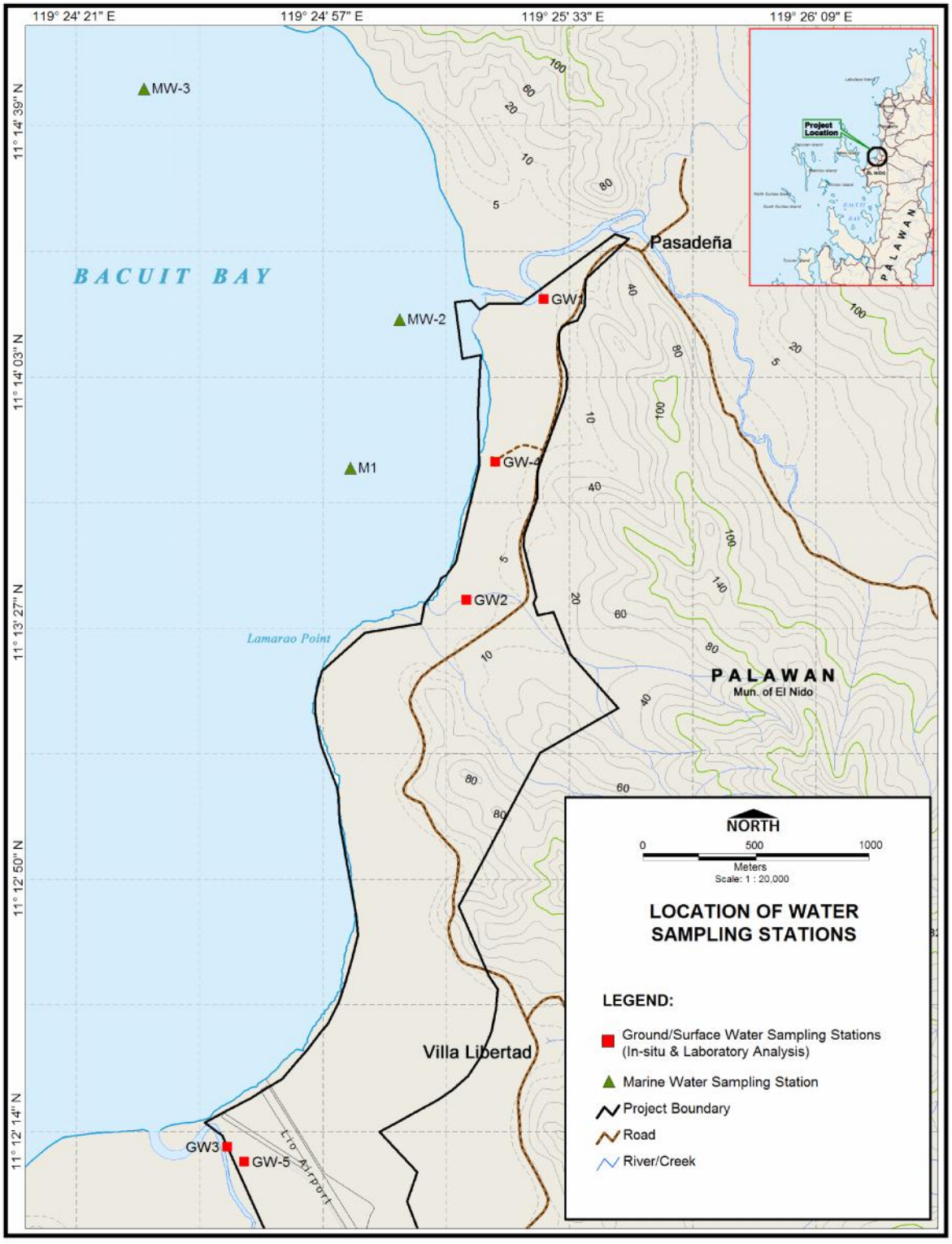


Figure 40. Location of water quality sampling stations.

3.2.3.2 Groundwater

Groundwater samples were obtained from one station in the Lio Airport on 14 August 2014. Data from four stations sampled during the 2012 EIA is also presented as shaded cells in the table. In-situ measurements and laboratory results were compared to the Philippine National Standards for Drinking Water (PNSDW). As gleaned from **Table 23**, values of total coliforms and fecal coliforms in the Lio airport sample exceeded the PNSDW. This is attributed to the anthropogenic activities within and in the vicinity of the sampling site.

Table 23. Groundwater quality date for Lio Tourism Estate (August 2014 and August 2012).

Parameters	Units	GW-5	Spring	Groundwater	FW-1	FW-2	PNSDW
Location		Lio Airport					
Latitude		11.20283	11.214320	11.214330	11.211090	11.213980	
Longitude		119.41321	119.421180	119.421240	119.419140	119.422650	
pH		7.55	6.35	5.96	7.21	5.90	6.5 – 8.5
Conductivity	uS/cm	375.5	51.43	72.92	348.9	44.2	-
TDS	ppt	214.2	0.050	0.082	0.336	0.042	500
Salinity	ppt	0.33	0.49	0.74	0.31	0.04	-
Resistivity	Ohms	1.29	9870	6140	1487	1175	-
DO	mg/L	4.38	4.86		6.46	4.29	-
Temperature	^{0}C	27.3	26.80	27.10	26.40	26.40	-
Total coliforms	MPN/100mL	>23			240	13	<1.1
Fecal coliforms	MPN/100mL	16			240	7.8	<1.1
BOD	mg/L	<1			2	<2	-
Oil and grease	mg/L	0.3			0.53	0.73	-
Nitrate	mg/L	6.0			<0.04	0.12	50
Phosphate	mg/L	0.07			0.01	<0.005	-

3.2.3.3 Marine Water

Marine water samples were obtained from three stations fronting the project site. Data from two stations sampled during the EIA in 2012 is also presented (shaded cells). The values were compared to DENR standards for Class SA water considering that Bacuit Bay is located within the El-Nido Taytay Managed Resource Protected Area. As gleaned from **Table 24**, all parameters are within the DENR standard for Class SA water except for total coliforms in Stations M-2 and M-3 and DO in MW-1 and MW-2. This is attributed to anthropogenic and natural causes, as the rivers and creeks discharging into Bacuit Bay pass through populated areas of the barangays. Marine water quality data obtained during the conduct of the EIA for Phase 1 indicated low DO values in all stations while total and fecal coliform values were within DENR standard for Class SA waters.

Table 24. Marine water quality data for Lio Tourism Estate (August 2014 and August 2012).

Parameters	Units	M-1	M-2	M-3	MW-1	MW-2	DENR Std*
Latitude		11.230590	11.236550	11.23708	11.216740	11.211220	
Longitude		119.41716	119.41908	119.41629	119.412840	119.12130	
pH		7.95	7.92	7.95	7.5	7.94	6.5 – 8.5
Conductivity	uS/cm	28.18	46.95	38.57	48.97	49.38	-
TDS	ppt	27.03	26.45	20.34	55.38	55.97	-
Salinity	ppt	32	32	30	3	2.8	-
Resistivity	Ohms	10.62	10.70	12.78	9.01	8.94	-
DO	mg/L	5.26	5.77	5.63	0.74	0.62	5.0 (min)
Temperature	^{0}C	27.10	26.90	26.90	25	25	3^{0}C inc
Total coliforms	MPN/100mL	4.0	1,600	350	4.5	<1.8	70
Fecal coliforms	MPN/100mL	4.0	920	350	<1.8	<1.8	-
BOD	mg/L	<1	<1	<1	2	<2	3.0
Oil and grease	mg/L	<0.3	0.3	<0.3	0.65	0.74	1
Nitrate	mg/L	<0.02	<0.02	<0.02	<0.04	<0.04	-
Phosphate	mg/L	<0.006	<0.006	<0.006	<0.005	0.01	-

* Class SA – tourist zones and national marine parks and reserves

3.2.3.4 Potential Key Environmental Impacts and Management Measures

Construction Phase

Possible sources of water quality degradation during the construction phase of Lio Tourism Estate include the following:

- Spillage of fuel / lubricants
- Spillage of construction materials during delivery
- Silted runoff from construction sites
- Discharge of domestic waste by construction crew that may cause bacteriological contamination of ground water, surface water and marine water

To minimize the project impacts on water quality, proper management of fuel/lubricants will be done. Oil sumps will also be available to minimize the impact should a fuel spill occur.

Care will be taken in the off-loading of construction materials from the barge. Siltation ponds will be installed around the construction area to minimize the siltation impacts on surface and marine waters.

Septic tanks will be provided in the construction camp to minimize fecal and total coliform contamination to surface, ground and marine waters.

Operation Phase

Possible sources of water quality contamination during the operation phase include the following:

- Wastewater generated in the resorts, hotels, commercial areas, etc.
- Possible spillage of fuel during the operation of diesel-powered boats for guest activities

Centralized and individual STPs will be provided in the various parts of Lio Tourism Estate to ensure that wastewater is treated prior to discharge. There will be separate sewer lines for black water (effluent from water closets, kitchen sinks and urinals) and grey water (effluent from showers, lavatories and condensate from air-conditioning systems). Separate chambers for primary and secondary treatment will be provided for black water and grey water in the STPs. Effluent from the tertiary treatment chamber of the STPs will be stored in clear water tanks for landscape irrigation and flushing of toilets.

Care will be taken during fuel transfers for boats and other fuel-dependent vehicles/ equipment that will be used in Lio Tourism Estate. Oil and grease contamination of marine and surface waters for guest activities (i.e., use of boats) is a residual impact. However, oil and grease data for both surface and marine waters indicate the absence of oil and grease contamination from the use of boats for guest transfers in the three operational El Nido Resorts.

3.2.4 Marine Ecology

3.2.4.1 Marine Benthos

Introduction

The proposed eco-resort will cover a 324-hectare land area in Barangays Villa Libertad and Pasadena, El Nido, Palawan. The development site covers the entire Lio Cove and has an estimated 4km coastal frontage, which extends from the El Nido airport to the Southern-most river boundary of Barangays Libertad and Pasadena (**Figure 41**). In this stretch of coastal waters, coral reef habitats were located and surveyed to collect baseline information in

preparation for the planned implementation of the second phase of the property development. The establishment of accurate baseline information is critical in the formulation of an effective management plan, which aims to achieve minimal project impact on the coastal marine environment of Lio Cove. Specifically, the study aims to:

1) Determine the composition and cover of the different benthic reef categories in the established coral reef stations;
2) Identify existing threats to the overall health of the coastal marine environment;
3) Accurately identify and evaluate possible project impacts on the health of the coral reef habitats and its associated communities; and,
4) Formulate a sound management plan that would effectively address the predicted project impacts.

The report incorporates the results of the 2011 marine habitat survey in Lamarao Point with the recently established monitoring stations to provide a broader perspective on the status of coral reefs in the study site**.**

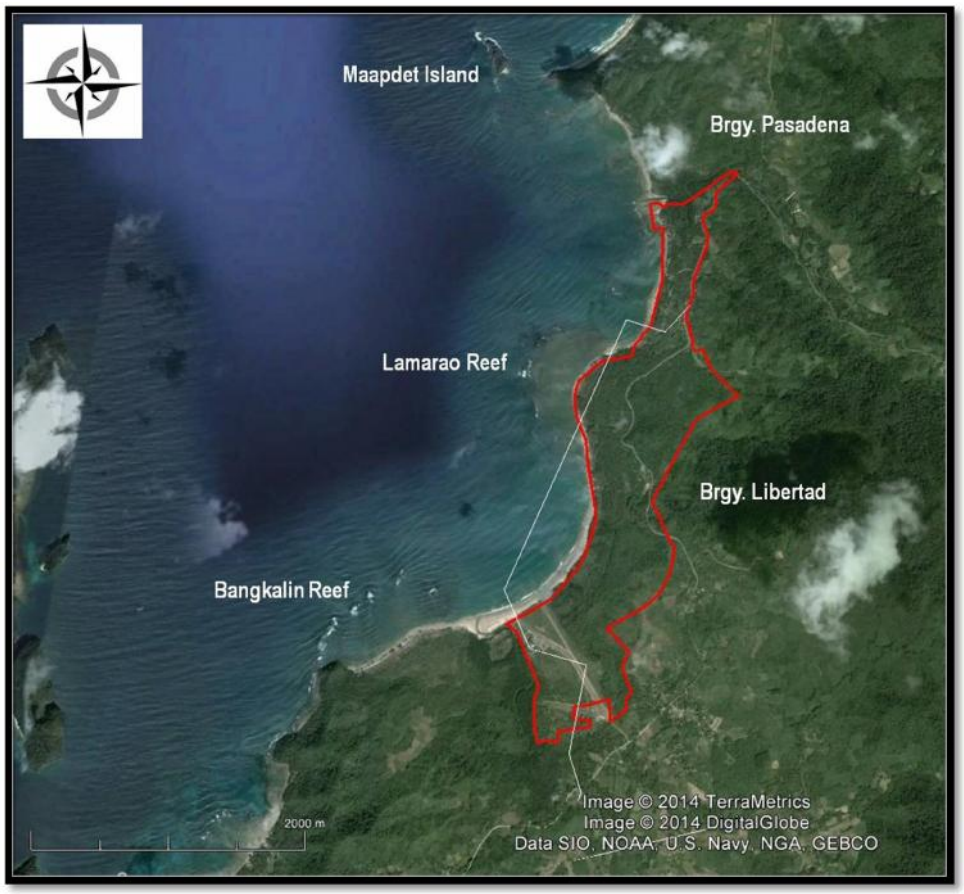


Figure 41. A map of the general project development site in Barangay Libertad, El Nido, Palawan.

Methodology

A total of seven coral reef stations were surveyed in front of a seven-kilometer stretch of coastline from Bankalin Point to the outer fringes of Maapdet Island (**Figure 41**). Except for the southernmost and northernmost stations, which were designated as control stations, the remaining five stations were established on major coralline formations in this stretch of coastline, predicted to be impacted by the project development. A municipal marine reserve,

the Pasadena Marine Protected Area, was also located within the stretch of coastal waters surveyed. However, we were not allowed to census the reef because of their strict "no activity" policy within the boundaries of the reserve. **Figure 42** presents the locations of these coral reef stations. In 2011, the predominance of macroalgae and the highly turbid conditions on the southern edge of Lamarao reef forced us adjust the location of CR2 further westward, near station CR3.

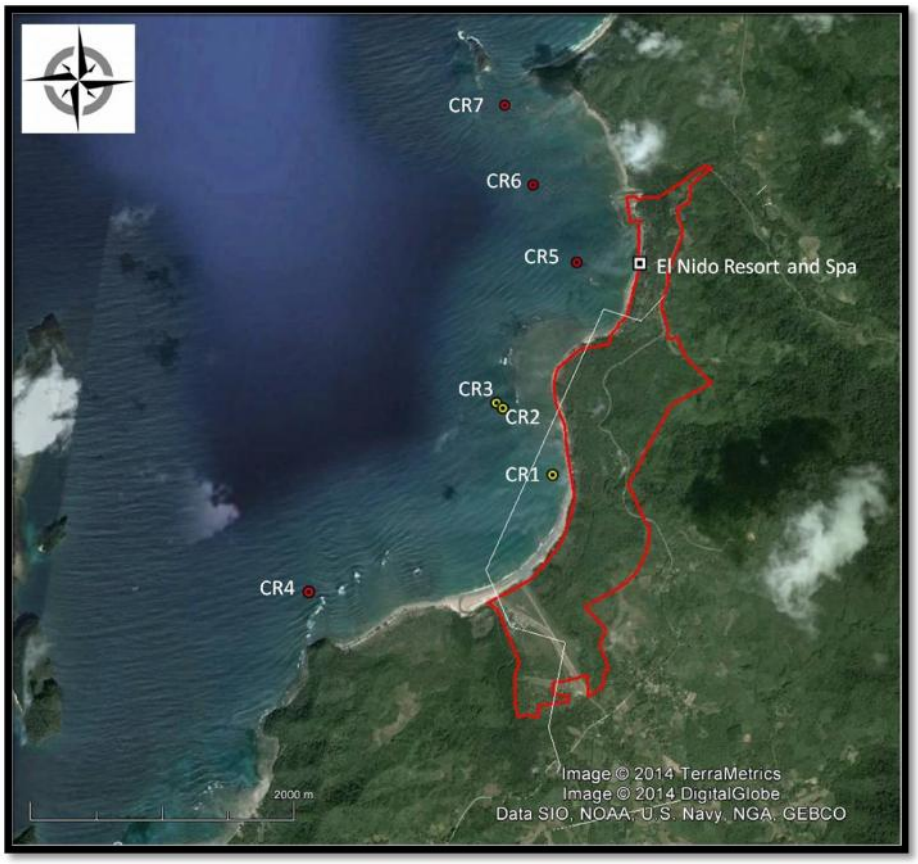


Figure 42. Location of the coral reef monitoring stations in the proposed development site in El Nido, Palawan (August 2014).

In the survey of Lamarao reef, two 30m transects were laid on the beginning of the slope near the edge of the reef flat. The patchy conditions of the reefs in this section of Lamarao reef limited the extent covered by the coral reef census to two 30m transects. Although a well-developed reef was noted in CR3, the number of survey transects per station was maintained at two for this sampling period. In the present survey, three 30m transects were laid on the more contiguous, and coral dominated reef areas of CR4, CR5, CR6 and CR7, to get a better representation of these coralline communities. Difference in the number of replication presents no complications primarily since the difference in the number of replicates are small and that One-Way Analysis of Variance (1 way ANOVA) is considered robust to moderate departures to the homogeneity of variance assumption.

Coral reef assessment was conducted using the Photo-transect (PHOT) Method. Aside from facilitating the conduct of the survey and providing a permanent record of benthic cover, the photo-transect method is also accurate in detecting changes on the reef through time (Leujak and Ormond, 2007). These features make the method ideal for baseline assessment and long term monitoring program of coral reefs. The advantages of using the photo-transect method in coral reef assessment have been extensively discussed in the works of Vergara and Licuanan

(2007), and Leujak and Ormond (2007). In this method, digital photographs were taken at one-meter interval, at a camera to substrate distance of 65 cm. The consistency of the camera distance to the substrate was ensured using a stainless distance bar with a camera mounting provision. The camera was set at custom white balance and is set at full wide angle to capture the largest possible area of the substrate. Photographs were refined using ADOBE Photoshop software. Using the same program, each picture was overlaid with five points, four near each corner and one at the center (**Plate 5**). Photographs are then displayed on a monitor screen and the life forms intercepted in the five points were sampled. In each of these points, life forms intercepted were recorded and scored. Percent cover was computed using the following equation:

$$\%\text{Cover} = \frac{\text{Total Sampled Points of Category}}{\text{Total No. of Points per transect}} \times 100$$

Coral reef status was then categorized based on live coral cover as established by Gomez et al., (1994):

Excellent	>75% live coral cover
Good	50-74.9% live coral cover
Fair	25-49.9% live coral cover
Poor	< 25% live coral cover

Mean cover of major benthic categories was statistically compared to determine significant differences among stations. Data was tested for normality and heterogeneity before subjecting them to ANOVA or the non-parametric Kruskall-Wallis test. ANOVA was used if the assumptions of normality and heterogeneity of data was met and Kruskall-Wallis test was implemented if otherwise.

Plate 5. A sample phototransect frame superimposed with 5 points for benthic scoring and determination of percent cover.

Results

The study site

The southeast coast of Bacuit Bay is characterized by shallow embayments, white sand beaches, rocky promontories and limestone formations. Contiguous and patchy reefal areas, algal meadows, seagrass bed, and sand are the primary coastal habitats that border this section of the bay. The development of these shallow coastal habitats are primarily influenced by sediment and freshwater inputs from Lio River and several ephemeral creeks, and from

strong waves forced by the northeast monsoon (Amihan) (Siringan et al. 2010). In addition, episodes of large waves generated by severe storms in northern Luzon also hit the coast of El Nido (Siringan et al. 2010).

The study area is primarily sandy at the embayments with more developed coralline formations at the promontories and the more exposed sections of the cove (see **Figure 42**). Coral reef formations in the study site were generally shallow at 2m to 4m depth. It was only in Bangkalin reef where the reef area surveyed exceeded a little over 6m in depth. Extensive reef flats were found in Bangkalin, Lamarao reef and in the vicinity of Maapiot Island. In Lamarao Point however, no significant live coral formations were found in the shallow reef flat, which were primarily dominated by macroalgae, primarily *Sargassum* (see **Figure 42**). Macroalgal growth was also dense in the reef flat of Bankalin (**Plate 6**).

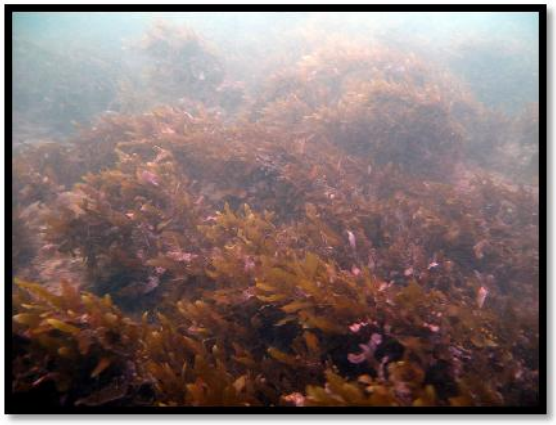


Plate 6. Dense growth of the macroalgae *Sargassum* sp. characterized reef flat of Bangkalin. *Sargassum* bed was also observed in the reef flat of Lamarao Point.

The Coral Reef Community

In general, the coral reefs of the study site exist in a generally stressed state with dense algal growth colonizing more than half of the substrate in 5 of the 7 stations surveyed (**Figure 43**). Hard corals were found to have higher mean cover than algae in the two northern most stations only (**Table 25**). Overall, hard coral cover exhibited a generally increasing trend from south to north of the study site, while algae and abiotics showed the opposite, decreasing in cover from north to south of the study site (**Figure 43**).

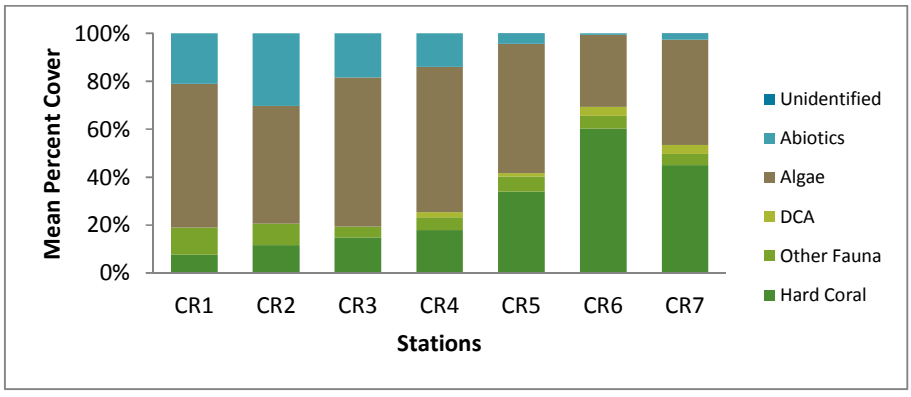


Figure 43. General reef characteristics in the established survey stations in Bangkalin Reef and Lio Cove (September 2011 and August 2014).

Table 25. Mean percent cover and importance value of the different hard corals intercepted on the coral reef stations established in Bangkalin Reef and Lio Cove (September 2011 and August 2014).

Family	Genus	Mean Percent Hard Coral Cover						
		CR1	CR2	CR3	CR4	CR5	CR6	CR7
Acroporidae	Acropora sp.	1.94	2.26	1.94	1.51	18.06	41.72	25.16
	Astreopora sp.	-	0.65	-	-	-	-	-
	Montipora sp.	-	-	0.65	0.65	1.72	1.72	0.86
Agariciidae	Leptoseris sp.	-	-	-	0.22	-	-	-
	Pachyseris sp.	-	0.32	-	0.43	0.65	-	-
	Pavona sp.	-	-	-	-	0.43	-	-
Dendrophylliidae	Turbinaria sp.	0.32	1.29	0.97	0.43	1.94	-	0.43
Euphyllidae	Euphyllia sp.	-	-	0.32	0.22	-	-	-
	Galaxea sp.	0.65	0.32	0.32	0.65	0.22	-	3.01
Faviidae	Barabattoia sp.	0.32	-	-	-	-	-	-
	Cyphastrea sp.	-	0.32	0.65	-	0.43	-	-
	Echinopora sp.	-	-	-	0.22	-	-	0.22
	Favia sp.	-	0.32	0.32	1.51	0.22	-	0.22
	Faviid	0.32	-	-	0.43	0.22	-	0.22
	Favites sp.	-	0.65	-	-	0.65	0.22	0.65
	Goniastrea sp.	0.32	0.32	0.32	0.43	0.22	-	0.22
	Hydnophora sp.	-	-	-	0.22	-	-	-
	Merulina sp.	-	-	-	-	1.29	-	-
	Montastrea sp.	-	0.65	-	-	-	-	-
	Oulophyllia sp.	-	-	-	0.22	0.22	-	0.22
	Platygyra sp.	0.32	-	-	0.22	-	-	-
	Trachyphyllia sp.	0.65	-	-	-	-	-	-
Fungiidae	Ctenactis sp.	-	-	-	-	0.22	0.65	2.37
	Cycloseris sp.	-	-	-	-	-	-	0.22
	Fungia sp.	-	-	-	0.43	-	1.29	4.09
	Herpolitha sp.	0.32	-	-	-	-	-	-
	Psammocora sp.	-	-	-	0.22	-	-	-
Helioporidae	Heliopora sp.	-	-	-	0.43	0.43	0.22	-
Lobophylliidae	Acanthastrea sp.	-	-	0.32	-	-	-	-
	Echinophyllia sp.	-	-	-	-	0.22	-	-
	Oxypora sp.	-	-	-	0.22	-	-	-
	Symphyllia sp.	0.32	0.97	-	-	-	-	0.22
Milleporidae	Millepora sp.	-	-	-	0.22	0.22	-	0.43
Pocilloporidae	Pocillopora sp.	1.29	-	-	-	-	4.30	0.22
	Seriatopora sp.	-	-	0.32	0.65	0.43	3.23	2.37
	Stylophora sp.	-	-	-	1.08	0.22	-	0.43
Poritidae	Goniopora sp.	0.32	1.61	0.65	0.22	0.22	-	-
	Porites sp.	0.32	1.94	8.06	7.10	5.38	6.88	3.44
Unidentified	UNID-HC	0.32	-	-	-	0.43	-	-
Mean Percent Cover		**7.74**	**11.61**	**14.84**	**17.85**	**33.98**	**60.22**	**44.95**
No. of Genus		**12**	**13**	**12**	**22**	**20**	**9**	**18**

The reefs of Bangkalin (CR4) and Lamarao (CR1, CR2, CR3) exist in a poor state with live coral cover estimate falling below 20% (**Figure 44**). The reefs in the northern part of Lio Cove exist in a much better condition highlighted by the 60% live coral cover in station CR6. Live coral cover estimate in station CR6 was significantly higher than live coral estimates in Stations CR1 to CR4 ($p=0.002$). Across stations, branching and massive forms of hard corals characterized the hard coral community of the reefscape. Massive hard corals were found to have the highest mean cover in the four stations that exists in poor state, while branching corals grew in dense aggregations on reefs with fair to good status (**Figure 44**). In spite of the relatively low mean cover of hard corals in the study site, a diverse aggregation of hard corals was found thriving on these shallow reefs. Overall, a total of 37 hard corals classified under 11 families were identified in the study site while several Faviids and other hard corals intercepted in the transects remain unidentified. Overall, *Acropora* and *Porites* (**Plate 7**) were observed to comprise the majority of the hard corals identified across stations. These hard coral genera are considered as the primary reef builders in the Indo-Pacific region (Montaggioni 2006).

Furthermore, the branching forms of these two genera provide notable relief and structural complexity to the reef. Other hard corals with relatively high mean cover were *Pocillopora* (**Plate 8**)in CR1, *Goniopora* in CR2, *Turbinaria* in CR3 and CR5, *Favia* in CR4, and *Fungia* in CR6.

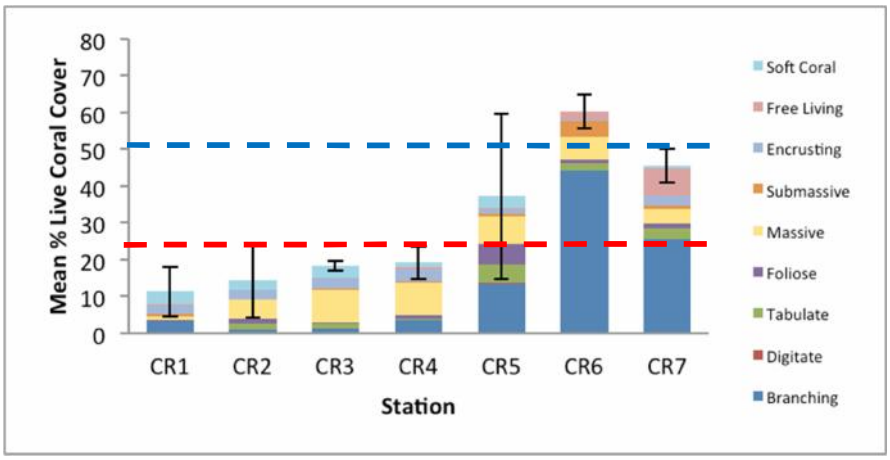


Figure 44. Mean percent live coral cover and life form composition across established coral reef monitoring stations in the study site (September 2011 and August 2014). Marked by the red broken lines is the upper limit of the poor category. The broken blue lines in turn, marked the upper limit of the fair category.

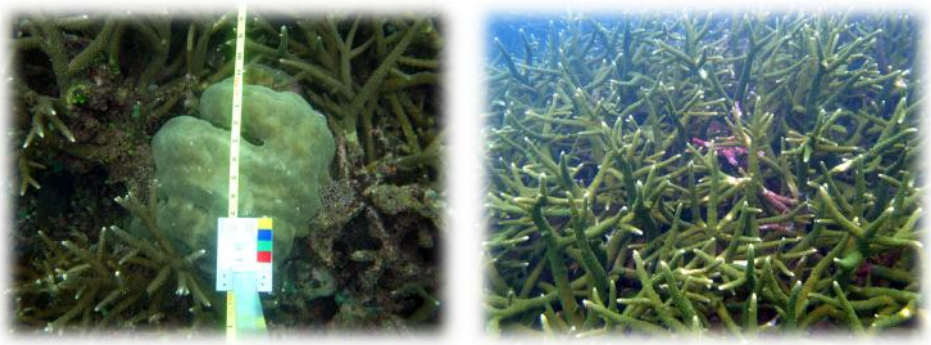


Plate 7. A massive *Porites* (center) amidst branching colonies of *Acropora* (left). Dense growths of branching *Acropora* characterized the shallow Northern reefs of Lio Cove (right). These genera were the most commonly intercepted hard corals in the study site.

Plate 8. Dense growth of submassive *Pocillopora* characterized the shallow reef flat of Station CR6.

Mean cover of invertebrate fauna other than hard and soft corals (OT) remained consistently low and did not significantly differ in mean cover estimates across stations (p=0.30). In the study site, mean percent cover of invertebrates under this category ranged from less than 1% in CR3 to 9% in CR7 (**Figure 45**). In the study site, this category was strongly predominated by sponges except in CR3 where crinoids were the more common invertebrate fauna intercepted other than corals. Other invertebrate fauna noted in the study site include bacterial mats, lophophorates, crinoids, polychaets, lophophorates, giant clams, tunicates, octocorals and whip corals.

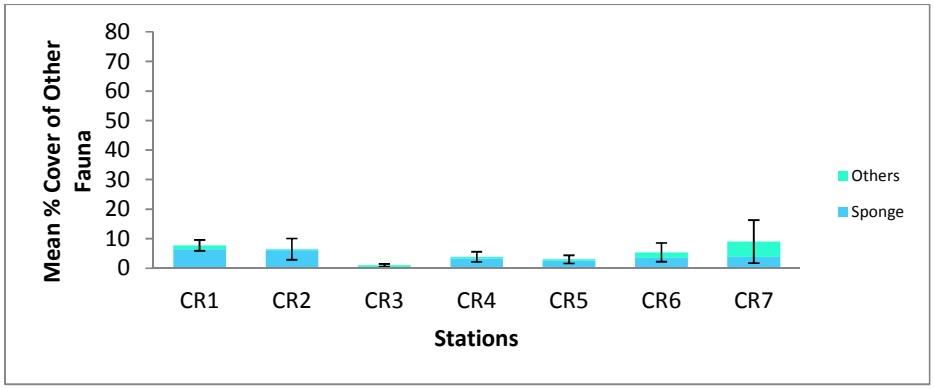


Figure 45. Mean percentage cover of the major invertebrate groups under the OT category in reefs across the 7 stations surveyed (September 2011 and August 2014). The octocoral *Heliopora* and the hydroid *Millepora* were not classified as OT but were instead included in the hard coral category due to their hard skeleton.

Percent cover of algae growing on non-coralline and fossilized reef substratum such as algal assemblages (AA), coralline algae (CA), macro-algae (MA), macro-algal assemblage (MAA), and turf algae (TA), and those growing on the more recently dead corals (DCA), were combined under the Total Algae class. Algal growth was dense and their cover extensive across the stations surveyed (**Figure 46**). It was only in station CR6 where relative algal cover fell below a significantly low level at 33.76% (p=0.01). Overall, the densely growing algal assemblage category (**Plate 9**)covered the largest portion of the reefs in the study site. Dead corals with algae (i.e., a category used to represent dead coralline substratum with low density algal cover as evidenced by the still visible coral skeletal features) were absent in Lamarao Reef and were sporadically intercepted in the remaining 4 stations. Dense growth of algal assemblage results in two things on the reef. First, it competes with hard corals, particularly the settling recruits, for space on the reef (**Plate 10**). Secondly, when silt particles settle on dense algal assemblage mats (**Plate 11**), they become trapped in the algal matrix. This suppresses herbivory on these epilithic algae resulting in the continued growth and development of these algal mats (Bellwood and Fulton 2008). This makes coral recruitment more difficult on these reefs.

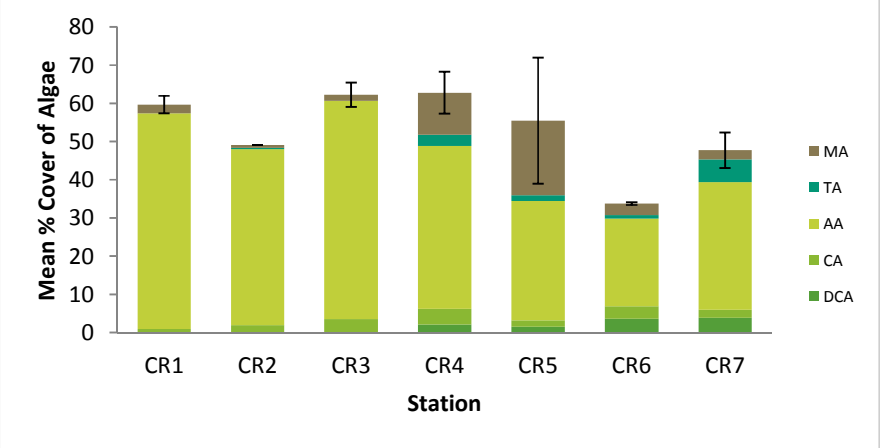


Figure 46. Mean percentage cover of the major algal classes under the Algae category across the monitoring stations surveyed (September 2011 and August 2014).

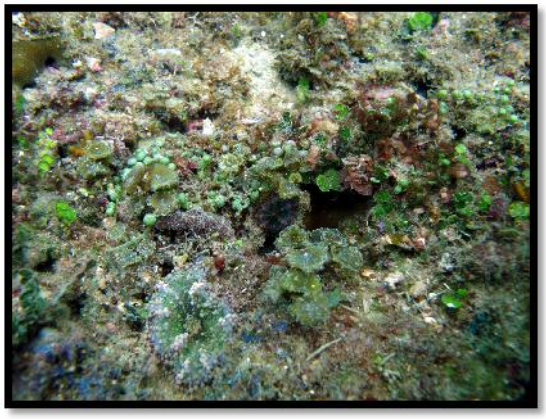


Plate 9. An algal assemblage patch. This category under Total Algae is characterized by dense growth of more than one type of low relief, algae.

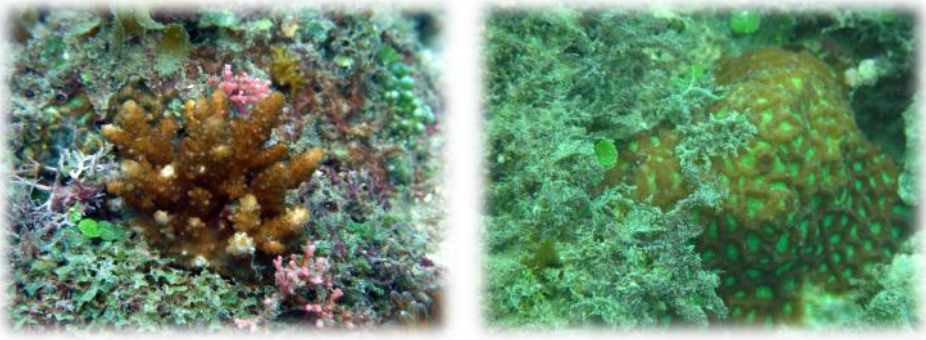


Plate 10. Juvenile corals (*Acropora* (left)and *Goniastrea* (right)) being overwhelmed by dense algal growth in the study site.

Plate 11. A sediment laden algal assemblage. This is the most common feature of the three coral reefs stations in Lamarao Point.

The reefs studied are generally patchy across stations with loose abiotic components (i.e., rubble, sand and silt) covering a large portion of the substrate in the four most southern stations (i.e., CR1 to CR4) (**Figure 47**). Although still predominated by loose substrates, abiotics declined notably in the more northern stations of CR5 to CR7. The observed difference in mean abiotic cover was also significant between station CR2 and the three Northern stations (p=0.003). Abiotics covered a high of 30.32% (CR2) to less than 1% in CR6. Fine terrigenous sediments were the most commonly intercepted abiotic features in stations CR1 and CR2, while sand characterized the abiotics in CR3.

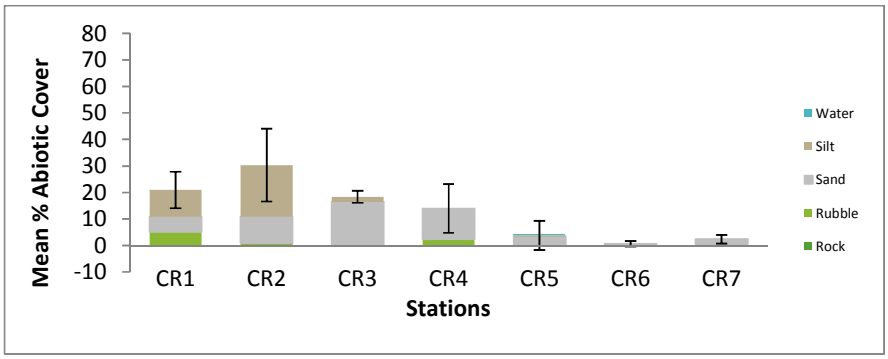


Figure 47. Mean percentage cover of the major abiotic categories in reefs across the 7 stations surveyed (September 2011 and August 2014).

Discussion

The coral reefs of northern Palawan are among the richest and most extensive in the country. These reefs have been recognized as an extremely high priority geographic area for conservation and research studies because of the multifunctional ecological role it plays as a feeding area, spawning ground, nursery area, and sanctuary to a diverse aggregation of marine organisms (COMECO 1996; Ong et al. 2002).However, consistent with a global trend of degradation (i.e., Alvarez –Filip et al., 2006), the coral reefs of the study site showed strong signs of stress as evidenced by the consistently high mean cover of algae (i.e., algal assemblage and macroalgae) across stations and the notably high turbidity observed in the study site. Dense growth of algae inhibits successful coral recruitment. Macroalgae abrades nearby corals that results in tissue damage and in extreme cases, results in the death of the colony. In addition, densely growing, low relief algal assemblage crowd coral recruits and smothers them. Smothering of corals is further facilitated by the amount of sediments trapped in the

algal matrix. Fine sediments trapped in dense algal matrix were commonly observed across sites in Lio Cove. Overall, the threat to coral reef persistence and recovery in the study site is considerably high. However, in spite of this stressed state, there remain reefs in the northern part of Lio Cove that have fair to good live coral cover. These areas need to be protected in order to maintain biodiversity, enhance fisheries in the area, and facilitate reef recovery through recruitment. Hence, all efforts to minimize project impacts on these important coastal marine habitats should be conducted. It should be ensured that recommended mitigating measures are strictly implemented especially since management interventions such as the establishment of marine protected area in Barangay Pasadena, are already in place. The strict enforcement of the "no-activity" policy within the reserve MPA boundary is reflective of the community's awareness of the importance of protecting their coastal marine resources. Hence, it could be expected that community vigilance on the implementation of project related tasks would be high.

Key Environmental Impacts to Coral Communities

In spite of the primary goal of the project, which is to provide an ecologically sustainable tourism destination in mainland El Nido, it is predicted that the project will still impact the overall ecology of the site. Majority of the predicted project impacts are linked to the following activities tied to both the construction and operational phase of the project: (1) earth moving, (2) sediment re-suspension, (3) effluent discharge and (4) groundings. The risks associated with the identified impacts are categorized as Low, Moderate and High, based on the community and environmental status before project implementation, and the magnitude and duration of impacts on the receiving system. **Table 26** presents a summarized risk assessment table linked to major development activities in the study site. In general, the risks associated with development activities are predicted to be moderate (i.e., medium risk). Although the risk of the reefs being exposed to the different stressors is generally high because of their proximity to the development area, the probability of these hazards being realized remains low. In light of the medium risk of the coral reefs being impacted by project development, we have outlined in this document mitigating measures on the most likely impact scenario. In the following paragraphs, we discuss in detail possible impacts and provide predictions on the extent of its effect on the state of coral reefs in the established monitoring stations. Specifically, the degree of impact was predicted based on the following criteria:

a) Condition of the community/habitat before project implementation
b) Impact of stressor to the ecosystem
c) Duration of impact
d) Ease of implementation of mitigating measures

Project development is expected to impact the shallow coral reef ecosystem in Lio Cove. The degree of impacts however is gauged based on the assimilative capacity of the receiving system; the level of threat to the abundance, frequency and distribution of species; loss of species; and, the complete loss of habitat. The following discussion presents an overview of threats to these coastal marine habitats brought about by the establishment of the proposed resort project.

1) Sedimentation

Coastal earth moving activities and offshore port construction will result in an increase in sediment deposition and re-suspension, particularly in the immediate vicinity of the construction site. Land excavation, filling, vegetation clearing, and dust re-suspension will further increase turbidity in the coastal waters of Lio Cove. The increased turbidity of the water column effectively reduces primary production and negatively impacts reef building scleractinians. Furthermore, sediment suspended in the water column abrades coral tissues while sediment deposited smothers corals and other benthic invertebrates.

The rate of sediment deposition, sediment type, and ammonia concentration in the sediment were noted as the more important factors that impacts diversity and abundance of benthic community (Chou et al., 2004). For coral reefs, the already stressed state of majority of the coral reef in the study site would be strongly impacted by increased sediment and nutrient flux from terrestrial ecosystems. Although branching and massive life forms have shown resilience to sedimentation, recruiting colonies would be vulnerable to such stress (see **Plate 10**). As was currently observed on these reefs, sediments would be trapped on the already extensive algal matrix, resulting in reduced grazing of these algae (Bellwood and Fulton 2008). Compounded by increased nutrient flux, the predominance of algae would be further enhanced in the area, particularly in a scenario where sedimentation is not effectively mitigated.

In coral reefs, the spatial extent of the impact could range from patchy to widespread coral mortality depending on the severity of sedimentation. However, this increase in sediment flux will be temporally limited to the construction phase of the project. The risk of coral reefs being impacted by increased sediment deposition is expected to be moderate, particularly in the shallow, northern reefs of Lio Cove and Maapiot Island, where reefs still exists in fair to good condition (**Table 26**). In spite of the relatively short period of exposure to increased sediment deposition and the availability of broad spectrum of measures to control sediment deposition, the predicted impact of sedimentation on the reef remains significant primarily because of the already stressed state observed in most of the reefs in the study site. In this condition, reef resilience to perturbation is low.

2) Water Pollution

Domestic wastewater

During the construction phase of the project, the predicted impact of sewage spillage is predicted to be minimal, especially if the mitigating measures are set properly in place. However, at full operation, the guest capacity of the resort would require significant amount of water, majority of which will be discarded as sewage. When left untreated, domestic wastewater causes significant increase in nitrogen and phosphorous-based nutrients in the receiving water body. In disturbed coral reefs similar to the algal dominated reefs in the study site, nutrification is detrimental and could further reinforce algal dominance on these reefs (Szmant 2002). The planned establishment of an in-house sewage treatment facility that would process all wastewater effluents would significantly reduce nutrient flux to coastal waters. Furthermore, the planned use of treated water for gardening and landscaping purposes would also minimize coastal nutrification. As such, the predicted impact of nutrification on coral reefs is expected to be minimal during the construction phase. However, as the number of guests increase through time during the operational stage of the project, the impact of increased sewage flux on the coastal waters is predicted to reach the mid-range level, especially in instances where the treatment facility break down, even temporarily.

Transport of nutrient enriched surface water run-off

Landscaping activities in selected areas within the 300-hectare property, which aims to visually enhance the surrounding environment of the property would require vegetation clearing and fertilizer input. These activities are predicted to contribute to localized nutrient enrichment in the study site, especially during periods of strong precipitation. However, impacts to the fringing reefs of Lio remain low, especially if the recommended mitigating measures are set in place.

Table 26. Risk assessment matrix of the proposed eco-tourism resort on the coral reef communities of Lio Cove, El Nido, Palawan. Risk estimates made in this table considered that appropriate mitigating measures were strictly implemented. Risk evaluation was based on the matrix of the US-EPA (2004).

Hazard	Pathway	Receptor	Critical Project Phase	Risk Estimation		
				Probability of receptors being exposed	Probability of hazard being realized	Risk
Sedimentation	Water	Coral reefs	Construction	High	Low	Medium Risk
Nutrification and sewage contamination	Water	Coral reef	Construction andOperation	High	Low	Medium Risk
Grounding of marine vessels	Water	Coral Reef	Operation	High	Low	Medium Risk
Increased solid waste generation	Water	Coral reef	Construction and operation	Medium	Low	Medium Risk
Pier Construction	Water	Coral reef	Construction	Medium	Medium	Medium Risk

Influx of chlorinated freshwater

Discharge of chlorinated freshwater from the pool could be a source of contaminant to receiving systems. Chlorine is added to pool water to disinfect and minimize algal growth. However, this chemical was found to depress phytoplankton productivity (Brook and Baker, 1972) and at high concentrations was found to be lethal or at the very least can damage physiological processes of a suite of marine organisms (Kurelec et al., 1983; Cooke and Schreer, 2001). However, chlorine concentrations used for the aforementioned purpose is minimal, and when discharged, the effluent is significantly diluted by the receiving water body. Hence, impact from this operational maintenance activity is predicted to be minimal.

Spillage of petroleum products

The operation of a 1MVa generator set would require a considerable amount of petroleum inputs. On top of this is the additional gasoline and oil requirement of water vehicles tied to the daily operations of the resort. Frequent transport, long term storage and the overall handling of oil and fuel exposes the coastal marine environment to possible spillage of these oil based products. However, considering the nature of oil and the possible amount of these materials finding its way to the marine environment, impacts to coral reefs are expected to be minimal.

3) Solid waste generation

From the construction to the operational phase of the project, solid wastes would be generated and will be directly proportional to the number of people on site. In Lio Cove, solid wastes, particularly plastics and fabrics, could easily get entangled on the shallow branching coral reef structures especially during periods of strong wave action (i.e., medium risk). Entangled domestic wastes could kill entire colonies and in predominantly branching reefs, could cause significant breakage of these highly complex structures (**Plate 12**). Nonetheless, with proper waste management system set in place, it is predicted that very few solid wastes would find its way on the shallow reefs of Lio Cove.

Plate 12. Entangled domestic wastes (i.e., dead vegetation, nylon nets, plastics and fabrics) cause damage and even death of the entire coral colony.

4) Groundings of small watercrafts

The establishment of the hotel and resort will increase shipping traffic in this area of Bacuit Bay on both the construction and operational phase of the project. This increase in traffic also increases the chances of boat grounding on the shallow reef areas, which characterize Lio Cove. Water vehicle groundings physically destroy coralline structures and in severe cases, will result in oil spills. Although the chance of grounding is expected to be low, it is still imperative that surface markers are deployed near shallow reef areas for safe navigation. Markers should be placed on reef areas near navigational routes to ensure that these areas are recognized and navigated properly.

3.2.4.2 Reef Fish Communities

Introduction

The overall aim of the study was to describe and assess the status of reef-associated fish assemblages in selected coral reef stations within the vicinity of the proposed development site. Specific objectives include:

- To describe the current condition of the fish assemblages at the survey sites in terms of species richness, abundance, biomass and compositional structure;
- To assess the status of species richness, abundance and biomass of fish against established benchmarks for the country;
- To identify potential stressor on fish communities that may original from the development project; and
- To propose a list of strategies to mitigate the potential impacts.

Methodology

Fish assemblages were surveyed along three replicate 50m transects at each of the four coral reef stations (except at CR5 – South Cove) where only 2 transects was surveyed) following principles of the fish visual census technique described by English *et al*. (1994). At each station, species richness, abundance and biomass were estimated. Along a 5m band across the 50m transect, fish were identified to species level whenever possible. The use of photographic field guides aided in fish identification (*i.e*. Kuiter and Debelius, 2006; Randal, 2005, Allen *et al*., 2003). The total lengths of fish were estimated to the nearest centimeter and the abundance of fish per species and size were estimated by actual counts. For aggregating or schooling fish, abundances were estimated by clusters wherein the number of fish were counted within a cluster and this was multiplied by the number of clusters that made-up the school or aggregation. The biomass of each species was calculated using the formula $\mathbf{W = aL^b}$, where **W** is the weight in grams, **L** the total length in cm, and ***a*** and ***b*** the species-specific growth constants derived from length-weight relationships (Kulbicki *et al*., 1993; Letourneur, 1998; Letourneur *et al*., 1998; Gonzalez *et al*., 2000; and FishBase, 2004).

Fish species were categorized as “indicator”, “non-target or major” or “commercial or target” species following importance and diet information from FishBase 2004. Indicator species are coral-feeding fish known to be closely associated with live corals; hence, their presence and abundance in an area may provide an indication of the relative condition of that reef (Crosby and Reese, 1996). They include most butterflyfish, and some wrasses and damselfishes. Commercial or target species are commercially important species or those that are targeted by fishermen for the market or for consumption. Commercial fish may be high-value species such as groupers, snappers and jacks, as well as some low-value species such as triggerfish, some wrasses of the genus *Cheilinus*, *Oxycheilinus* and *Hemigymnus*, and even some lionfish *Pterois* sp. Non-target or major species are ecologically important species that hold unique niches and function as important trophic links. These fish are often the most numerous and conspicuous on reefs, and include most species of damselfishes, wrasses, and anthias among others.

Survey data at 3 other stations gathered from a previous survey of the area in 2011 are also presented in the report.

Current Condition and Status of Fish Communities

The results of the study, as well as data from a 2011 survey of three survey stations, were presented in this report. A total of 7 stations were surveyed, 3 from 2011 (CR1, 2, and 3) and 4 from the present study conducted in August 2014 (CR4, 5, 6, 7). The coordinates and relative locations of the survey stations are as follows:

Table 27. Survey stations for reef fish communities in the vicinity of the project site.

Station	North	East	Remarks
CR1	11.213700	119.416050	Lamarao Reef Stn.1 (2011)
CR2	11.218960	119.412030	Lamarao Reef Stn.2 (2011)
CR3	11.219390	119.411500	Lamarao Reef Stn.3 (2011)
CR4	11.204967	119.398445	Algal Dominated Reef near the airport, Bangkalin
CR5	11.231194	119.417412	South Cove Reef
CR6	11.238142	119.413612	North Cove Reef
CR7	11.245653	119.410919	Maapdet Island Reef

Species Richness

A combined total of 156 species of reef-associated fish species were identified from the 7 survey stations (**Appendix 6**). Overall, there were 9 coral health indicator species, 94 major or ecologically important fish, and 53 commercial or target species. The mean total fish species richness was 30 species/250m^2 and mean estimates at individual survey stations ranged from 17 species at Station CR1 up to 44 species at Station CR4 (**Table 28**). Major fish such as damselfishes and wrasses comprised the majority of the species found at each station and they made up from 53% of the mean species at CR6 up to 88% of the species at CR1. Major species were largely damselfish (Pomacentridae, 35 species), wrasses (Labridae, 21 species), and cardinalfish (Apogonidae, 8 species), dottybacks (Pseudochromidae, 5 species), and butterfly and bannerfishes (Chaetodontidae, 4 species) (**Appendix 6**).

Table 28. Mean fish species richness (species/250m^2) from 7 selected coral reef survey stations (Lio, El NIdo, August 2014).

Station	Family	Species	Relative Composition		
			Indicator	Major	Target
CR1	7	17	6	88	6
CR2	14	34	6	68	26
CR3	9	33	9	76	15
CR4	11	44	8	58	35
CR5	6	18	11	72	17
CR6	10	33	14	53	33
CR7	9	25	9	68	23
TOTAL	**10**	**30**	**9**	**67**	**26**

Note: data at CR1, CR2 and CR3 were obtained from an initial survey at the study site conducted in September 2011.

The relative variety of target fish was low compared to major fishes. Target species comprised between 6% and 35% of the mean species richness at each station (**Table 29**). Most of the target fish species were from the family of threadfin breams (Nemipteridae, 8 species), Labridae (7 species), snappers (Lutjanidae, 5 species), surgeonfish (Acanthuridae, 5 species), parrotfish (Scaridae, 5 species), and groupers (Serranidae, 5 species) (**Appendix 6**). Target fish species identified from the survey stations such as the groupers, snappers, threadfins, fusiliers (Caesionidae), breams (Lethrinidae), surgeonfish, rabbitfish (Siganidae) and barracuda (Sphyraenidae) may be considered to have high commercial value. The other target species such as some wrasse, parrotfish, goatfish (Mullidae), and soldierfish (Holocentridae) are of less commercial value, but are nevertheless taken in fisheries for subsistence or the market.

Table 29. Mean fish abundance (individuals/250m^2) from 7 selected coral reef survey stations (Lio, El Nido, August 2014).

Station	Mean Abundance	Relative Abundance		
		Indicator	Major	Target
CR1	78	1	96	3
CR2	277	2	70	28
CR3	216	6	89	5
CR4	294	5	69	26
CR5	80	7	84	9
CR6	208	6	69	25
CR7	168	2	91	7
TOTAL	**195**	**4**	**77**	**19**

Note: data at CR1, CR2 and CR3 were obtained from an initial survey at the study site conducted in September 2011.

There was a total of 9 indicator species, which belonged to the butterflyfishes (Chaetodontidae, 6 species), wrasses (2 species), and a damselfish (1 species) (**Appendix 6**). The relative composition of indicator species was less than 10% of the mean species richness at each station, except at CR5 and CR6 where the comprised 11% and 14%, respectively (see **Table 28**).

Fish Abundance

Pomacentridae (damselfishes) was the single most abundant family among the 31 families of fish identified from the survey stations. All together the mean abundance of damselfishes was 114 individuals/250m^2 (**Figure 48**). This was nearly double the mean abundance of Caesionidae (fusiliers), the second most abundant family, with about 60 individuals/250m^2. Other families of fish that stood out in terms of mean abundance were cardinalfish (Apogonidae), wrasses (Labridae), sweepers (Pempheridae), parrotfish (Scaridae), rabbitfish (Siganidae) and barracuda (Sphyraenidae).

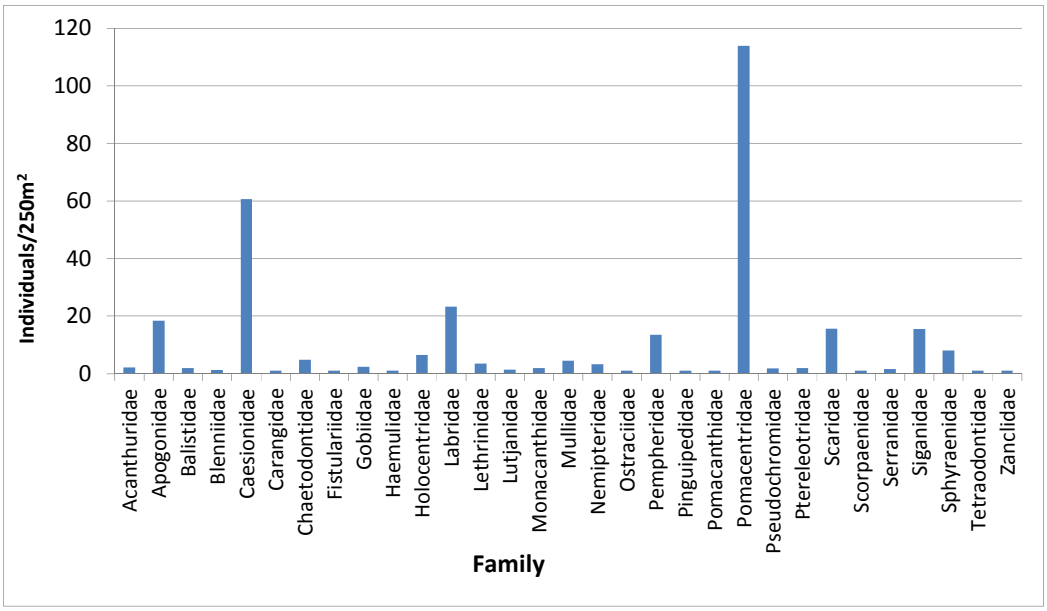


Figure 48. Mean total abundance (individuals/250m^2) of fish families from 7 selected coral reef survey stations (Lio, El NIdo, August 2014).

The mean total estimated fish abundance was 195 individuals/250m^2 with a range of 78 individuals at Station CR1 up to 294 individuals at CR4 (see **Table 29**). Mean fish abundance at CR1 and CR5 were relatively low at 78 and 80 individuals/250m^2, while the count estimates at

Stations CR2, CR3, CR4 and CR6 were considered high at over 200 individuals. Fish abundance at CR7 was moderate at 168 individuals/250m^2. Major fish species were numerically dominant over target and indicator species across all stations and this was especially notable at Stations CR1, CR3, CR5 and CR7 where they comprised between 84% and 96% of the mean estimated abundance. With the compositional bias for major species and the comparatively low relative abundance of target species at these four stations, it is suggested that these may not be important fishing sites for local fishers. The most abundant and common major fish were the damselfish *Amblyglyphidodon curacao*, *Pomacentrus adelus* and *Plectroglyphidodon lacrymatus* (**Appendix 6**). Other major species of notable total abundance were the cardinalfish *Archamia* sp. (Apogonidae, CR2), the damselfishes *Neoglyphidodon nigroris*, *Pomacentrus chrysurus*, *Pomacentrus coelestis*, *Pomacentrus cuneatus*, and *Pomacentrus* sp. At least four of these numerically dominant major fish species are commonly associated with areas of rubble and silt (*P. adelus*, *P. chrysurus*, *P. coelestis* and *P. cuneatus*), while *P. lacrymatus* is associated with dead corals with algal mats (Allen *et al*., 2012; Allen, 1991).

The relative abundance of target fish ranged from 3% to 28% (see **Table 29**). Relative abundance estimates of target fish were highest at CR2, CR4 and CR6 at 28%, 26% and 25%, respectively. At these stations the dominant target species were the fusilier *Caesio* sp. (Caesionidae) at Station CR2, the parrotfish *Scarus hypselopterus* and the soldierfish *Sargocentron rubrum* (Holocentridae) at Station CR4, and the fusiliers *C. cuning* and *Pterocaesio digramma,* the parrotfish *Scarus chameleon* and the rabbitfish *Siganus argenteus* at Station CR6 (**Appendix 6**).

The mean relative abundance of indicator species did not exceed 10% of the mean fish abundance at any of the stations (see **Table 29**). Among the nine coral indicator fish identified the most abundant and common were the wrasse *Diproctacanthus xanthurus* and the butterflyfish *Chaetodon octofasciatus* (**Appendix 6**).

Fish Biomass

The top fish families with the highest overall mean biomass were Caesionidae, Holocentridae, Pomacentridae, Scaridae and Siganidae (**Figure 49**). Fish from these families were moderately sized and generated high estimated biomass, except for Pomacentridae whose shear abundance accounted for their mean total biomass. Other families with noticeable biomass were Fistulariidae (flutemouth), Haemulidae (sweetlips), Labridae and Nemipteridae. Members of these families were considered to be target fish species.

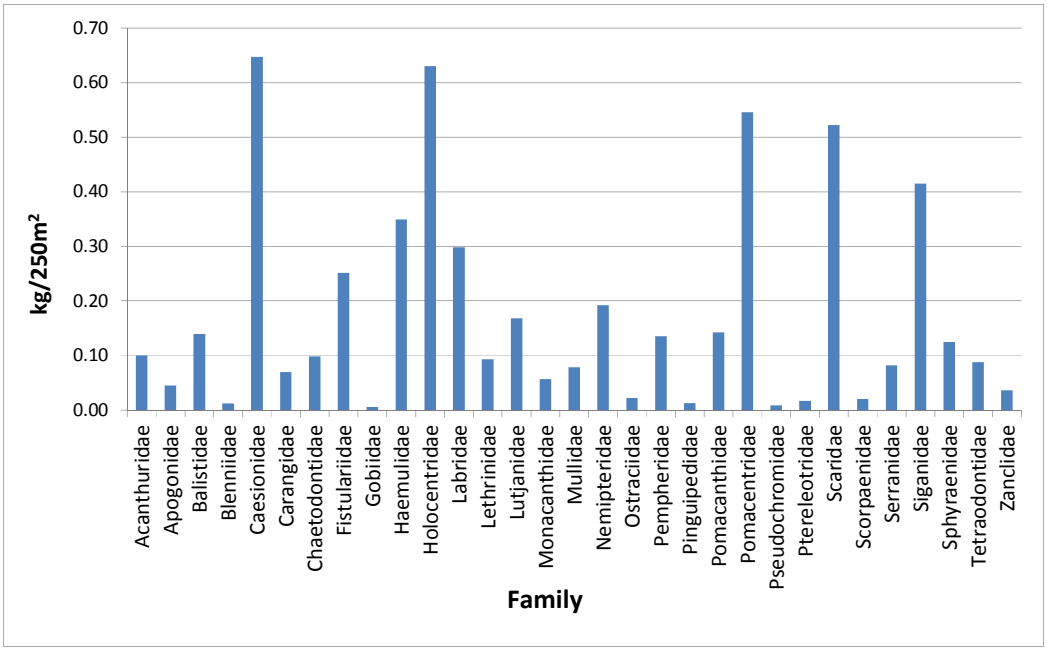


Figure 49. Mean total biomass (kg/250m^2) of fish families from 7 selected coral reef survey stations (Lio, El NIdo, August 2014).

The mean total biomass of fish from the 7 survey stations was 2.3 kg/250m^2 (**Appendix 7**). Mean biomass ranged from 0.3 kg at Station CR1 to 4.2 kg/250m^2 at CR6. Stations CR4, CR6 and CR7 had the highest biomass estimates among the 7 survey stations with over 2 kg, while the other 4 stations had less than 1.5 kg each. Target fish contributed higher relative biomass than major species at 4 stations, but at Stations CR3, CR5 and CR7 major fish species had higher relative biomass contributions. Target species with the highest accumulated biomass were the soldierfish *S. rubrum*, the parrotfishes *S. chameleon* and *Chlorurus sordidus*, and the fusilier *C. cuning* (**Appendix 7**). The soldierfish *S. rubrum* mainly accounted for the biomass of target fish at Station CR4 while *S. chameleon* and *C. cuning* were the 2 main contributors at Station CR6. There were three major fish species whose total accumulated biomass exceeded 1 kg and these were the damselfishes *P. lacrymatus*, *A. curacao* and *N. nigroris*.

Community Status

Survey data on fish species richness, abundance and biomass were extrapolated using species-area plots and species-area relationships, and direct ratio and proportion in order to standardize the units of measure with those used for the benchmark status categories of Hilomen *et al*. (2000). Despite the relatively poor condition of coral communities in several of the reef survey stations, it was encouraging to have relatively good species richness. Standardized species richness data revealed that only 2 of the stations were within the "poor" status category of 27 – 47 species/1000m^2 (CR1 and CR5), 3 stations were within the "moderate" category of 48-74 species/1000m^2 (CR3, CR6 and CR7), and 2 stations fell within the lower range of the "high" category of 75 – 100 species/1000m^2 (CR2 and CR4) (**Figure 50**). Virtually the same pattern was observed for standardized abundance data estimates. Stations CR2 and CR4 had the highest standardized abundance data and were within the "high" category of 2,268 – 7,592 individuals/1000m^2, Stations CR3, CR6 and CR7 were closer to the upper range of the "moderate" status category of 677 – 2,267 individuals, while CR1 and CR5 were at the lower range of the "moderate" category (**Figure 51**). Estimates of fish biomass at the 7 survey stations were relatively poor. Standardized biomass put 4 of the stations in the "low" category of 5.1 – 20 MT/km^2 (CR1, CR2, CR3, and CR5), Station CR7 within the

"moderate" category of 20.1 – 35 MT/km^2, and Stations CR4 and CR6 within the lower range of the "high" category between 35.1 – 75 MT/km^2 (**Figure 52**).

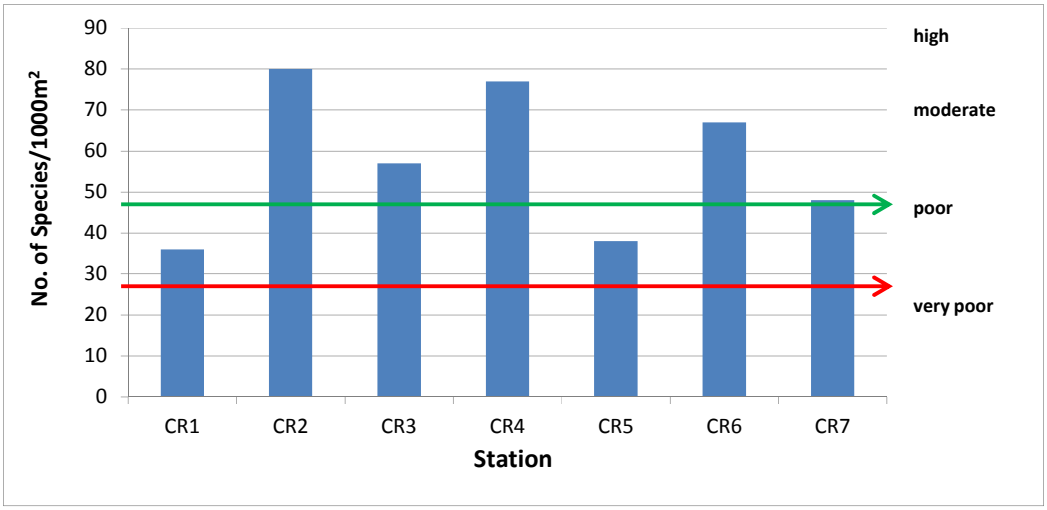


Figure 50. The status of species richness (no. of species/1000m^2) of reef fish assemblages at 7 selected coral reef survey stations (Lio, El NIdo, August 2014). Actual species richness estimates were standardized from 250m^2 sampling areas to 1000m^2 using species area plots (Primer 5) and species-area relationships extrapolation. Status categories are based on benchmarks established by Hilomen *et al.*, (2000) (0-26 very poor; 27-47 poor; 48-74 moderate; 75-100 high; >100 very high).

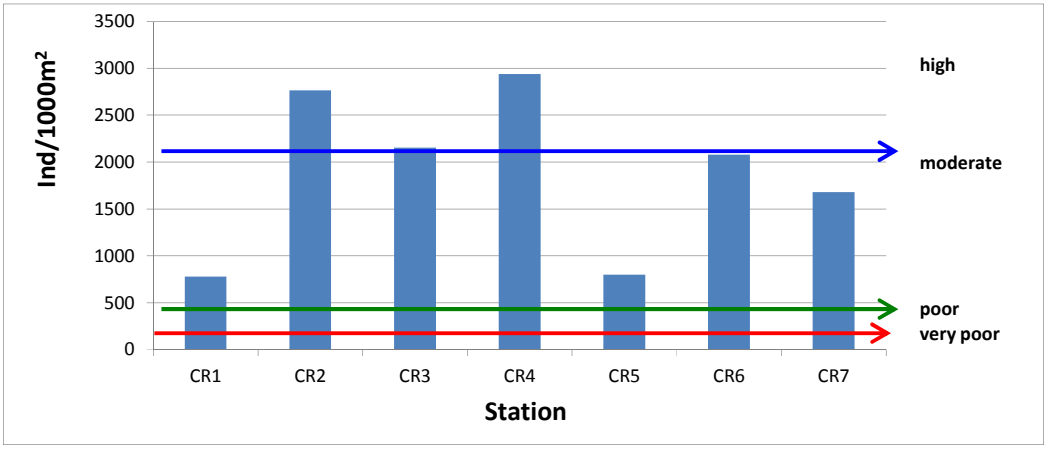


Figure 51. The status of abundances (individuals/1000^m) of reef fish assemblages at 7 selected coral reef survey stations (Lio, El NIdo, August 2014). Actual abundance estimates were standardized from 250m^2 sampling areas to 1000m^2 by ratio and proportion. Status categories are based on benchmarks established by Hilomen *et al.*, (2000) (0-201 very poor; 202-676 poor; 677-2267 moderate; 2268-7592 high; >7592 very high).

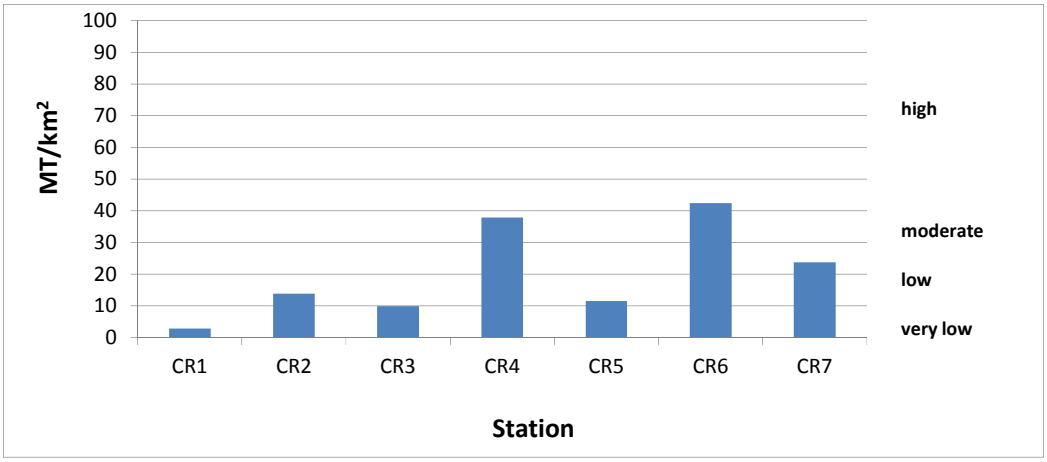


Figure 52. The status of biomass (MT/km^2) of reef fish assemblages at 7 selected coral reef survey stations (Lio, El NIdo, August 2014). Actual abundance estimates were standardized from kg/250m^2 sampling areas to MT/km^2 by ratio and proportion. Status categories are based on benchmarks established by Hilomen *et al*., (2000) (<5 very low; 5.1-20 low; 20.1-35 moderate; 35.1-75 high; >75 very high).

Potential Impacts of Development Project on Fish Communities

Aggravated coastal sedimentation and smothering of coral reef habitats are two of the major potential impacts identified with the proposed development project. Siringan *et al*. (2010) also mentioned these disturbances in their assessment of coastal dynamics and beach stability in the area. Their findings agree with the hazards identified by the Engineering Geological and Geohazard Assessment Report (ARS Testing and Inspection, Inc., 2008).

The predicted impacts of the development project on the fish assemblages in the area may be considered indirect. Changes in the physical and biological features of coral reef habitat from coral dominated to the less preferred algae or silt dominated reefs, can lead to changes in the diversity, composition, structure of fish assemblages and the overall productivity of the area (Ainsworth and Mumby, 2014).

Construction Phase

- **Solid and liquid waste**. Considerable volume of solid and liquid waste will be generated by the work force during the construction phase. Management and handling of these wastes are of primary importance at this stage. Solid and liquid waste management and handling systems proposed during the operational stages of the project need to be installed as early as the construction phase.
- **Sedimentation**. Excavation and clearing of the project construction site may release large volumes of soil which may find its way into the marine environment via rivers and streams systems, as well as directly through wind and air. Strategies to avoid run-off and sedimentation need to be considered: (1) installation of silt screens, (2) establishment and construction of sediment traps, (3) timing of excavation and clearing activities during the dry season, (4) road maintenance, and (5) immediate landscaping of built-up areas.
- **Introduction of invasive species**. Transport of construction materials from Manila via "batil" may pose the potential for the introduction of exotic animals such as rodents and such. These exotic animals may pose hazards to endemic fauna (i.e. predation of marine turtle eggs and hatchlings, as well as the young of other terrestrial fauna). Strategies to ensure this does not happen need to be undertaken (1) inspection and maintenance of sea-faring vessels at the port origin and at the destination; (2) installation of rodent guards at mooring/anchor lines; (3) deployment of rodent traps

in the area, especially along sections of the coastline where the vessels are to anchor and where materials are to be unloaded; (4) selective elimination of potential exotic species caught in the traps.

Operational Phase

- **Solid and liquid waste**. Solid and liquid waste generated during the operational phase need to be managed appropriately. Handling and disposal systems of solid waste need to be eco-friendly (*i.e.* composting, recycling, etc.) and wastewater treatment facilities should be considered.
- **Tourist activities**. The influx of tourists and the water-based activities in the area may potentially disturb important marine fauna known to use the near-shore coastal areas of the project site such as the *Dugong dugong* and marine turtles. These species have been documented in the area and use it as developmental, feeding and nesting habitats. Activity areas may be delineated by marker buoys. Recreational activities may need to be prohibited during certain periods when these marine fauna are sighted in the area.

3.2.4.3 Fisheries

Methods

Fisheries in El Nido were characterized through archival research, collation of data from secondary sources and key informant interviews. Statistical reference areas covering El Nido fisheries have shifted boundaries over the past 70 years. From 1951 to 1977, Bacuit Bay was reported as a distinct water body. By 1978 to 1987, fisheries data from Bacuit Bay along with Malampaya Sound, Imuruan Bay and Balabac Strait into were consolidated into a larger statistical area, the West Palawan Waters. During 1980 to 1987, the coverage extended up to the offshore limits of Philippines' exclusive economic zone in the West Philippine Sea. Since 1990, Palawan province has been the unit of statistical reporting. Records obtained from El Nido Municipal Agriculture Office were the source of fisheries production data covering 2007 to 2012.

From 1 to 4 August 2014, key informants were interviewed about fisheries and other aquatic resources in El Nido using a questionnaire patterned after Pilcher and Kwan (2012). During the interviews, locations of fishing grounds described by the key informants were sketched on maps of El Nido, Bacuit Bay and other municipal waters. The interviews were conducted in three onshore locations in El Nido as well as the Municipal Agricultural Office in El Nido Town Proper (**Table 30**). Primary criteria for selecting a key informant were: (1) membership in a Fisheries and Aquatic Resources Management Council; and (2) extensive engagement in fishing activities.

Table 30. Interview locations and the number of key informants from each location.

PLACE NAME	GEOLOCATION		NUMBER OF KEY INFORMANTS INTERVIEWED
	Latitude	Longitude	
Barangay Buena Suerte	N11.18021	E119.38764	1
Barangay Villa Libertad	N11.19858	E119.42365	2
Barangay Pasadeña	N11.23953	E119.42608	1
Municipal Agriculture Office	N11.17980	E119.39055	2

Discussion

From 1980 to 2012, Palawan fisheries generated 9,380,311 MT (**Figure 53**), which is roughly 9% of the total production of the country (BAS, 2014). At its peak in 2006, Palawan contributed 21.7% (233,350.28 MT) to the marine fisheries production of the country, steadily declining afterwards to 15.8% (187,053.24 MT) by 2010.

During 1980 to 2012, Palawan's municipal fisheries contributed 2,854,827.77 MT or 79.5% of Palawan's total marine production. Commercial fisheries provided the remainder (751,668.17 MT, 20.5%). The production of inland fisheries in Palawan is negligible.

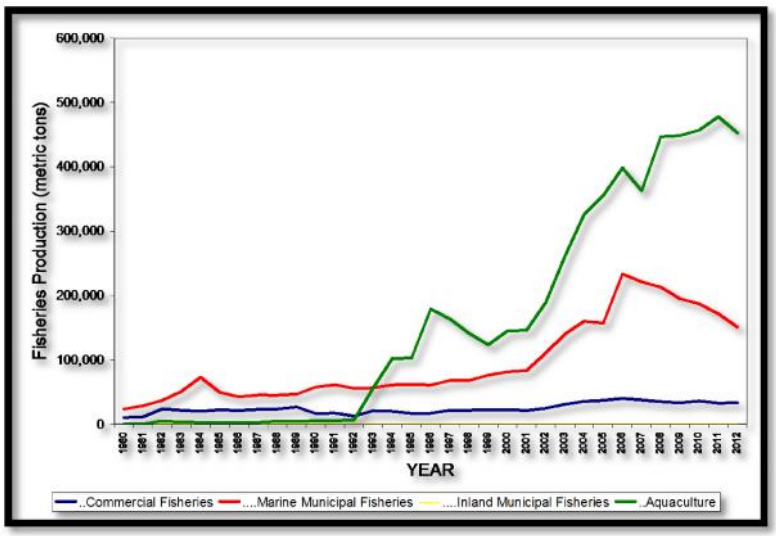


Figure 53. Palawan's contribution to the National Philippine fisheries production.

Fishing sectors in El Nido Municipality

The 2013 Municipal Fisheries Profile indicates that only marine municipal fisheries were present in El Nido during the recent year. Explicitly, the fisheries profile stated that commercial fishing, fishponds (both freshwater and brackishwater), fishpens and bangus fry fishing had ceased operating in El Nido for the past year (MAO-El Nido 2013).

Fishing assets

Using an ecosystems approach, marine fishing grounds can be viewed as natural habitats which support species adapted to such habitats. Economically valuable species, mostly unique to each habitat, are extracted by fishers using habitat-specific gear (**Table 31**).

Fishing watercraft

In 2013, 629 municipal fishing vessels were registered in El Nido (MAO-El Nido, 2013). This reflects a 50% reduction in the 1,252 fishing craft reported in 2010 (MAO-El Nido, 2010). Compared to the 804 fishing craft reported for 1994 (PCSD 1997 Profile as cited in Ingles 2000), the trend was increasing until 2010 then precipitously decreased in 2011. Thus, the 2010 fisher to fishing craft ratio was 1.89:1 dropping from 4.17:1 in 2013. Given this reduction in number of fishers who have access to fishing boats, this would indicate that fishers would have some form of sharing arrangements for use of fishing craft.

Fishing grounds

The 2013 Fisheries Profile of El Nido identified major fishing grounds, namely: (1) northeast of Cabuli Island; (2) northwest of Cabuli Island; (3) west of Lalutaya Island; (4) Cawayan Island; (5) Tapiutan Island; and (6) Guntao Island (MAO El Nido 2013).

Marine fishing grounds in El Nido are part of three basic habitats, namely: (1) reef-associated ecosystems; (2) soft-bottom habitats (also known as demersal fishing grounds); and (3) open sea (also known as "pelagic" areas).

Table 31. Description and characteristics of the top five fishing gear in El Nido and some commercial fishing gears formerly used in Bacuit Bay.

FISHING GEARTYPE	DESCRIPTION	TARGET SPECIES	NOTES
Single hook and line	A hook attached to a monofilament line and lead sinker. The fishing grounds generally nearshore reefs.	Predatory fish species from all ecosystems bite the baited hooks including barracuda, threadfins ("bisugo"), groupers ("lapu-lapu") mackerel, jacks, snappers, tangigue and tuna)	This was the most productive gear for 2005 with a total yield of 3,095.63 tons
Hook-and-line ("*kawil*")	Baited with chicken feather or "crystallet" fibers	Live reef food fish (LRFF)	Used in coral reef ecosystems
Multiple hook and line	A series of hooks with monofilament lines attached to a mainline.	Various fishes	The fifth most productive gear giving a total yield of 1,808.76 MT for 2005
Bottom-set gill net ("*lambat*")	Monofilament net panels almost undetectable deployed to catch fish at the sea bottom.	Snares a variety of fishes by the gills as these moves through the meshes including sardines, mackerels and slipmouths. Is also used to catch sharks in El Nido	The second highest producing gear in El Nido, which produced 2,859.15 tons in from 2004 to 2005. Used in soft-bottom habitats
Spear	A hand thrown or sling-propelled projectile having a pointed lead end.	Generally reef fishes including groupers ("lapu-lapu"; snappers ("maya-maya"), surgeon fishes ("labahita") and parrot fishes	Mostly used in reef-related fisheries such as coral reefs.
Squid jig ("*bira-bira*") with lights	Used at night, the common, traditional fishing ground is near the mouth of Bacuit Bay (WWF-Philippines 2005).	Squid	One of the top five fishing gears in El Nido done at night (WWF-Philippines 2005).
Squid/Fish trap ("*bobo*")	A cubical or rectangular woven cube frame about ½ to 1 meter at each side and enclosed in netting with exception of a 30 cm one-way entrance	Various fishes and squids	This gear was the third most productive gear with a catch of 2097.75 tons in 2005.
Beach seine ("*sinsoro*")	A bag net with pull ropes on both ends and set in a semi-circle facing the shore. Villagers work the ropes together to get the net ashore	Coastal schooling species such as juvenile anchovies ("dilis") & sardines, as well as demersal fishes such as goatfish and slipmouths.	Observed operating in front of the proposed project site on May 2011 and August 2014.
Commercial Trawl	A funnel-shaped net dragged along the sea bottom behind a ship or boat using tow cables.	Demersal species such as threadfins ("bisugo"); slipmouths ("sapsap"); lizardfishes ("kalaso"); and shrimps	A commercial gear operated in Bacuit Bay since 1951 and now banned by RA 8550 with 15 km municipal waters
Bag Net	Set at a depth of about 30 fathoms resembling an inverted mosquito net with the open end facing the surface	Used at night and with lights to catch schooling small pelagic fishes including anchovies, sardines, roundscads, and mackerels.	This was the highest producing commercial fishing gear during 1951 to 1987 with the catch reaching about 2,000 MT in 1958.
Shallow bamboo stake fish corral ("*baklad*")	Lines of bamboos with net panels staked in sandy or muddy bottoms set across the path of fishes, a leading to a circular cage where fishes get impounded	Squids, schooling small pelagic fishes including anchovies, sardines, roundscads, and mackerels	A *baklad* constructed along Guntao Island reportedly caught P500,000 worth of squid in one night

Coral reefs. In El Nido, coral reef-associated ecosystems supported 41.1% (5,772.8 MT) of the fisheries in 2005. Generally, there are three reef-associated habitats, namely: (1) coral reefs; (2) seagrass beds; and (3) mangrove forests.

Corals reef ecosystems supply fishery resources primarily through (1) taxonomic diversity; and (2) fish biomass. In El Nido, 2.53% of the reefs have dense coral cover while 31.74% have

sparse coral cover. These characteristics of coral cover in El Nido indicate that the coral reefs are being subjected to stress.

Natural coral reefs in El Nido support at least 813 species under at least 31 taxonomic families; the 10 most species-rich reefs in El Nido host from 170 to 211 species (Allen and Erdmann 2009). In comparison, oil platforms located in deeper areas about 60km offshore have just about $^1/_3$ of such biodiversity in various taxonomic levels (**Figure 54**).

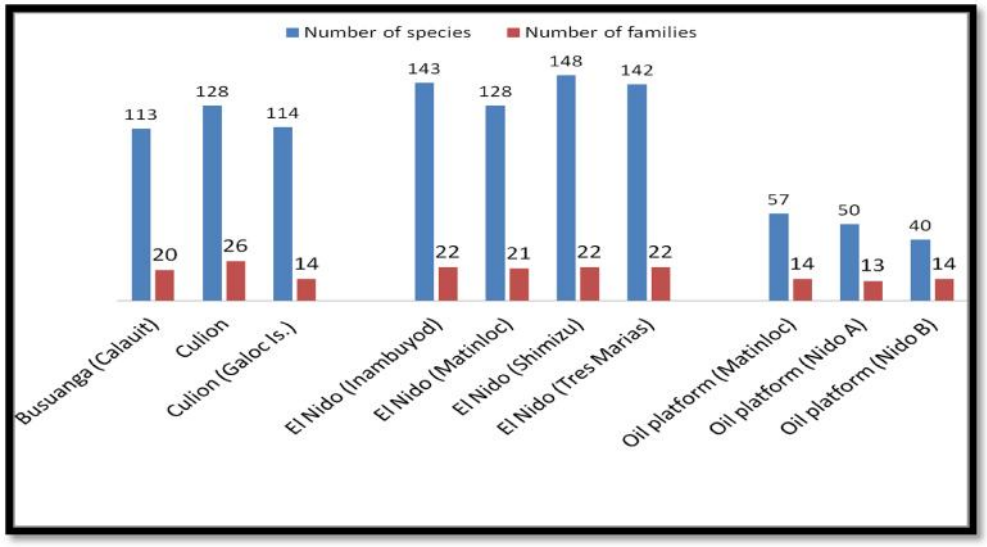


Figure 54. Taxonomic diversity (at the family and species levels) of fishes found in coral reef sites in El Nido, Culion and Busuanga compared with oil platforms in northern Palawan (in Ingles 2000 and Seastems 2008).

Coral reefs throughout the Philippines have related fish biomass which ranges from 0.31 to >220 mt/km^2 based on the 227 reef transects measured by Hilomen *et al.* (2000).

In El Nido, the reef-associated fish biomass ranged between 97.8 to 216.5 mt/km^2. Alino *et al.* (1998) and Nañola *et al.* (2002) compared the reef-associated fish biomass of representative reefs in Palawan (**Table 32**). The study shows that El Nido has higher fish biomass estimates than Calamianes and the Kalayaan Islands but lower than the maximum values of Tubbataha Reefs.

Table 32. Reef-associated fish biomass of representative reefs in Palawan.

Site	Fish Biomass (tons/km^2)
Tubbataha Reefs	213
El Nido	97.8 to 216.5
Kalayaan Island Group	22.64
Calamianes	3.44 to 57.6

Natural reefs from all four sites (*i.e*. El Nido, Calamianes, Kalayaan Islands and Tubbataha Reefs) had much less fish biomass estimates than the three offshore oil platforms (Nido A, Nido B and Matinloc), which ranged from 298 to 750 mt/km^2 (Seastems 2008). Significantly for fisheries, economically valuable species targeted by fishers were 98 to 99% of the fish biomass (Seastems, 2008). **Figure55**provides a graphical comparison of the fish biomass estimates in Palawan from selected coral reefs and oil-related infrastructures. The higher standing fish biomass in El Nido may be the result of the relatively protected status of reefs in the El Nido Managed Marine Resources Area.

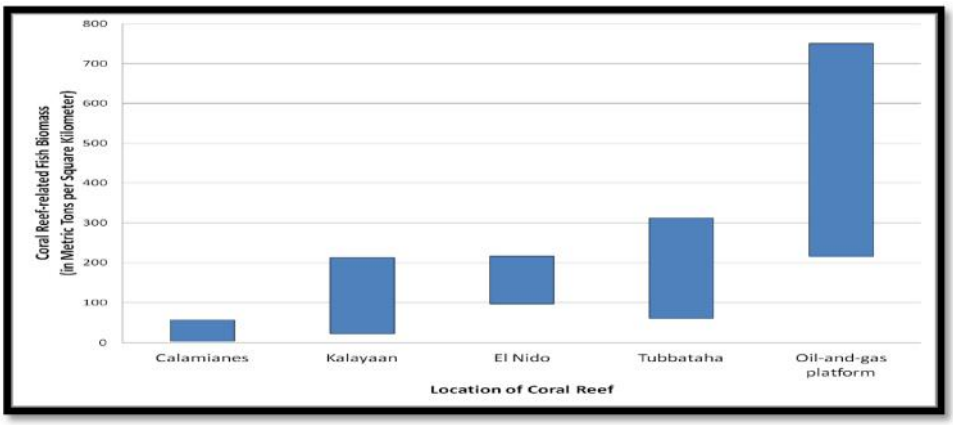


Figure 55. Graph comparing estimates of reef-associated fish biomass in the Calamianes, Kalayaan Islands, El Nido, Tubbataha reefs and three offshore platforms in northwestern Palawan (Sources: Nañola *et al.* 2002; Ingles 2000; Seastems 2008).

Seagrass beds. The extent of seagrass beds in El Nido is indicated by intermittent sightings of dugongs (*Dugong dugon*) and green turtles (*Chelonia mydas*). During the aerial survey conducted from September to October 1985 by the Toba Aquarium of Japan, 86 dugong sightings (75 adults and 11 calves) were in the El Nido area (Kataoka *et al.* 1995).

Mangrove forests. Mangrove forests form at the intertidal zones of coasts of estuarine habitats (Fernando *et al.* 2008). In 2011, this type of ecosystem provided 17.16 MT of mud crabs in El Nido (Manlavi, 2011).

Soft bottom habitats. There are two rivers discharging into the marine waters of the project site, namely: (1) Lio River and (2) Bulalacao River. These provide a limited freshwater input and sediment into Bacuit Bay. Where rivers discharge into marine coasts, estuarine habitats form (Mann 1980). Specialized species are able to make use of this limited estuarine habitat.

One fishing gear, the beach seine (locally called as “sinsoro”) was observed operating in the sediment discharge plume of Bulalacao River on 02 August 2014 (**Plate 13**). The actual fishing location was obtained as Latitude 11.23588ºN, Longitude 119.42234ºE. The fish catch for the morning of 02 August 2014 was almost wholly “sapsap” called in English as ponyfishes and slipmouths (Leiognathidae).

Plate 13. The fishing gear called beach seine, locally known as “sinsoro”, searching for fish schools of anchovies along the nearshore area adjacent to the project site on 02 August 2014.

In more general terms, the fishing zone of the “sinsoro” is the shallow water area fronting the beach from the shore up to approximately 100m seaward. Thus, the “sinsoro’s” fishing zone

falls within the area of the resort and may be cause of conflict between the resort and fisherfolk.

However, during an interview, the key informant sensed that the owner of a "sinsoro" was phasing out his fishing gear. The reason stated for the phase-out of the remaining "sinsoro" was lack of buyers of the fish catch. Unlike in previous years since 1980, El Nido no longer has buyers who take in large volumes of anchovies. According to a key informant, the buyers who previously engaged in fish trading have shifted their investments to tourism-related industries.

Related to the sediment discharged by rivers, soft-bottom habitats in El Nido supported 39% (5,519 MT) of the reported fisheries yield in 2005. These environments consist of mud, sand or mud-sand mixtures from which worms, shells, crabs, sea cucumbers and other invertebrates are able extract nutrition (Gross 1993).

Fishing boats from Barangay Pasadeña were seen deploying their gear about 0.5 to 1km from the shoreline fronting the proposed project site. This fishing activity takes place twice a day; the first from around 5AM to 8AM and the second from late afternoon (4PM) to early evening (7PM). The fishing boats remain stationary for about 1 to 2 hours in the area where the fishing gear was deployed. A key informant identified the gear as "palubog," or "bottom-set gill net." These gears are reportedly deployed away from the seagrass and seaweed beds growing in front of the proposed project site to avoid gear entanglement with the said marine plants. The target species are from soft bottom habitats. No conflict is expected with the said gear since the dense *Sargassum* seaweed beds act as a natural barrier between the "palubog" fishing ground and the shore. Removal of seagrasses and seaweeds is banned through Fisheries Administrative Order No. 250 dated 10 March 2014 (DA 2014) entitled\ Prohibition on the collection, harvesting, gathering, selling and/or harvesting of brown algae (*Sargassum* spp.) and seagrass.

Open sea habitats supported 19.6% (2,74k8.14 MT) of El Nido's 2005 landed fish catch. The work of Benson *et al.* (2011) on leatherbacks indicates that areas with physical energy low enough to favor jellyfishes are present around El Nido. Such areas include oceanic features (such as current boundaries, embayments and eddies) and coastal features (such as high nutrient input from land, high productivity and relatively shallow waters). These are types of open sea habitats used by economically important fisheries resources.

Historical fishery production

As mentioned in the "Methodology" section, Bacuit Bay was reported as a distinct water body from 1951 to 1977 (**Figure 56**). A graph of the fisheries data covering this period reveals a peak production of 5,710 MT in 1958. The graph also indicates a 95% collapse in 1960. Two much smaller peaks occur in 1969 and 1975, each one roughly 10% of the 1958 value. Evidently, during the almost three decades covered by the data, Bacuit Bay's production remained at a small fraction of the earlier years.

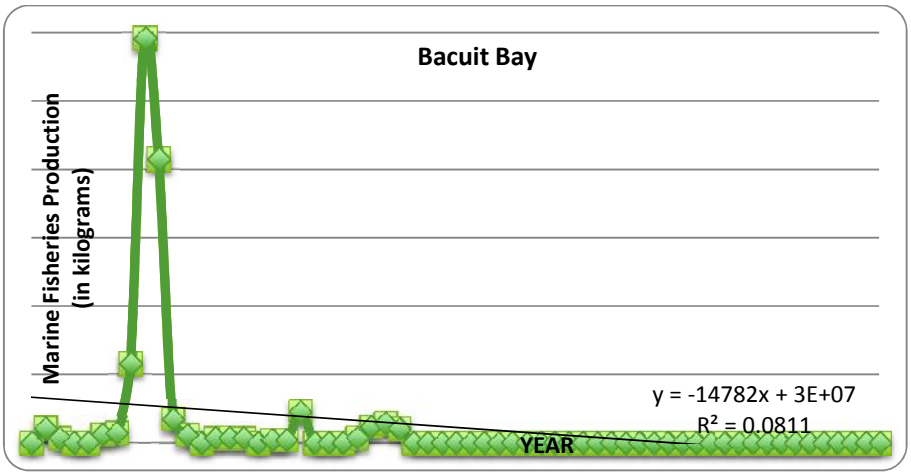


Figure 56. Annual commercial fishery production of Bacuit Bay, 1951 to 1977 (Sources: BFAR Statistics 1951 to 1977).

Historical catch composition

Commercial fish landing data is segregated into fish groups in BFAR Statistics reports. DA-BFAR statistics compiled data on 30 fishery resources caught in Bacuit Bay from 1950 to 1977 (**Figure 57**). However, 15 groups are reported only once during the entire 27-year period. Moreover, some fishery resources are simply reported as part of the "Miscellaneous" category. When graphed in time series, these data reveal decadal shifts in the major fish groups caught.

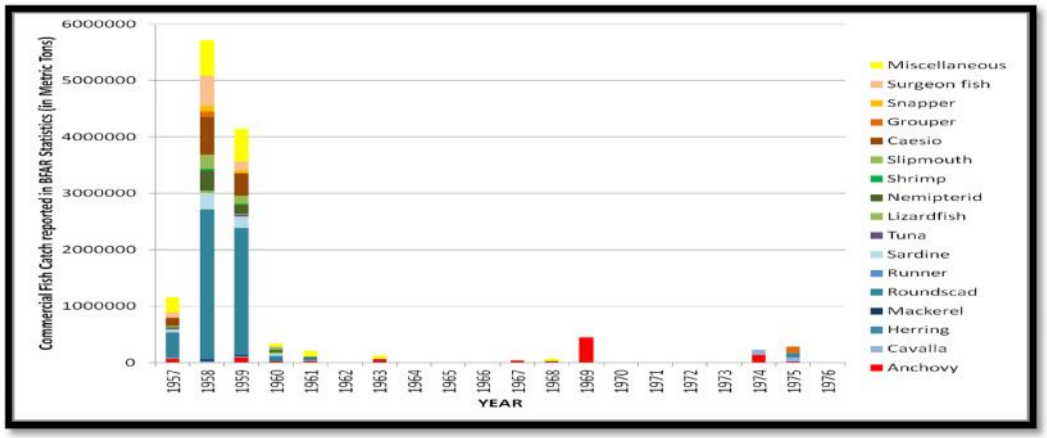


Figure 57. Annual commercial fisheries production by species and quantity, 1951 to 1977 (BFAR Statistics 1951 to 1976).

For the 1950's, a detailed examination of the catch composition shows that 2,656 MT of roundscads ("galunggong") comprised about 50% of the catch (**Figure 57**). Reef-related fish groups, the caesionids ("dalagang bukid") and the surgeon fishes ("labahita") provide about 20% of the catch.

Figure 58 shows the same data graphed to focus on details during the 1960s. The graph illustrates a gradual increase in anchovies ("dilis") caught by Bacuit Bay's commercial fisheries. A peak anchovy production of 446 MT was reported in 1969. This amount is about 90% less than the 1958 roundscad production. Thus, although the dominant catch had shifted to anchovies, this fish group never fully achieves the level of ecosystem capacity previously occupied by the roundscads. Data from 1961 up to 1974 does not contain any mention of

roundscad catch from Bacuit Bay. Only after 12 years does the roundscad reappear but reduced to a level of 2% of the 1958 catch.

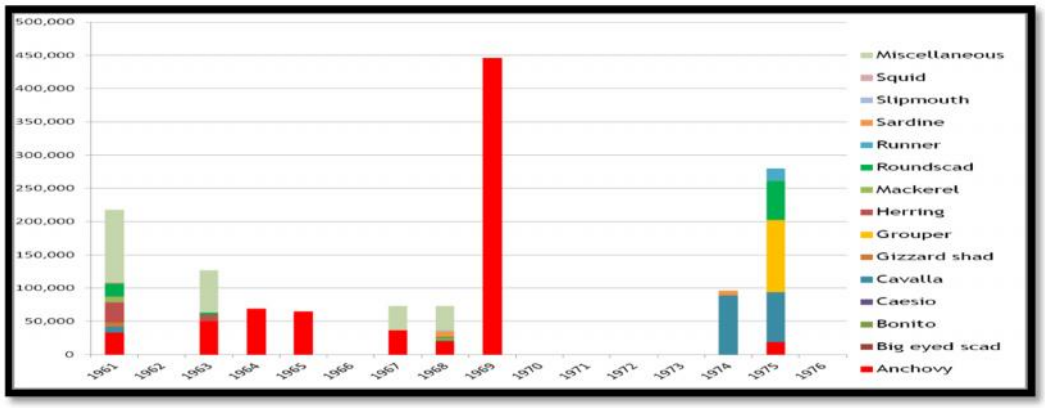


Figure 58. Graph focusing on the catch composition of the annual commercial fisheries production for 1961 to 1976 (Sources: BFAR Statistics 1961 to 1976).

During 1975, groupers ("lapu-lapu") from coral reef ecosystems make a marked jump in reported production (108 MT) (**Figure 58**). This occurrence highlights a shift in exploitation from open sea habitats to reef-associated ecosystems.

Historical fishing technologies

From 1951 to 1977, four main commercial gears were reported operating in Bacuit Bay, namely: (1) otter trawl; (2) purse seine; (3) hook-and-line; and (4) bagnet. Otter trawls operated in the mid-1950s and the early 1970s. Peak production of the trawl was in 1956 with a reported catch of about 500 MT. Purse seines and commercial hook-and-line contributed very minimally to the reported catch. Available data shows that bagnets were used commercially in Bacuit Bay from 1959 to 1974. Fish catch in Bacuit Bay was reportedly 3,000 MT in 1959; evidence that bagnets were mainly responsible for the high reported fish catch from Bacuit Bay in 1959 (**Figure 59**).

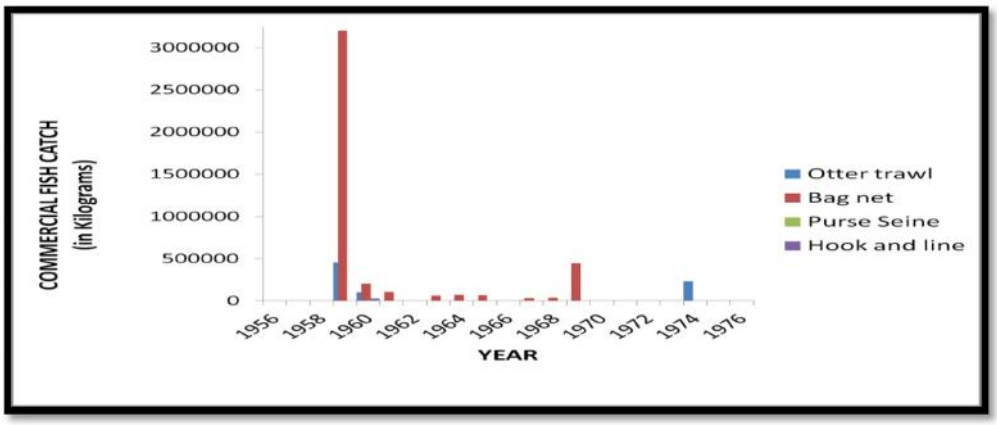


Figure 59. Historical production of Bacuit Bay segregating individual types of commercial fishing gear, 1951 to 1977 (BFAR Statistics 1951 to 1976).

Fisherfolk demographics

The 2013 Fisheries Profile for El Nido reflects 2,628 municipal fishers recorded for 2012 (MAO El Nido, 2013). In 2011, there were 2,615 registered fishers in El Nido (MAO El Nido, 2011). This is a ten (10%) increase from the 2,368 reported from El Nido in 2010 (MAO-El Nido, 2010).

Based on the 2,235 fishers in 1991 (PCSD 1991 Profile as cited in Ingles 2000), the average rate of increase among the El Nido fishers has been 15% over the past 20 years (**Figure 60**).

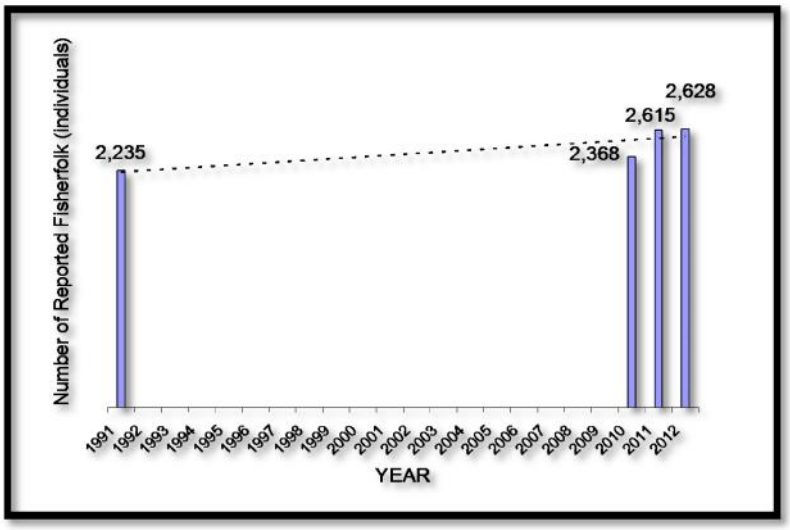


Figure 60. Graph illustrating the rate of increase of fishers in El Nido from 1991 to 2012 (PCSD 1991 as cited in Ingles 2000; MAO-El Nido, 2010; MAO El Nido, 2011; MAO El Nido, 2013)

Annual production: Reef-associated, Demersal and Pelagic species

The 2013 Municipal Fisheries Profile reported the annual fish catch production of El Nido. Fish production ranged from 701.108 MT in 2007 to 418.194 in 2012. Fish production was achieved by nine (9) types of gears, namely: (1) hook-and-line; (2) gill net; (3) trap; (4) squid jigger; (5) beach seine; (6) fish aggregating device; (7) entangling net – for blue crab; (8) spear fishing; and (9) shallow fish corral. Ominously, the 3.7% annual decline during the first four years has accelerated to a 33.5% decrease between 2010 and 2012 (**Figure 61**).

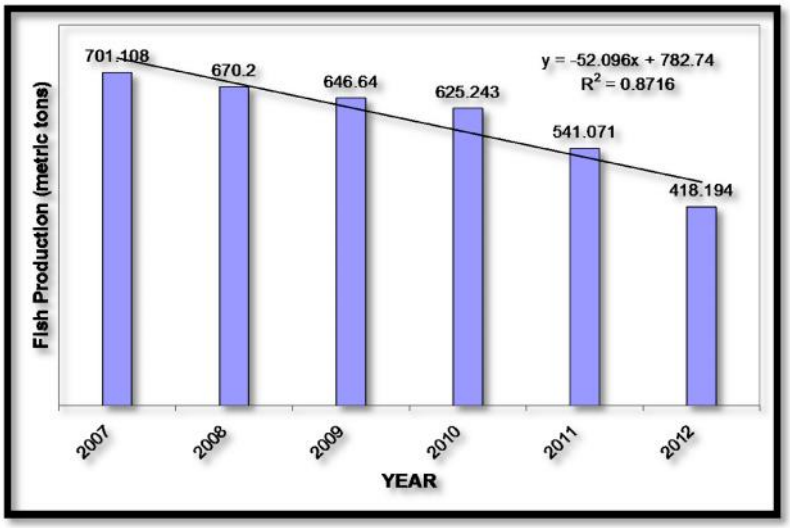


Figure 61. Fish production in El Nido (MAO El Nido 2013).

In comparison, WWF-Philippines (2005) estimated an annual yield of 14,039 MT from 18 types of municipal fishing gears (**Table 33**). 84.80% of this was produced by the top five fishing gears, namely: (1) single hook-and-line; (2) bottom-set gill net; (3) fish trap; (4) squid jigs; and (5) multiple hook and line.

Table 33. Estimated Annual Fisheries Yield and Daily Catch Rate in El Nido, Palawan: Feb. 2004 to Feb. 2005 (WWF Philippines 2005).

ECOSYSTEM	TYPE OF FISHING GEAR	ANNUAL FISHERIES YIELD (T)	CATCH (KG/DAY)
Pelagic	Pelagic lines	2,297.36	52.8
Pelagic	Pelagic nets	450.78	19.35
Demersal	Demersal lines	429.02	16.11
Demersal	Demersal nets	2,992.22	209.90
Demersal	Demersal traps	2,098.62	89.11
Reef-Associated	Reef-associated lines	5,520.71	24.55
Reef-Associated	Reef-associated hand instruments	251.21	12.29
	Total	14,039.92	

The combined data of WWF and the 2013 Municipal Fisheries Profile would suggest that El Nido's fisheries production had decreased by about 13,621 tons between 2012 and 2005. Such drop in fish yield despite the increase of fishing effort in terms of number of fishers would circumstantially indicate overfishing.

Catch composition

Catch composition classified based on local name identified 26 fisheries resource groups exploited by fisheries in El Nido (**Table 34**). Most (44.33%) of these resources are open sea species based on taxonomically affiliation. About $^{1}/_{3}$ (32.31%) are demersal resources associated with soft-bottom habitats. Reef-related fisheries for octopus and caesionids ("dalagang bukid") comprise 2.1% of the abundance of species caught. Given the importance of grouper ("lapu-lapu") fisheries in Bacuit Bay during the 1970s and the absence of groupers in the data set, the category "Others" (21.19%) are most probably reef-related fisheries.

Based on 2005 data, fishing gear targeting reef-associated ecosystems and soft-bottom habitats provided the highest production at 41.1% and 39.3%, respectively. Pelagic fishing gear contributed 19.6% (**Figure 62**).

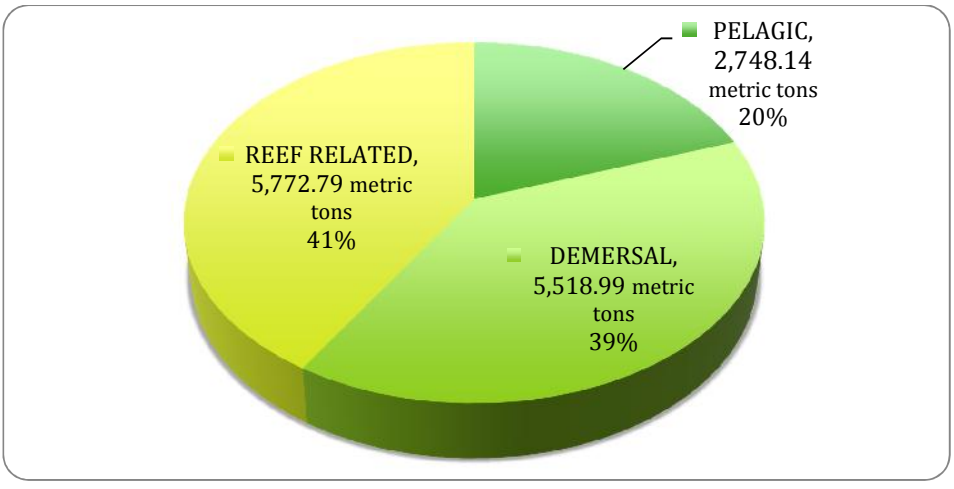


Figure 62. Annual fishing yield for 2005 classified by natural support habitats and ecosystems.

Table 34. The twenty-six (26) groups of fishery resources making up the major portion of the catch composition of all the fishing gears in El Nido, Palawan; Feb. 2004 to Feb. 2005 (Municipal Fisheries Profile of El Nido 2011; WWF-Philippines 2005; Ganaden and Lavipie-Gonzales, 1999).

FISHERY RESOURCE GROUP	TAXONOMIC AFFILIATION	RELATIVE ABUNDANCE (%)	ECOSYSTEM
1. Bisugo	*Nemipterus* spp	8.31	Soft bottom habitat
2. Sapsap	Leiognathidae	7.86	
3. Liwit	*Trichiurus* spp.	5.52	(Demersal resources)
4. Kalaso	*Saurida* spp; *Synodus* spp.	4.45	32.31%
5. Pak-An	*Megalaspis cordyla*	3.11	
6. Pagi	Dasyatidae	1.17	
7. Putian	Gerreidae	1.09	
8. Pating	Elasmobranchii	0.8	
9. Alumahan/Lumahan	*Rastrelliger kanagurta*	13.56	
10. Kalapato	*Atule male*	13.22	Open sea
11. Pusit	Loliginidae	2.56	
12. Tulingan	*Katsuwonus pelamis; Auxis spp; Euthynnus affinis*	9.69	(Pelagic resources) 44.33%
13. Galunggong	*Decapterus* spp	1.23	
14. Matangbaka	*Selar* spp	1.17	
15. Hasa-Hasa	*Rastrelliger brachysoma*	1.03	
16. Tangigue	*Scomberomorus spp.*	0.99	
17. Salay/Salay-Salay	*Alepes* spp	0.88	
18. Malasugi	*Makaira* spp.		
19. Talakitok	*Caranx* spp.		
20. Tamban	*Sardinella* spp.		
21. Pugita	*Octopus* spp	1.15	Reef-related resources
22. Baracuda	*Sphyraena* spp.		
23. Dalagang-Bukid	*Caesio spp.; Pterocaesio spp.*	1.01	2.16%
24. Lapu-lapu	Serranidae		
25. Others		21.19	Possibly reef-related
26. Various deep sea reef fishes			

Reef-related Live food fish fisheries in El Nido

For live reef fish, the fishing grounds extend to offshore areas about an hour's boat ride from Guntao. Additionally, Arquiza (2001) notes that some El Nido fishers described their fishing grounds as being near the "oil drilling areas" and took 3 hours to reach.

During the years 2003 to 2007, PCSD (2007) reported that annual production of Palawan's live food fish fisheries (LRFF) ranged from 305.19 MT to 769.26 MT (**Figure 63**). The total 2,793 MT the traded for this period was valued at P5 billion (PCSD (2007). PCSD's valuation closely approximates El Nido's P1,800/kg price for each 0.5 to 1kg live fish, about 25 to 40cm in length.

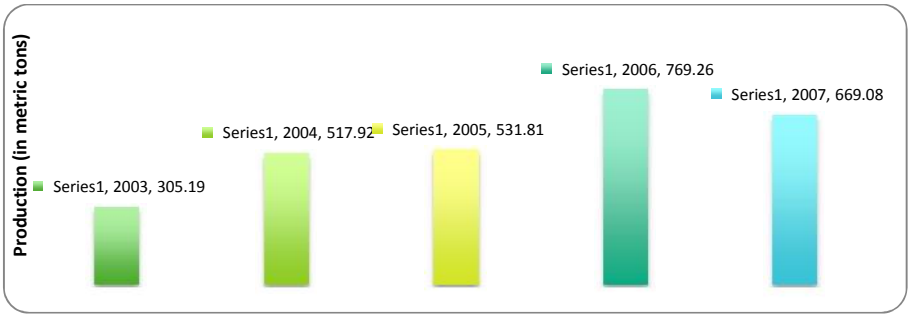


Figure 63. Live reef food fish production in Palawan 2003 to 2007 (Source: PCSD 2007).

In El Nido, a BFARMC (Barangay Fisheries and Aquatic Resources Management Council) representative estimated that 90% of the residents in Barangay Bebeladan are engaged in live reef food fish. In the national census taken last 2000, there were in 1,785 persons in the Barangay Bebeladan (NSO 2002). The LRFF takes place all year round except during bad weather.

After reviewing air transport documents dated November 2000, Arquiza (2001) calculated that 40 to 280kg of live reef food fish equivalent to 80 to 560 individuals were airlifted daily from El Nido to Manila. From these data, the monthly totals may be estimated at 1.2 to 8.4 MT corresponding to 2,400 to 16,800 individuals.

Due to municipal ordinance banning live reef food fish trading in El Nido (WWF-Philippines 2005), the live fish have to be brought to buyers in the adjacent municipalities of Liminangcong, Coron and Taytay. Recently, Municipal Resolution No. 11-82 adopted Palawan Ordinance No. 941 specifying a regulated system for LRFF trade (Sangguniang Bayan of El Nido 2011). Thus, although estimates of live reef fish production in El Nido for previous years are unavailable, an outcome under this resolution would be data on live reef fish production.

Pelagic squid fisheries in Bacuit Bay

PCSDS (2006) valued Palawan's squid fisheries at about Php 40 million in 2003. In El Nido, squid is priced at around P150/kg although previously prices reached P245/kg. For 2011, 87.503 MT of squid were caught under the BFAR's Agri-business Land Development Project (Manlavi, 2011). Two squid resources were targeted by this project, namely: (1) "pusit lumot"; and (2) "pusit laot".

Squid caught in El Nido totaled 2,054.20 tons in 2005, comprising 2.56% of the relative abundance of species caught during that year (WWF-Philippines, 2005). The total annual income proceeding from the 2003 squid production can thus be estimated to be between P308,130 to P503,279. Interestingly, fishers from Bebeladan interviewed about squid fishing stated that a fish corral owner earned P500,000 in one night after a large aggregation of squid was trapped by his fish corral in Guntao Is.

El Nido has been assessed to have abundant cephalopod resources by the WWF-Philippines (2005) although the identification of squid species in El Nido remains unavailable. Calamianes is one of the nearest areas where squids have been studied. *Uroteuthis bartschi* was identified by Hernando and Flores (1981) as the dominant species in Calamianes' fishery. They determined that seasonal migration of *U. bartschi* is influenced by the ocean currents off western Palawan. This resembles squid fisheries season in El Nido (**Table 35**). Two other species, *Loligo* and *Dorytheutis*, are exploited in Calamianes from February to May (Ingles 2000).

Table 35. Squid fishing season in El Nido and size characteristics of the target species.

SIZE	LOCAL/ SCIENTIFIC NAME	SEASON
"Smaller"	*pusit barakitos*	Exploited by the El Nido squid fisheries from November to February
"Bigger"	*pusit barako*	Exploited by the El Nido squid fisheries from March to June
	Loligo (Doryteuthis) singhalensis	Pelagic species. Exploited in Calamianes by local, subsistence and commercial fisheries (purse seines and dip nets with lights).
	Loligo spp.	Exploited by the Calamianes squid fisheries from February to May.
	Uroteuthis bartschi	Exploited by the Calamianes squid fisheries

The El Nido squid fishers disposed of their catch in at least four ways, namely: (1) selling fresh squid in the market; (2) keeping the squid in a cold storage facility; (3) drying the squid; or (4) home consumption.

Key informants revealed their fishing grounds to be around Cauayan Island and Cadlao Island in depths ranging from 10 to 25 "dipa" (1 dipa = roughly 1 fathom). Squid fishing grounds in these islands are ≥ 1km from the coast of mainland Palawan. Thus, no expected conflict between squid fishers and beach users is expected in the proposed project.

Demersal shark fisheries in El Nido

Shark fisheries in Western Palawan Waters produced 13 to 435 MT per year from 1981 to 1986 (BFAR statistics 1981 to 1986). BFAR-NFRDI (2009) values shark meat at 28 to P35/kg and dried sharkfins at P2,500 to P8,000/kg.

The shark fishery in Western Palawan Waters was 100% municipal using hook-and-line, spear fishing and beach seine (BFAR statistics 1981 to 1986). Shark fisheries have been reported in El Nido (BFAR-NFRDI 2009). In El Nido, shark fishers use bottom set gillnet and achieved a daily catch per unit effort of 31.86kg in 2005 (WWF-Philippines, 2005). Sharks had a relative abundance of 0.80% in relation to the total number of fishes caught in 2005.

Other fishery products

Manlavi (2011) provides further information for five other fishery products, which are gathered from the wild, namely: (1) cuttlefish; (2) sea grapes; (3) blue crab; (4) sea cucumber; and (5) sea horse.

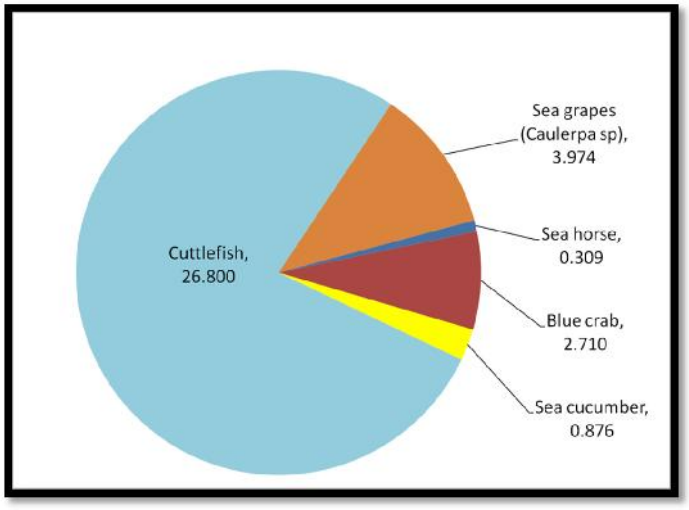


Figure 64. Percentage composition of other marine fisheries production in El Nido (Manlavi 2011).

Under the Agri-business Land Development of the Bureau of Fisheries, 26.8 MT of cuttlefish and 2.7 MT of blue crab were caught from the wild throughout El Nido (Manlavi, 2011). The other fishery products (*e.g.* sea horse, sea cucumber and sea grapes) could usually be gathered from seagrass ecosystems.

The 2013 Municipal Fisheries Profile also reported the annual seaweed production of El Nido. Seaweed production peaked at 1,680 MT in 2009 then thereafter dropped an average of 64.3% annually. By 2011, only 202.2 MT of seaweed was produced in El Nido. Production rose to 311.6 MT in 2012 (**Figure 65**).

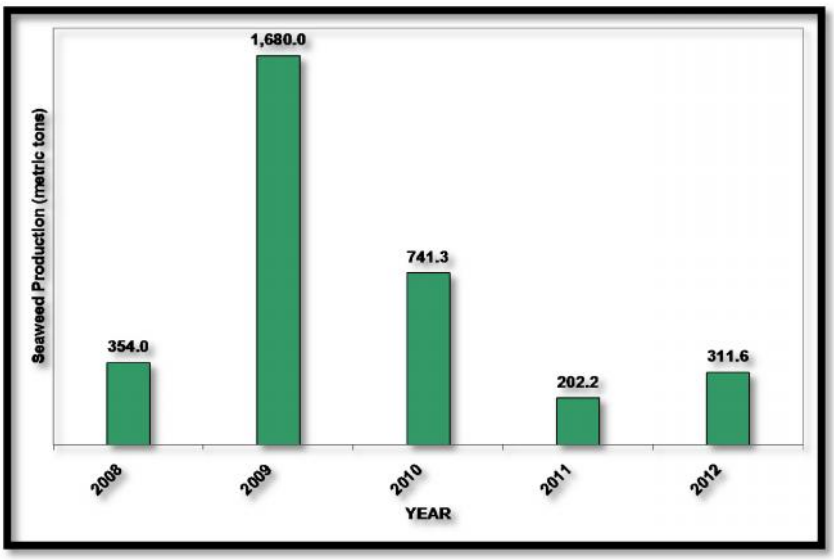


Figure 65. Seaweed production in El Nido (MAO El Nido 2013).

Inland (Freshwater) Capture Fisheries

The 2013 Municipal Fisheries Profile indicates that there are no municipal inland fisheries. However, a key informant described a very seasonal inland freshwater fishery. During the dry season, rivers recede to their lowest levels forming lentic ecosystems, slow moving waterways such as pools and ponds. Fishers wade into the waterways and simply grope the mud banks and substrate, catching large murrels by hand. In some cases, several people dam a waterway using mud piles then use pails to drain the water off. A net is slipped into the drained area to catch several target species (**Table 36**).

Table 36. Species targeted by inland capture fisheries in Barangay Villa Libertad, El Nido (Source: Key informant interviews, 1-4 August 2014).

LOCAL NAME	COMMON ENGLISH NAME	SCIENTIFIC NAME
"puyo"	climbing perch	*Anabas testudineus*
"dalag"	murrel	*Ophicephala striata*
"tilapia"	St. Peter's fish	*Tilapia* spp; *Oreochromis* spp
"paitan"	cyprinid	*Cyprinidae*[3]

[3] The key informant was not able to describe the "paitan" itself, pointed out differences with other species. For instance, the KII categorically negated that "paitan" is the same as "kasili," commonly known in English as "eel." The key informant also said that "paitan" was different from "puyo," (*Anabas testudineus*) , called in English as the climbing perch.

The identification of "paitan" may be difficult without obtaining a specimen. "Paitan" is a commonly used local word to denote various types of fishes in the Philippines. Herre (1924) specified *Trichiurushaumela*, a marine species as "paitan." Ganaden and Lavipe-Gonzales (1999) specified a fish called "pangitan" in Palawan (Cagayanin) as *Anguilla marmorata* (Quoy and Gaimard 1824), known commonly in English as the giant mottled eel.

"Paitan" may also signify carp-related fishes (cyprinids) that although widespread in Palawan, remain poorly studied. During the Palawan Cyprinid Survey conducted by Matillano and Cervancia (2006), six cyprinid species were identified, four of which were Palawan endemics. Moreover, the survey collected and described a new species, *Cyclocheilichthys shoppeae* from northern Palawan (Cervancia and Kotellat 2007).

Although the 2013 Municipal Fisheries Profile reports that there are no freshwater fishponds in El Nido, a key informant identified a guarded pond which stocks "tilapia" that is located upstream from the seasonal inland fishing ground. The key informant surmises that escapees from the guarded pond are the source of "tilapia" which the seasonal fishers catch." Tilapia" has become a generic local word that denotes species from the genera *Tilapia* and *Oreochromis* as well as the numerous hybrids.

Illegal fisheries

Although, El Nido lies within a protected area, the El Nido-Taytay Managed Marine Resources Protected Area, specially trained apprehending officers have encountered illegal entrants from other countries within El Nido's municipal waters (**Table 37**). Notwithstanding the provisions of Republic Act 8550 against commercial fishing within 15km from the municipal shoreline, commercial fishers are still sighted near the mouth of Bacuit Bay where they can quickly escape to sea when approached by law enforcement teams.

Table 37. Geographic distribution of illegal poaching incidences in the vicinity of El Nido.

LOCATION	NUMBER OF CASES	DATE	REMARKS
Palawan	886	1995 to 2006	Documented by the Philippine Commission on Illegal Entrants (Anda 2011).
Palawan	675	1996 to 2001	Reported by Benavente-Villena and Pido (2004)
West Palawan	17		
El Nido	3	June 2008	Four Vietnamese nationals were caught poaching near Malampaya Natural Gas Project
		September 2008	One Vietnamese vessel was intercepted in El Nido
		07 April 2009	Seven Chinese nationals were caught poaching near Cadlao Island, El Nido Target species include: (1) 13 dead green turtles (*Chelonia mydas*); (2)*E. imbricata*); (3) giant clams (*Tridacna* spp, *Hippopus* spp); (4) sea cucumber (*Holothuria*); (5) live wrasses (*Cheilinus undulatus*) and (6) an undetermined amount of fish.
			More than 100 hawksbill turtles (*Eretmochelys imbricata*) were on board.

3.2.4.4 Marine Wildlife

Marine Turtles

Seastems (2001) reported the occurrence of four marine turtle species in Palawan, namely: the green turtle (*Chelonia mydas*); the hawksbill turtle (*Eretmochelys imbricata*); the olive ridley turtle (*Lepidochelys olivacea*) and the leatherback turtle (*Dermochelys coriacea*). Although the loggerhead turtle (*Carettacarretta*) has not yet been reported from western

Palawan, a loggerhead turtle was encountered in Green Island Bay, Roxas, Palawan (De Veyra 1997).

Seagrass-foraging green turtles (*Chelonia mydas*) occur in El Nido, notably in Dimakya Island as well as Busuanga, Coron Bay and Cuyo Islands (De Veyra 1997). Green turtle nesting has also been recorded in El Nido (**Table 38**).

Table 38. Reported green turtle nestings in El Nido from 2000 to 2009 (Viloria 2009)

LOCATION OF NESTING	BARANGAY	YEAR
Sitio Cagbatang	Pasadeña	2007
Sunset Beach, Cadlao Island	Buena Suerte	2008
Codognon Beach	Bebeladan	2008

Coral reefs in El Nido were observed to be foraging areas for hawksbill turtles (*Eretmochelys imbricata*) (PCP data 1987; De Veyra 1997). As part of conservation efforts in the 1980s, hawksbill nests were retrieved from beaches in many islands of El Nido (*e.g.* Guintunganuan, Cadlao and Dilumacad) then relocated to a centrally-managed hatchery in Miniloc Island (PCP data 1987). Torres (2004) has shown that the hawksbill nesting pattern was year-round. Thus, Palawan is contributing substantial numbers of hatchlings to increase population. Limpus (pers. comm.) suggested that the western portion of Palawan maybe a developmental habitat for the hawksbill turtles. On this basis, portions of El Nido (including the area in front of the project site) were declared as a marine turtle sanctuary (MNR 1984). Additional records of hawksbill nesting are listed in **Table 39**. Meanwhile, the most recent hatching incidence involves 127 hatchlings in Dilumacad Island on 16 January 2014[4].

Table 39. Reported hawksbill nestings in El Nido from 2000 to 2009 (Viloria 2009).

Location of nesting	Year
Sitio Pacalsada, Barangay Corong-corong	2002
Entalola Island	2008
Codognon Beach, Barangay Bebeladan	2008

Just after the typhoon Glenda, the decomposing carcass of a juvenile hawksbill turtle was found floating awash nearshore in Pasadeña. Due to the possible health hazard, the carcass was buried immediately after retrieval (**Plate 14**).

[4] Source: https://www.facebook.com/elnidoresorts?directed_target_id=0. Accessed 15 September 2014.

Plate 14. Decomposing carcass of a juvenile hawksbill turtle (*Eretmochelysimbricata*) found floating nearshore along Barangay Pasadeña after Typhoon Glenda. The carcass shown here is being buried immediately after retrieval the preempt health hazards (Photograph courtesy of ENR Security)

The olive ridley turtle (*Lepidochelys olivacea*) utilize dunes of river-deposited sand as nesting grounds and can serve as indicators of estuarine habitats. An olive ridley was retrieved after nesting in El Nido town last 1986 (PCP data, 1987). In 2008, another olive ridley nesting was more recently recorded in 2008 from Miniloc Island (Viloria 2009).

In El Nido, Seastems (2011) encountered an adult leatherback turtle on May 2011. Salinas *et. al* (2009) report on a leatherback that died after being entangled in a drift gill net off El Nido in 2005. The leatherback had a harness and still undetermined device etched-labelled with "SEIMAC WILDCAT 16501". Additionally, Seastems (2011) encountered an adult leatherback turtle last May 2011 in offshore El Nido. Fishers interviewed from Palawan said they encountered leatherbacks at sea (Cruz 2006).

Out of 136 leatherback turtles that Benson *et al.* (2011) satellite tracked after nesting in Papua New Guinea, 13 moved to northern Palawan. Bjorndal (1997) stated that leatherback occurrence mirrors the distribution of their jellyfish prey. Western Palawan supports a seasonal jellyfish fishery (Omori and Nakano 2001). In May 2011, Seastems (2011) encountered a big population of jellyfish while returning to El Nido from an open sea area. Aerial surveys are ongoing to examine the link between western Palawan habitats and leatherbacks from Papua New Guinea. Although Pritchard (1977) reported that leatherbacks do not nest in the country (in Palma 1994), two documented leatherback nestings have occurred; the first occurred on 14 July 2013 at Barangay Rawis, Legaspi City[5], while the second was at Barangay 13, Poblacion, Dolores, Eastern Samar on 05 August 2013. This would indicate that nesting may still be a reason for leatherback turtle presence in Palawan.

Key informants mentioned accounts of marine turtle nesting and hatchling emergence but were uncertain of the species identification. Although Cruz (2006) has reported that the green turtle, hawksbill turtle and olive ridley turtle nest in El Nido, nesting incidence is low, considering that El Nido is not a major marine turtle rookery unlike the Turtle Islands. Further, reports of hawksbill nesting are mostly from isolated islands (De Veyra 1997) in low nest counts (Cruz 2002; Palma 1994; Alcala 1980). Thus, nesting of marine turtles along the sandy beach fronting the project is possible but the incidence is expected to be low.

Threats to marine turtles come from harvesting of eggs, capture in fishing gear and direct hunting (Cruz and Torres 2003). Passive fishing gears, which are known to catch marine turtles include bamboo stake fish traps ("baklad") and set nets while active fishing gears include spears and spear guns. Marine turtles are protected under Philippine law.

3.3 AIR

3.3.1 Meteorology/Climatology

The prevailing climate in the project site is classified as Type 1 under the Modified Coronas Climate Classification system. Type 1 climate receives less rainfall during the months of November to April (dry season) while rainfall is abundant from May to October (rainy season).The northeast monsoon (amihan) prevails during the dry season while the southwest (habagat) monsoon prevails during the rainy season.

Climatologic parameters with normal and extreme values from the nearest PAGASA synoptic station in Coron, Palawan were used to describe existing meteorological conditions in the area

[5] Source: https://www.facebook.com/marinewildlifewatchofthephilippines/posts/10151570935029001. Accessed 15 September 2014.

(**Tables 40** and **41**).Climatological normals are 30-year monthly and annual summaries of rainfall (amount and number of rainy days), temperature (maximum, minimum, mean, dry bulb, wet bulb, dew point), vapor pressure, relative humidity, mean sea level pressure, wind direction and speed, cloud amount or cover, number of days with thunderstorm, and number of days with lightning.

Climatological extremes are monthly and annual greatest daily rainfall, highest temperature, lowest temperature, highest wind speed and direction, highest sea level pressure, and lowest sea level pressure.

Table 40. Climatological Normals at the PAGASA station in Coron, Palawan (1981-2010)

Month	RF (mm)	RD	Temperature (°C)			RH	Wind		Cloud Cover (okta)
			Max	Min	Mean		Dir	V (mps)	
JAN	18.5	3	32.4	22.7	27.5	80	E	2	5
FEB	14.0	2	32.6	22.9	27.8	79	E	2	4
MAR	15.4	2	33.2	23.6	28.4	78	E	2	4
APR	38.1	3	34.0	24.3	29.1	77	E	2	4
MAY	198.1	12	33.4	24.4	28.9	81	E	1	5
JUN	360.8	19	31.7	23.9	27.8	87	S	1	7
JUL	479.9	23	30.9	23.4	.27.1	88	S	1	7
AUG	466.3	22	30.9	23.4	27.2	88	S	2	7
SEP	447.1	21	31.1	23.5	27.3	88	SW	1	7
OCT	250.8	17	31.8	23.5	27.7	87	E	1	6
NOV	118.6	9	32.5	23.6	28.1	83	E	2	5
DEC	74.0	6	32.3	23.2	27.8	82	E	2	5
ANNUAL	2481.7	139	32.2	23.5	27.9	83	E	2	6

SOURCE: PAGASA
NOTES: RF – rainfall; RD – no. of rainy days; RH – relative humidity; Dir – wind direction; V – velocity; mps – meters/sec

Table 41. Climatological extremes at the PAGASA Station in Coron, Palawan as of 2013.

MONTH	TEMPERATURE				GREATEST DAILY RAINFALL		HIGHEST WIND (MPS)			SEA LEVEL PRESSURES (MBS)			
	HIGH	DATE	LOW	DATE	AMOUNT	DATE	SPD	DIR	DATE	HIGH	DATE	LOW	DATE
JAN	36.4	01-26-1996	12.2	01-15-1974	103.9	01-01-1960	22	SE	01-25-1975	1019.4	01-01-1962	1001.7	01-06-1999
FEB	36.1	02-11-1998	13.3	02-09-1974	67.8	02-02-2001	16	E	02-17-1985	1019.8	02-22-1968	1001.5	02-16-1991
MAR	37.4	03-14-1950	13.4	03-16-1974	56.2	03-27-1982	24	S	03-27-1982	1019.5	03-02-1981	998.0	03-27-1982
APR	37.6	04-29-2003	14.0	04-01-1974	81.8	04-09-1956	16	E	04-12-1986	1021.2	04-25-1950	1003.5	04-20-2001
MAY	37.6	05-08-2002	18.1	05-26-1977	185.9	05-17-1966	25	SW	05-26-2006	1021.6	05-28-1950	999.2	05-21-1976
JUNE	36.5	06-02-1993	17.6	06-12-1977	173.3	06-06-2009	18	SW	06-23-2011	1020.4	06-06-1950	998.6	06-29-1964
JULY	35.7	07-14-1996	17.1	07-22-1977	190.5	07-28-1962	15	SW	07-21-1999	1017.2	07-12-1979	991.4	07-03-1952
AUG	34.7	08-14-1998	17.0	08-16-1977	317.6	08-13-1979	18	SW	08-01-2009	1015.9	08-13-1976	991.5	08-22-1982
SEP	34.6	09-01-1988	17.4	09-03-1977	266.1	09-19-1997	20	SSW	09-27-2011	1016.9	09-15-1968	997.5	09-10-1996
OCT	36.6	10-15-1996	17.2	10-08-1973	289.4	10-13-1970	21	E	10-29-1995	1017.4	10-27-1968	994.9	10-22-1952
NOV	37.0	11-21-1995	16.1	11-29-1977	172.6	11-13-1990	40	E	11-13-1990	1017.1	11-15-1968	985.7	11-13-1990
DEC	35.2	12-02-1998	14.7	12-17-1977	223.3	12-04-1972	32	W	12-06-1993	1018.8	12-06-1960	980.4	12-19-19.59
ANNUAL	37.6	04-29-2003	12.2	01-15-1974	317.6	08-13-1979	40	E	11-13-1990	1021.6	05-28-1950	980.4	12-19-1959
	37.6	05-08-2002											
Period of Record	1950-2013				1949-2013		1966-2013			1949-2013			

Source: PAGASA
NOTES; mps – meters per second ; spd – speed

Principal Wind Currents. Wind currents that generally prevail over the country also influence the climate in the area. These are the southwest monsoon (*habagat*), the northeast monsoon (*amihan*) and the north Pacific trade (*daplak*). The southwest monsoon affects the project site from May to September and peaks during August. This principal wind current occurs when warm moist air flows over the Philippines from the southwesterly direction causing torrential rains to the area and other western parts of the country.

The northeast monsoon affects the area from October to late March and intensifies during January and February. It originates from the cold Asiatic winter anticyclone and brings cool and relatively dry air from a northerly direction as a maritime tropical air mass.

The north Pacific trade wind in the area usually prevails from April up to early May. This extremely warm wind system comes from the easterly direction and is usually associated with the occurrence of thunderstorms.

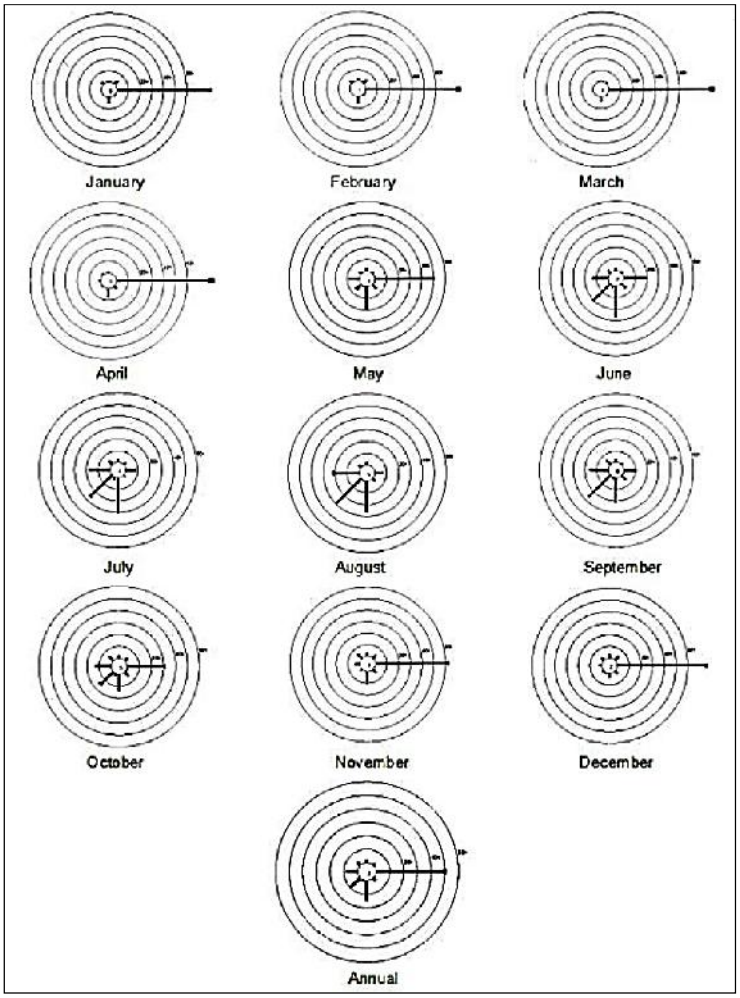


Figure 66. Monthly wind rose diagram for the PAGASA station in Coron, Palawan (2006).

Rainfall. The onset of the rainy season in the project area is in May and continues until October. Maximum rainfall occurs from July to September with monthly rainfall values exceeding 400mm. A relatively dry period prevails from November to April with February and March as the driest months with average monthly rainfall value of 14mm. Annual average rainfall distribution is 2,481.7mm. The annual number of rainy days is 139 with a maximum of

23 rainy days. The highest daily rainfall recorded from 1949 to 2009 ranged from 56.2 to 317.6mm.

Temperature. Annual maximum temperature at the project site is recorded in April at 34^0C while the lowest annual temperature is in January at 22.7°C. March and April are the warmest months while the coldest months are December through February. Temperature recorded from 1981-2010 varies from a mean high of 37.6°C to a mean low of 12.2°C.

Humidity. The project area has an annual average relative humidity of 83%. During months of June to October, relative humidity is usually high (85%-87%) and low (78%-81%) from March to April.

Thunderstorms and Lightning. During the rainy season and the onset of the southwest monsoon, the occurrences of thunderstorms are high. In the project area, this climatic phenomenon is observed 60 days in a year with a maximum frequency of 11 days occurring in June. Thunderstorm is usually accompanied by lightning, which occurs 85 days in a year. The number of days with the most number of thunderstorms and lightning are observed from May to October.

Cloud Cover. El Nido municipality is generally cloudy for most part of the year. Highest cloud cover is observed during the months of July to September at 7 oktas. It is partly cloudy from March to April at 3 oktas.

Surface Winds. The prevailing wind at the project site comes from an Easterly direction at a constant speed of 2mps. During months of June to October, the dominant wind direction shifts from Southerly, Southwesterly to Westerly direction (**Figure 66**). Light winds (1 to 4mps) prevail most of the time with an average monthly wind speed of 2mps (**Table 42**). Annual extreme wind speed experienced in the span of 52 years (1950-2002) is 40mps from the Easterly direction (see **Table 43**).

Table 42. Normal monthly wind frequency (%) at the Coron, Palawan PAGASA station (1971-2000).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual (%)
N	3.2	2.0	1.1	0.4	2.2	1.1	2.0	0.8	0.8	1.2	3.0	1.4	1.6
NNE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NE	8.2	4.3	0.4	0.7	1.8	1.5	0.4	0.4	0.8	4.1	5.9	6.4	2.9
ENE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E	74.5	74.8	88.4	81.5	50.2	14.9	9.3	9.7	10.4	41.5	58.1	75.0	49.5
ESE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SE	1.8	5.1	1.8	1.5	5.4	5.9	1.6	2.0	2.9	5.3	6.8	5.1	3.7
SSE	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.4	0.5	0.1
S	4.7	7.9	6.8	11.9	17.9	27.9	25.8	21.8	17.5	9.7	9.7	3.2	13.8
SSW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SW	1.1	0.4	0.4	0.7	8.2	26.4	36.8	45.1	27.1	19.1	5.1	1.8	14.1
WSW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	1.1	0.0	0.0	0.1	8.2	9.3	15.7	11.3	17.5	9.7	2.1	0.5	6.3
WNW	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NW	2.5	1.6	0.7	1.1	2.2	2.2	2.4	2.0	6.7	3.7	5.9	2.8	2.8
NNW	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.1
Total	97.1	96.5	99.6	97.9	96.1	90.0	94.0	93.1	83.7	94.3	97.0	97.2	94.9
CALM	2.9	3.5	0.4	1.1	3.9	10.0	6.0	6.9	16.3	5.7	3.0	2.8	5.1
1-4	90.3	83.9	85.7	84.0	91.5	84.6	9.7	89.9	81.2	84.6	91.5	88.8	87.1
5-8	5.7	11.4	12.8	14.1	3.9	3.9	3.3	3.2	2.1	9.7	3.8	8.8	7.0
>8		1.2	1.1		0.7	1.5	0.0	0.0	0.4	0.0	1.7	0.4	
9-12	0.7			0.4									0.7
>12	0.4			0.4									0.1
Total	100	100	100	99.6	100	100	100	100	100	100	100	100	100

The annual wind directions have the following frequencies: 49.5% for the easterly winds; 13.8% for the southerly and southwesterly winds; and 6.3% for the westerly winds (**Table 42**). The monthly maximum wind speeds ranging from 10-19 mps were recorded from 2006 – 2010 (**Table 43**).

Table 43. Monthly maximum windsat the Coron, Palawan PAGASA Station (2006-2010).

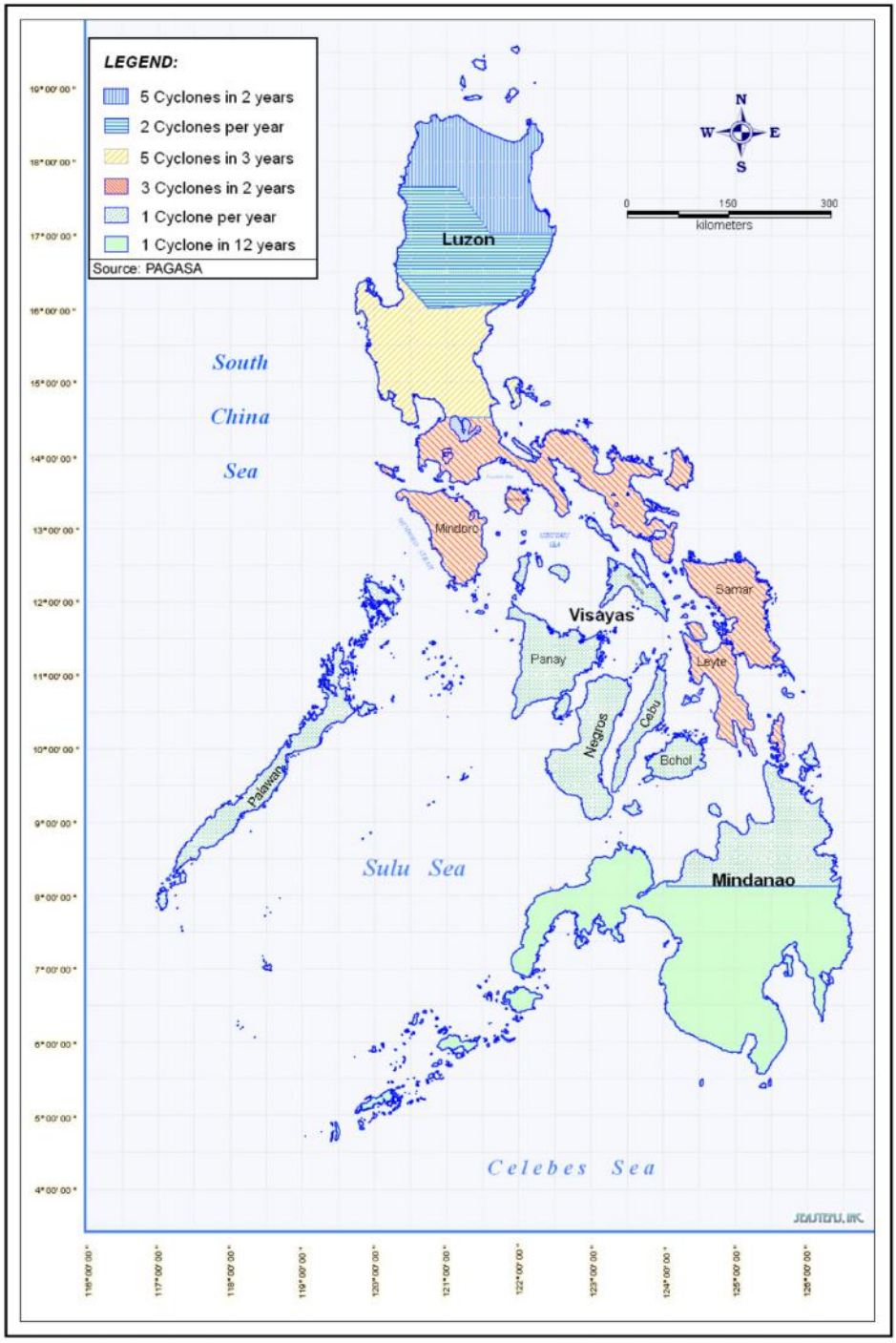
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2006	M	M	M	M	M	M	M	M	M	12/NW	M	M	M
2007	M	M	M	M	M	M	M	M	M	15/SW	16/NNW	10/NE	M
2008	12/NE	12/NW	14/SE	13/SE	16/S	16/S	10/S	12/S	15/SW	10/ESE	19/W	11/SE	14/SE
2009	10/SE	12/ESE	13/SE	13/ESE	16/S	14/SW	18/SW	18/SW	18/SW	12/SW	No data	10/NE	18/SW
2010	15/NE	13/ESE	13/ESE	13/ESE	12/ESE	14/SW	10/SSW	13/SW	12/S	13/SW	12/SE	No data	13/ESE

S/D = speed/direction; M = missing

Tropical Cyclone Frequency. Tropical cyclones are normally formed within the Pacific Ocean and enter the Philippine area of responsibility at an average of 20 tropical cyclones per year of which nine make landfall. Northern Palawan is located in a region of the Philippines where one can expect the passage of tropical cyclones once a year (**Figure 67**). Thus, the risk from typhoons in the project site is very low. Palawan is also susceptible to other natural hazards including strong winds, waves and storm surge associated with typhoons. While some parts of the country were greatly affected by extreme storm surges during the passage of Typhoon "Yolanda", storm surge was not reported in El Nido. **Table 44** presents a list of worst typhoons to pass the country and Palawan from 1951-2013.

Table 44. List of worst typhoons to hit Palawan (1951-2013).

Name	Period of Occurrence	Wind Speed	Track
Tropical Storm "URING" (Thelma)	November 2-7, 1991	95 kph	Eastern Samar; Leyte; Northern Cebu, Northern Negros Occidental; Southern tip of Guimaras; just south of Cuyo Is.; Northern Palawan.
Super Typhoon "RUPING" (Mike)	November 10-14, 1990	220 kph	Dinagat Island, Southern Leyte, Cebu, Negros Occidental; Northern Guimaras, Iloilo, Antique, Northern part of Cuyo Islands; Linapacan Strait, Northern Palawan.
Typhoon "NITANG" (Ike)	August 31-September 4, 1984	220 kph	Surigao del Norte, Southern Leyte, Northern Bohol, Southern Cebu; Negros Oriental; Negros Occidental, Guimaras; Southwestern Iloilo, Antique; Northern Cuyo Islands; Coron Is., Palawan.
Typhoon "UNDANG" (Agnes)	November 3-6, 1984	230 kph	Eastern Samar, N. Leyte, Masbate, Northern Iloilo, Capiz, Aklan, Northern Antique, Coron and Culion Islands of the Calamian Group
Typhoon "AMY"	December 6-19, 1951	240 kph	Eastern Samar; Leyte; Cebu; Negros Occidental; Iloilo; Antique; Cuyo Islands and Northern Palawan.
Super typhoon "YOLANDA"	November 8-10, 2013	315	Eastern Samar; Leyte; Cebu; Negros Occidental; Iloilo; Antique; Cuyo Islands and Northern Palawan.



Frequency of Tropical Cyclones

Figure 67. Tropical Cyclone Frequency and Risk Map of the Philippines.

3.3.2 Climate Change Projection

The climate change projections of PAGASA for the years 2020 and 2050 are used for this report. The projected changes are relative to the baseline climate data of PAGASA from 1971 to 2000. Climate change projections were done for rainfall, temperature and extreme events (**Table 45**).

Table 45. Projected changes in temperature, rainfall and extreme events for Palawan Province (PAGASA 2011).

	Observed Baseline				Change in 2020 (2006-2035)				Change in 2050 (2036-2065)			
	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON
Temperature increase in °C	26.9	28.1	27.3	27.4	27.8	29.2	28.3	28.3	28.7	30.2	29.3	29.2
Seasonal rainfall change	101.8	189.3	781.7	640.6	117.5	182.1	779.1	660.2	109.1	180.3	782.7	647.5
	No. of days w Tmax >35°C				No. of dry days				No. of Days w/ RF >200mm			
	1971-2000		2020	2050	1971-2000		2020	2050	1971-2000		2020	2050
Frequency of extreme events	29		23	297	8348		6457	6455	2		7	7

Figure 68 is a graphical presentation of the baseline and predicted temperature in Palawan province for the years 2020 and 2050. It can be gleaned from the graph that temperatures in Palawan are expected to slightly increase with 0.9 to 2.0°C increments in the medium and long terms.

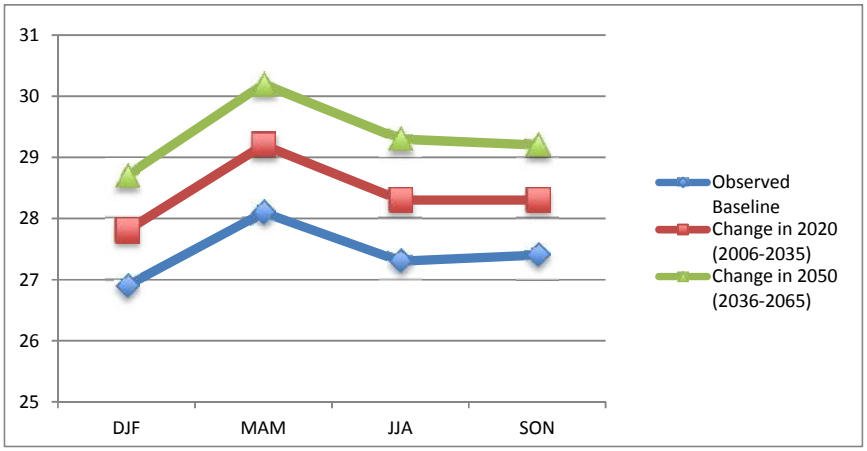


Figure 68. Temperature Projections for Palawan Province (Source: PAGASA 2011).

Figure 69 presents a graphical presentation of the predicted seasonal rainfall change in Palawan Province for the years 2020 and 2050. As shown on the graph, significant increase in rainfall is predicted for the rainy months from June to November. A less than significant increase in rainfall amount is predicted for the months of December to March.

In terms of extreme events, significant temperature increase is not predicted for 2020 although much hotter days are expected in the year 2050. Meanwhile, the number of dry days is expected to decrease in both 2020 and 2050. The number of days with rainfall greater than 200 mm is expected to increase from 2 days to 7 days for both 2020 and 2050. This means that the number of days with extreme amounts of rainfall is expected to increase in the medium and long terms.

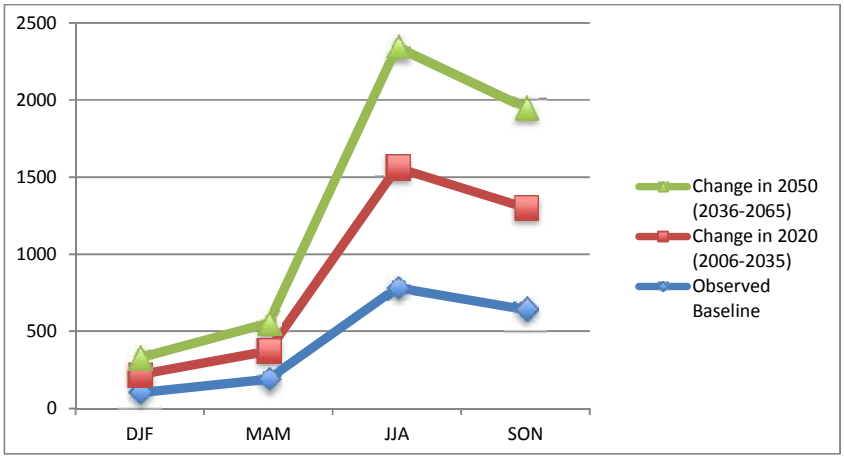


Figure 69. Predicted Seasonal Rainfall Change in Palawan Province (PAGASA 2011).

3.3.3 Air Quality and Noise

3.3.3.1 Methodology

One-hour air and noise quality monitoring was conducted by CRL Calabarquez Corporation in five sampling stations from 13 to 14 August 2014 (**Figure 70**). The stations were pre-selected and strategically distributed to evaluate the existing air quality in the vicinity of the sampling station (**Plate 15**). The location of the sampling stations has the following geographic coordinates:

Station	Location	N Latitude	E Longitude
A1	Brgy Villa Libertad	11.192889	119.424444
A2	ITI Airport	11.203500	119.413278
A3	Brgy Pasadeña	11.269694	119.437111
A4	Northern Station	11.236250	119.425083
A5	El Nido Cove Resort	11.231222	119.423222

Three types of ambient air samplers were used for this project. These are briefly described in the matrix below.

Name of Equipment	Brand/Model	Testing Capabilities
High volume sampler	Tisch Environmental	TSP
Personal sampler	SKC	NO2, SO2
Anemometer	Lutron	Wind speed
Sound level meter	Lutron	Noise

TSP. The high volume sampler is equipped with an all-weather shelter timer and flowchart meter. It is powered by electricity from external sources. Ambient air was drawn through a glass fiber filter over a period of time. Particles having a diameter of 20 to 50 um were collected ordinarily. The filter paper containing the sample was weighed, thus the final weight of the sample over that of the standard volume of air sampled gave the concentration of TSP.

NO_2, SO_2. The SKC sampler is equipped with flow meter powered by external/internal power sources and low flow controller. It is attached to a parallel tubing with two pieces of midget impingers. For SO_2, the bubbler has a straight orifice nozzle while for NO_2, the bubbler has a fritted nozzle. A known volume of air was sampled with a wet chemical system where a constant volume of air sample passes through a suitable reagent that was reactive to the specific pollutant desired. As the air sample passes through the bubbler rack, the air diffuses forming air bubbles and slowly reacts to the chemical reagent forming a complex ion.

Plate 15. Representative photos of air quality sampling stations for Lio Tourism Estate.

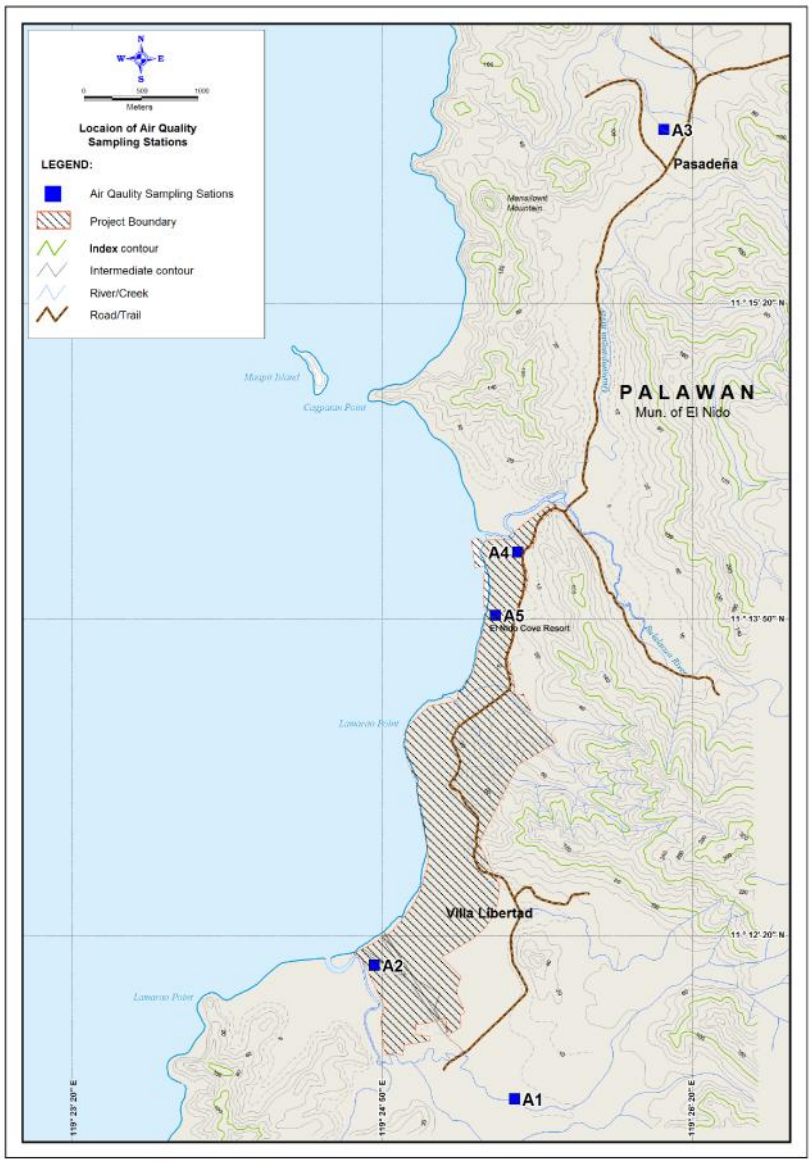


Figure 70. Location of air quality sampling stations.

The SKC personal sampler was calibrated with KRISS traceable digital calibrator to assure its accuracy. The samples were then analyzed using prescribed and approved methods.

Wind speed. The anemometer has a range of 0.1 m/s to 30 m/s and is calibrated against standard that is traceable to the National Institute for Standards and Technology (NIST).

Noise. A digital sound level meter was used in noise monitoring. The equipment can detect sound levels ranging from 30 dB to 130 dB. Lowest and highest noise levels were measured in each sampling station and were manually recorded. The multiple sound readings for a period of 15 minutes in each station were summarized getting its logarithmic average. The resulting value gave the equivalent noise level. Station A1 was located within the public school of Villa Libertad while Station A3 was located in the basketball court in front of the barangay healt ceter in Pasadena. Station A2 was located near the departure lounge of the Lio Airport. Station A4 was located near the northern boundary of the project site while Station A5 was located within the El Nido Cove Resort.

3.3.3.2 Results of Ambient Air Quality Sampling

The following matrix provides the results of the ambient air quality sampling conducted at the project site while the official lab results is presented in **Appendix 8**. As gleaned from the table, all values are within the DENR national air quality standard except for TSP in Station A1, which exceeded the standard value. This is attributed to the ongoing construction activities at the elementary school compound across the street from the sampling station. Majority of the air quality data from the five sampling stations reflect the unpolluted air typical of rural areas with no major sources of air pollution.

Noise values in Stations A1 and A3 also exceeded the DENR noise standards. This is attributed to anthropogenic activities in the vicinity of the sampling stations.

Table 46. Ambient air and noise quality data in the project site and vicinity (13-14 August 2014).

Location	Date (2014)	Time of Sampling	TSP (µg/Ncm)	SO_2 (µg/Ncm)	NO_2 (µg/Ncm)	Noise dB(A)	DENR Noise Std
A1	13 August	1330H – 1430H	417.45	ND	ND	58.85	50[1]
A2	13 August	1540H – 1640H	30.07	ND	ND	51.21	65[2]
A3	14 August	0828H – 0928H	22.95	ND	ND	54.52	50[3]
A4	14 August	1005H – 1105H	24.55	ND	ND	47.86	70[4]
A5	14 August	1300H – 1400H	43.05	ND	ND	42.04	65[5]
DENR Standards (NAAQGCP) / Guideline Value		**1 hour sampling**	**300**	**340**	**260**		

Notes: ND – Not detected. Minimum Detection Limit for NO2 =0.04 µg; SO2m=0.15 µg;Exceedances are highlighted in blue.
1 – Class AA (contiguous area that requires quietness such as schools)
2, 5 – Commercial area
3 – Residential area
4 – Light heavy industrial area

Air quality sampling conducted during the 2012 EIA also indicated the unpolluted air quality at the project site with all samples from the three stations within the DENR standard for 1-hr and 24-hr sampling.

3.3.3.3 Key Potential Impacts on Air Quality

Construction Phase

Possible sources of air pollution during the construction phase include dust, noise and gaseous emissions from construction activities. Sand, cement bags and other construction materials are possible sources of dust emission while machinery trucks and vehicles are possible sources of gaseous emissions. However, air quality degradation during the construction phase is not

expected to cause nuisance to the barangay population centers due to its distance from the project site. Dust may also affect plant productivity but impact is of short-term duration and use of dust suppression equipment or practices is expected to mitigate this impact.

Covers for construction stockpiles and trucks delivering construction materials should be provided to minimize fugitive dust emissions. Exposed areas should also be regularly sprayed with water to minimize suspended particulates. Dust curtains may be provided for plants.

Work should be restricted during the daytime to reduce nuisance from noise. Trucks and vehicles used during construction should be properly maintained to reduce air pollution from exhausts. Noise mufflers should be used to minimize the increase in noise levels.

Operation Phase

Possible sources of air pollution during the operation phase are the use of diesel-fired power generators, vehicles and equipment. Proper and regular maintenance of the equipment and vehicles will minimize gaseous emissions.

3.4 PEOPLE

The Municipality of El Nido is located on the northern part of the province of Palawan. It is about 238 kilometers from Puerto Princesa City and about 420 kilometers away from Manila. The municipality was formerly called "Bacuit" during the Spanish occupation, but it was changed to "El Nido" under RA 1140 of 1954. Nido is the local name of a rare species of swallow *(Collocalia fuciphaga*) that produces edible birds' nests and is prevalent in the municipality.

El Nido is a first class municipality with a total land area of 92,326 hectares. It has a distinct marine and coastal environment that showcases diversity in its flora and fauna and scenic geologic formations. Recognizing the importance of the rich and diverse ecosystems of El Nido, it was established as a Marine Turtle Sanctuary in 1984, a Marine Reserve Park in 1991, and finally proclaimed a Managed Resource Protected Area in 1998.

As a managed protected area, El Nido is considered the largest marine sanctuary in the country. The El Nido-Taytay Managed Resource Protected Area covers a total of 90,321 hectares of which 60% are marine areas and 40% are terrestrial areas. The local government and the protected area management board (PAMB) of El Nido are in the forefront of ensuring that the areas' natural resource are strictly protected and sustainably managed.

3.4.1 Socio-Economic Features

El Nido is composed of eighteen barangays, four of which are considered urban barangays while the rest are rural barangays. Majority of these barangays are coastal communities.

Based on the May 2010 population census of the National Statistics Office, the municipality registered a total population size of 36,191 and is projected to reach 39,501 in 2013 with an annual growth rate of 2.96%. The number of households is expected to increase to 7,900 by 2013 from the registered 7,238 total number of households in 2010.

The table below presents the municipality's population distribution and number of households by barangay in 2010. Barangay Bucana posts the highest population size, followed by Barangay Teneguiban while Barangays Maligaya zone 1 and Villa Paz registered the lowest population size with 1,142 and 1,072 individuals, respectively.

Table 47.Population distribution and number of households by barangay (NSO 2010)

Urban Barangays	Population	Number of HH
Maligaya Zone 1	1,142	228
Buena Suerte, zone 2	2,512	502
Masagana, zone 3	1,666	333
Corong corong,zone 4	1,846	369
Rural Barangays		
Aberawan	1,305	261
Bagong Bayan	1,216	243
Barotuan	2,085	417
Bebeladan	2,224	445
Bucana	4,231	846
Mabini	1,262	252
Manlag	1,882	376
New Ibajay	2,938	588
Pasadena	1,584	317
San Fernando	1,796	359
Sibaltan	1,505	301
Teneguiban	4,067	817
Villa Libertad	1,858	372
Villa Paz	1,072	214
Total	36,191	7,238

The upward trend in population growth for the past years is attributed to migration from adjoining provinces and from island municipalities within the province. The relative attractiveness of El Nido in terms of economic opportunities and livelihood advancement are main reasons for the high migration rate in the municipality. El Nido's net migration rate in 2000 was estimated at 58.41% against the net natural population increase of the municipality which was only 41.49%*(2000 NSO Census and Provincial Health Office Report).* This trend in effect poses pressure on the municipality's ability to meet the growing demand for access to social services and employment opportunities.

In the 2011 CBMS survey of the Provincial Planning Office of Palawan, there are 5,014 households in El Nido having an income that is below the poverty threshold. Poverty incidence in the municipality stood at 67.52% during the 2011 CBMS survey and increased by 0.76% compared to the 2008 CBMS survey result.

The municipality's poverty incidence rate of 67.52% is much higher compared to the 2011 provincial and national average of 57.95% and 22.30% respectively. Despite the boom in its tourism industry, economic hardship is apparent in the locality. Based on the report of the Provincial Planning and Development Office (PPDO), BarangaysVilla Paz and Bucana have the highest percentage of households with income below poverty threshold at 91.60% and 86.14 % respectively. Barangay Maligaya has the lowest percentage of households below the poverty threshold at only 14.43%.

Further, out of 21,392 persons under the productive age (15 years old and over) in 2011, only 11,820 are in the labor force. Majority of them (10,804 individuals) are either employed or self-employed. This 2011 figure of 10,804 indicates a significant employment proportion rate of 91.40%. This 2011 employment rate was slightly lower than the provincial and national employment averages of 92.36% and 93.00% respectively.

3.4.2 Resource Characterization/ Existing Livelihood

Agriculture and fisheries are the main sources of livelihood in El Nido. Rice, coconut, and cashew are the major crops in the municipality. About 3,550 hectares of land is planted to rice with 12,550.30 metric tons of yield recorded in 2011. Rice yield for that year has reached 150.5 % level of sufficiency.

Cashew production of El Nido was recorded at 11,397.89 metric tons with 4,900 farmers into this type of livelihood. Coconut production was recorded at 7,516,270 for 92,743 trees, while mango yield was recorded at 534.8 metric tons based on the 2011 PPDO Report.

Seasonal edible bird's nest gathering is also one of the local sources of income.

Majority of the labor force of El Nido is engaged in agri-fishery (66.06%), agriculture (41.45%), fishing (23.74%) and forestry activities (0.88%). Commercial establishments, retail stores and manufacturing and other services accounts for 9.9% where more than half of these services are tourism- related.

Due to the protected statusof Bacuit Bay, commercial fishing and other illicit resource use activities such as mangrove cutting are not allowed. Local fishers use hand-line and gill nets and motorized and non-motorized outrigger boats for fishing. At present, there is a heightened challenge for the LGU and the Park Management of El Nido to completely curtail the use of open resource (both aquatic and land resources) by local communities who are dependent on these resources for survival.

In 2013, 4.7 million tourist arrivals was recorded by the Department of Tourism in the country. It is projected that by 2016, there will be 10 million tourist arrivals in the country with Palawan as one of the major tourists destinations. This industry is a key job generator for the country and for its local destinations.

Tourism in El Nido has gained grounds in recent years and is considered a vital economic backbone of the municipality. Tourist arrivals for 2014 are projected at 78,000. El Nido is known for the El Nido Resorts, which operates three island resorts in Bacuit Bay. These resorts are of international standards and have self-contained facilities for board and lodging, sports and other recreational facilities. Various types of tourist lodging houses and inns are also found in the town proper. Booking offices, island tour guide, diving services, boat hire services, pedal bike rentals for inland tours, internet cafes, restaurants and eateries that serves foreign cuisine, massage parlors and spas and other tourism-support services has been on the rise in the past five years.

These tourism-based services accounts for 53.2% of all service establishments in the municipality.Wholesale and retail trade, expansion of commercial establishments and transport (shuttle vans El Nido- Puerto Princesa and vise-versa) hire services are also emerging economic activities.Small and medium enterprises operating at the household or cottage level also operate within the municipality.

The Local Government of El Nido through its Tourism Municipal Office has developed additional tourism destinations to complement existing tourism activities in the municipality.Worth visiting are the additional attractions in the area namely; Bulalacao Waterfalls, El Nido Waterfalls, Nagcalitcalit Waterfalls and Tabangca Hot Spring at barangay Pasadeña; Kuyawyaw Waterfalls at Bagong Bayan, Makinit Hot Spring and Peng Hot Spring at barangay Barotuan ; Singkokan Waterfalls and naturally grown mangrove plantation at barangay Villa Paz; Macangit and Estar caves at barangay New Ibajay; Santikan viewdeck at barangay Corongcorong and the Roman Catholic Church located at the town proper.

In strict collaboration with the Park Management Office, NGOs and other private resort owners, the local government of El Nido is keen on strictly implementing its tourism plan and regulations to ensure that future developments will not create further destruction to sensitive marine and coastal ecosystems in the area.

3.4.3 Social Services

3.4.3.1 Education

Based on the 2011 CBMS survey result, basic literacy rate among children with age 10 years old and above in the municipality stood at 97.23% which was slightly lower as compared to the 2008 CBMS survey result of 97.80% or a decrease of 0.57% during the three year period. Further, the literacy rate of El Nido for school year 2011-2012 is a little higher compared to the provincial average of 91.54% and that of the national average of 95.6%.

El Nido has a comprehensive educational service from primary to tertiary level. It has 27 elementary schools with 132 instructional classrooms complemented with 139 elementary school teachers. There are 39 daycare centers situated in various barangays of the municipality. A private preparatory and primary learning center is also present in the locality.

For secondary education, El Nido has 8 secondary schools with 53 instructional classrooms and manned by 72 secondary school teachers. There are two universities for tertiary education, the Western Philippine University located at barangay Villa Libertad and the Palawan State University located in barangay New Ibajay.

3.4.3.2 Health and Sanitation

Based on the 2011 Socio-economic Profile of El Nido, the leading causes of morbidity are bronchitis, broncho pneumonia, hypertension, influenza, upper respiratory tract infection, urinary tract infection, diarrhea and animal bites (all kinds). Malaria ranked 5th with 232 patients affected.

Pneumonia, hypertension, cancer (all forms), cardio respiratory arrest, acute gastroenteritis, cardiovascular disease, stroke, acute peptic ulcer and pulmonary tuberculosis are recorded as the leading causes of mortality in 2011. Infant mortality is mainly caused by pneumonia, abnormality and sepsis, while pre-eclampsia and hemorrhage are the leading causes of maternal mortality.Waterborne diseases like diarrhea, cholera, fungal infections and other diseases could be related to poor water system and waste management.

Malnutrition prevalence rate among children aged 0-5 years old in 2011 stood at 6.0%. Malnutrition is not only attributed to the poor intake of daily nutrients but is also caused by poor environmental conditions, lack of sanitary toilets and potable water affecting the health and nutritional status of children in most localities in the province.

The 2011 malnutrition prevalence rate of the municipality, based on the CBMS report of the PPDO, is slightly lower compared to the provincial average of 7.76% and significantly lower than that of the national average of 32.30%.

El Nido has one Rural Health Center situated in the town proper and 16 satellite health stations located in barangays Aberawan, Bagong Bayan, Barotuan, Bebeladan, Buena Suerte, Bucana, Corong-Corong, Mabini, Manlag, New Ibajay, Pasadeña, San Fernando, Sibaltan, Teneguiban, Villa Libertad and Villa Paz. To further strengthen the delivery of basic health services in the municipality, satellite clinics were established in the sitios of Abuay (Villa Paz), Diapila (Teneguiban), Calitang (Bucana) & Cagbanaba II at barangay New Ibajay.

The rural health center has one municipal health officer, one assistant municipal health officer, two nurses, one medical technologist, two rural sanitary inspectors, one laboratory aide, nine midwives and 209 barangay health workers (BHW) tasked to promote basic public health and sanitation in the locality.

El Nido is one of the five municipalities in the province that have the highest number of accredited BHWs. There is also one private practicing physician and a dentist in El Nido town proper. For patients requiring extensive medical services, they are taken to the North Palawan Provincial Hospital that is located in Taytay, aroundtwo hours away from El Nido. Patients with more serious medical conditions are brought to Puerto Princesa City or Manila.

3.4.3.3 Water and Wastewater Disposal System

In the 2011 Provincial report of Palawan, 86.76 % of households in El Nido have access to potable drinking water supply. This proportion of households with access to potable drinking water was a bit higher compared to the provincial average of 85.42% but lower than the national average of 88.90%. The rest of the barangays are still dependent on deep well and springs. Some residents use Solar Water Disinfection (SODIS) through the assistance of Helvetas Philippines.

Despite being cited as one of the most visited tourist destinations in the country, El Nido is still deficient in its water supply system and lacks a proper wastewater management facility. In 2012, NEDA contracted a water resource engineering team to conduct a feasibility study in the municipality for the water supply and sanitation facility of El Nido town.

This 2014, under the Tourism Water Supply Infrastructure Program (TWSIP) of the DPWH, El Nido municipality is listed among 30 municipalities nationwide as one of the key target areas of the project. The program seeks to facilitate tourism and economic growth in identified priority areas in the country focusing on water source development and facility construction. The TWSIP is a joint project of DPWH, DOT, LWUA and NAPC with the support of USAID. Funding for the program has already been released 3rd quarter of 2014.

On waste management, the municipality is presently in the process of converting its existing controlled dumpsite into a sanitary landfill through the assistance of the Sustainable Coastal

Tourism in Asia (SCOTIA). It is located in barangay Villa Libertad and covers an area of four hectares. The LGU has intensified its waste management program and campaign to educate communities who still practice the open pit and burning methods.

A material recovery facility (MRF) managed by Ten Knots Resort is situated at sitio Dagal-Dagal, barangay Corong-Corong. The MRF is located in less than a hectare land area and serves as a drop-off station and sorting center of wastes generated by the resorts (Miniloc, Pangulasian and Lagen) for purposes of composting and recycling of waste materials.

El Nido is one of the recipients of the Barangay Environmental Sanitation Project (BESP) of the provincial government in 2003. It has adopted the low-cost sewerage alternative where septage effluent is treated prior to land disposal. Dislodging is done through the use of vacuum tanker to a drying bed prior to agricultural use. Collection is simplified through condominal sewer network among clustered houses, which conveys the sewage through combination of small-bore and condominal sewer system into CST (communal septic tank) with sand filter beds or soak-away pits.

Ten Knots Resort has its own desalinating plant,which generates the water requirements of the island resorts. All island resorts are also equipped with an STP or sewage treatment plant to ensure that the wastewater from the toilets and kitchens are rendered non-damaging to the environment. Water that is recycled from the STP is used for flushing and irrigation.

3.4.3.4 Power Supply

Based on the December 2013 report of the Provincial Government, Barangays electrified increased from 63.00% in year 2006 to 89.00% in year 2013 for the whole province of Palawan. In El Nido, 54% of the households have power connection and were already energized. Majority of these households are located in the urban barangays at the Poblacion.

Power is provided by the NAPOCOR and is distributed by the Palawan Electric Cooperative (PALECO). Prior to 24-hour power last December 2014, electricity was only available for 16 hours. Electricity used to be available only from 2:00 in the afternoon up to 6:00 in the morning of the following day.

The El Nido Resorts generates its own electricity. Other barangays use solar panels and generators.

3.4.3.5 Communication

SMART and GLOBE telecommunication companies provide communication service in the municipality. Internet service is available in various establishments around the poblacion. Wireless broadband is also present in most of the lodging houses and hostels in the area.

A postal office is located in the poblacion. Incoming correspondence from Manila and other provinces are sent through wooden water vessels plying the El Nido-Manila route while correspondence from Puerto Princesa City is sent through vans and jeepneys.

A local radio communication station is also present in the municipality. Newspapers and magazines transported from Manila by a ITI are available daily to subscribers.

3.4.3.6 Transportation

Travel from Puerto Princesa City (the provincial capital of Palawan) to El Nido municipality (vise-versa) is through buses and shuttle vans which depart from San Jose terminal of PPC at 8:00 AM daily. El Nido has a total distance of two hundred sixty nine kilometers (269 km) from the capital city and travel time takes around 6 to 7 hours.

Travel around mainland barangays in El Nido is through the earth paved circumferential road that connects the rural barangays with poblacion barangays. Jeepneys and tricycles are the major mode of transportation around mainland El Nido.

Commercial and cargo water vessels plythe El Nido-Manila route three times a week. Boats plying the El Nido-Coron route have trips on Tuesdays, Fridays and Sundays. Pump boats are also available for rent for trips going to other island municipalities such as Linapacan, Culion and Taytay.

Daily flights to Manila are provided by Island Transvoyager Inc, (ITI), which caters mainly to the guests of El Nido Resorts. ITI uses a 50 seater ATR aircraft with 55 minutes travel time between El Nido and Manila.

3.4.4 Ancestral Domain Areas

The first settlers of El Nido are known to be the Tagbanuas of the Calamians and the Cuyunons who migrated from the island municipality of Cuyo. These ethnic groups are mostly situated in barangay New Ibajay, sitio Batakalab, sitios of barangay Teneguiban, barangay Bucana, sitio Patuyo and Lalutay Island. The Tagbanua Tandulanen ethnic group dwells in barangay Bagong bayan *(NCIP, Provincial Office of Palawan, 2008 Report).*

There are ancestral domain areas being delineated in the municipality that is situated in barangays Teneguiban, Sitio Kawa-kawa, Barangay Corong-Corong and Cadlao island-Obogon Cove, Barangay Buena Suerte, Barangays Barutoan, Bebeladan, and Bucana. These areas are mostly inhabited by IPs according to the NSO survey, but no CADT application has been recorded at present.

3.4.5 Key Social Impacts

3.4.5.1 Identify settlers that will be displaced from among the existing settlers

Aside from the El Nido Cove Resort, the 325-ha project area is uninhabited and primarily covered by brushland, woodland, coconut plantation, grassland and freshwater swamp vegetation. ALI has acquired El Nido Cove Resort to integrate the land area into the planned development. Hence, Lio Tourism Estate will not displace any settlers. Instead, it will bring positive impacts to the community, such as generation of employment, increase in business opportunities, income from sales of produce and development of skills for hotel/resort management and operation.

Provision of beach access to locals is one of the major concerns raised during the various consultative meetings with the host barangays and municipality. The Proponent should look into this concern. A beach access for local residents that is acceptable to both parties should also be included in the planning design.

3.4.5.2 Discuss the in-migration patterns impact as a result of project implementation

The accelerating population growth rate in the province of Palawan has been a post-World War II phenomenon, After the war, the province's demography has grown far greater than can be explained by any process other than migration at a massive scale. The province's demography is now being increasingly augmented by the fertility behavior of second and third generation migrant families. Scientific studies of the PCSD indicate that the average 3.5 per annum population growth rate of the province is due to in-migration. In-migration is considered one of the key issues related to the dwindling forest resources of Palawan due to the continuous demand for the establishment of human settlements.

El Nido municipality is a miniature model of the in-migration pattern that characterizes the province of Palawan. The attractive location of El Nido, its abundant natural resources and

brewing economic opportunities are just some of the pull factors that draw migrants to settle in the area for years.

Lio Tourism Estate and the enhancement of its existing airport is expected to amplify the existing in-migration pattern and demographic growth rate in El Nido. The project will require substantial amount of manpower both high-skilled and low-skilled labor (but labor-intensive). If majority of the required labor force is available within El Nido, no drastic changes could be felt in the present demography of the locality that is due to in-migration. If majority of the manpower will be hired from outside of El Nido, it could have a wide-ranging effect on the present population of the municipality and the host barangays.

The tendency of workers to decide to stay temporarily near the project site (host barangays), sometimes with their families (average of four members) will mean additional migrants. An increase in the population size will likely result toincreased population density within the barangay proper of Villa Libertad and Pasadena. This will worsen the barangays' present waste management issue, insufficient health services and water distribution problem among its local residents.

The need for highly skilled manpower of the project during its operation phase may require hiring of professionals coming from Puerto Princesa City, Manila, and other urban provinces or even, from abroad. Young professionals enticed by the beauty of El Nido at the same time provided with the best opportunity to establish their career will most likely opt to transfer in El Nido either as transient or permanent residents. Contract of employment, relationships, family reunification and transnational marriages are contributory factors that may build up in-migration as an offshoot of the project.

Long-term non-economic push factors that may heighten in-migration in the long-run are the availability of better education and improved health services in the area (compared to other island municipalities in the province). The two tertiary institutions in El Nido might be encouraged to open more complementary courses and field of studies that support tourism-related professions. This will attract more students from other municipalities within the Province since El Nido is already a tourism training ground and offers higher chance of various employment opportunities such as ancillary services and indirect jobs.

With better amenities and services offered by the project favorable to retirees, El Nido will attract more foreign and Filipino retirees from other countries.

This pattern of population growth that is related to in-migration is seen as a potential threat to the ecological stability and social wellbeing of the municipality if not properly mitigated.

3.4.5.3 Impacts on IPs and culture/lifestyle

Documented success stories of El Nido foundation's community-based ecotourism projects may be replicated or introduced to the Tagbanua community situated in Teneguiban, El Nido where local government authority can motivate the IP community to further produce local/indigenous crafts that will be enhanced into high quality marketable products to cater to the growing demand of the tourism industry.This will mean additional sources of livelihood for the IPs and better opportunity for them to improve their living conditions.

Being a community largely created by in-migration area, the social cohesion in El Nido is not as tightlyknit as long settled communities. Social relationships are not that well cemented by affinity and associations hastily change in time. With the upward trend of in-migration to come, it is inevitable for existing beliefs, values, norms and material goods shared by local stakeholders of El Nido to evolve or transform into something else, which may affect local lifestyle. Migrants who will introduce new social behaviors and attitudes similar to the existing

population are less likely to disrupt the present social environment than those who bring in new ideas and behaviors.

3.4.5.4 Project implementation's threat to public health vis' a vis the baseline health conditions in the area

High occurrence of tourism-related diseases and illnesses is perceived as a major threat in the public health condition of El Nido when the project becomes operational. This also encompasses injuries and recreational-related hazards. Diseases are related to food, water or air, animal borne or communicable through human contact including sexually transmitted diseases. Based on the record of El Nido RHU, there has been no reported case yet of HIV-infected patient in the locality.

At present, the RHU only provides consultation services to its patients, observation of symptoms and provision for basic medications and first aid. Severe cases that need confinement are taken to the North Palawan Provincial Hospital, two hours away from El Nido town proper. There is a need to enhance the health services and facilities of the town to include lying-in clinics and additional health professionals. A social clinic that provides counseling and guidance for patients affected with communicable diseases such as HIV is seen as a necessity in a high-tourism locality like El Nido. Health professionals and volunteers in the municipality should also be educated in 'travel safe' campaigns in preparation for the growing tourism industry of the town.

The issue of prostitution in relation to the booming tourism in El Nido is also a grave threat. This includes child prostitution, pornography and sex trafficking where often guardians and parents are involved as perpetrators using the issue of poverty as an excuse.

Waste management issue is seen as an enormous problem for the municipality if the present situation on proper waste disposal and management is not given prompt and intensive attention by the LGU. Although Lio Tourism Estate will include under its utility components installation of sewage treatment plant and material recovery facility, it is still best for the LGU to address the macro issue on waste management that besets the whole town of El Nido. The waste management system that the project will mount is already an immense assistance to the LGU in sustaining LIO's clean and unpolluted environment.

Local Health Benefits expected from Project implementation

The establishment of a clinic or health center within the proposed resort will mean additional health professionals and facility for the municipality and for barangays Pasadena and Villa Libertad. Patients that need further medical treatment can be easily transported to Manila through the bigger airplanesof ITI. The economic spin-offs that will be brought about by the project will mean improved employment rate, thus poverty incidence and malnutrition will likewise be addressed significantly.

Assuming that the local government has started to put in place basic social mechanisms that pertains to health, environment and tourism before Lio Tourism Estate becomes operational, Ayala Land Corporation and Ten Knots will be guided on the appropriate health-related projects to be created to benefit primarily the host barangays (Villa Libertad and Pasadena) and augment the health programs being implemented by the LGU of El Nido.

3.4.5.5 Local health benefits expected from project implementation

The establishment Lio Tourism Estate in Barangays Villa Libertad and Pasadeña will be beneficial to the people especially during health emergencies because the project will have in-house medical personnel, transport vehicles, boats and a private plane that flies to Manila two to three times a day. Additionally, TKPI conducts regular medical missions in El Nido. This

will benefit the local residents especially those who cannot afford to seek medical treatment in El Nido's municipal health office.

3.4.5.6 Impact of the project on the delivery of basic services and resource competition in the area

The project will have a long-term positive impact to the municipality of El Nido, its host barangays and adjoining municipalities in Northern Palawan. El Nido will directly earn from taxes and permits to be incurred by the project and this is translated to an increase in revenues both for the municipality and the barangays. This will also prompt the increase in land value especially in areas within its proximity.

Employment rate is anticipated to largely improve, especially if the project will be able to tap majority of its required manpower within the municipality during the construction and operation stage. Demand in construction materials available within the municipality during the construction phase can step up the local economy. Manpower sourcing and construction material sourcing are projected activities that will highly impact the locality and its adjoining areas. Thus, the project should take into consideration where to source their construction materials since the LGU and community have already raised their concerns about the state of El Nido's natural environment and its limitations.

Employing local residents for the construction phase and operation of the project will greatly address the LGUs banner program of providing environmentally sound alternative livelihood options to its local constituents. It can stimulate more economic activities in the locality. With gainful employment, economically active individuals of the municipality can secure better access to health services, can increase their capacity to provide better quality and longer years of education to their dependents and can enjoy a better quality of life for themselves and their families.

Wages of employed locals will eventually result to second wave impact. With better purchasing power, they will have increased demand for local produce and harvest that will be felt by food-producers. Increase in demand for food and raw material sourcing and operating supplies of the hotel guests and establishment operators will be greatly felt once the project becomes operational. On the downside, employed locals and other residents will have to compete for the same subsistence supply of local produce which the resort will also be securing in greater quantity for its operation.

The economic spin-offs that will be brought about by the project in terms of job generation, commerce, tourism related-services, tourism activities, agricultural production, transportation and communication will bring in greater benefits to the locality and the local government of El Nido. But it cannot be discounted that the establishment of a high-end resort within the mainland, will have a great effect on the operation of existing small to medium-scale tourism business establishments in El Nido.

With tourists and guests having more options in their choices of accommodation and services in mainland El Nido, this may weaken the returns of other small-scale resort establishments and amenities. This poses greater challenge to existing resort owners and tourism-related establishments on how to progressively sustain and enhance the marketability of their products for specific target markets/sectors that cannot be reached by high-end resort establishments such as Lio Tourism Estate.

Lio Tourism Estate will also address the deficiency of available accommodations and amenities for the increasing number of tourist arrival in El Nido annually. There are only 1,025 hotel rooms available at present (based on the record of the Municipal Tourism Office) that caters to 64,905 tourist arrivals in 2013 and 78,000 forecasted arrivals in 2014, respectively. Further,

the LGU is strengthening their tourism-related policies and ordinances to ensure the preservation of their tourism attractions.

With more people, services and guests coming in, peace and order in the locality will also be threatened. At present, robbery is becoming a rampant issue. Local residents who might fail to qualify for employment in the project may not readily accept the families of in-migrant workers and can be seen as potential source of rifts and conflicts if not well mitigated.

The Local Government Unit and the Philippine National Police will have to reinforce their manpower skills and upgrade equipment in crime prevention and crime solution in the municipality. Community safety and management of the wellbeing of tourists should be strengthened in the over-all activities of El Nido's law enforcement agencies. Installation of preventive and security safety measures for tourism and commercial establishments should be pursued such as CCTV cameras. Additional patrol boats for PNP use are immediate needs that the LGU should address.

The estate facilities (police station, security outpost and fire station) and security system to be constructed that is included in Lio Tourism Estate will reinforce the peace and order management of the PNP and LGU of the locality. More and improved streetlights installed will minimize and prevent crime related incidents in the area.

3.4.5.7 Impact of the project on traffic situation in the area

Traffic congestion in El Nido is presently felt within the town proper with the growing number of four-wheel vehicles (private and commercial jeepney) and tricycles, which are the major modes of transportation around mainland El Nido. The existing tapered alley roads within the town proper can barely accommodate two contiguous vehicles at the same time.

In 2011, the Local Government passed an ordinance organizing a Traffic Management Group and deputized several personnel to manage the road traffic and provide daily checkpoints within the town proper and markets. This team will have to be strengthened and traffic facilities installed in anticipation of the growth of activities in the area.

No traffic situation has been experienced so far from El Nido poblacion to Lio airport and vise-versa via the concreted national road. But with the onset of the project, it is expected that vehicular traffic will build-up. More vehicles will traverse beyond Corong-Corong and El Nido town proper, which at the moment are the major destinations of most visitors. The possible improvement of the provincial road from Taytay to El Nido connecting New Ibajay and Sandoval circuit road will provide better accessibility to the project and will draw more visitors that may add up to traffic build-up during peak seasons.

The expansion and enhancement of the Lio airport will bring in more commercial flights that can cater to more passengers. This will mean an increase in airport transfer service or vehicles that will ferry passengers to and from the airport. This will translate to an increase in demand for sufficient parking space.

The flow of motorists during typical rush hour will be modified. With better and more diverse employment opportunities offered by the project once operational, Barangay Villa Libertad and Barangay Pasadena will become a crowd-puller area that will reduce the pull-factor value of the poblacion. This flow-pattern will decongest not only the traffic build up around town but also the overcrowding of establishments, which will result to reduced impact on existing resources of the poblacion.

3.4.5.8 Entity to be accountable for environmental management in the area

The **Protected Area Management Board** (PAMB) administers the El Nido-Taytay Managed Resource Protected Area, which covers around 36,000 hectares of land and 54,000 hectares

of marine waters. The PAMB is mandated to decide on management strategies and policies, decide on matters pertaining to planning, resource protection, PA administration and program implementation and monitoring and evaluation. It is composed of the PCSD as Chairman, DENR, Mayor of El Nido, Mayor of Taytay, eighteen (18) barangays of El Nido, four (4) barangays of Taytay, El Nido Foundation, Municipal Planning and Development Council, Municipal Tourism Council, ABC President, CRAEN, Municipal Tourism Officer, Women association, Farmers association, Fishermen association, SB Chairman for Tourism, Pumpboat association, Department of Education, Philippine National Police, World Wildlife Fund.

- **The Protected Area Superintendent (PASU)** is the chief operating officer assigned on-site to oversee the day-to-day activities of the protected area management office. He both executes administrative and regulatory functions in accordance to the implementing rules and regulations stated in the protected area management plan of El Nido and Taytay. A senior technical officer from the Department of Environment and Natural Resources is assigned as the PASU in El Nido with his support staff.
- The **Provincial Bantay Kalikasan and Joint Task Force Malampaya** are enforcement entities that provide protection, support and security to the environmental enforcement activities of the protected area management board of El Nido and to the **multi-sectoral network of enforcementteam** in the municipality with the PNP, Coastguard, Philippine Navy, Air Force and the LGU.
- The **El Nido Foundation** is a local NGO with independent 15-member Board of Trustees, coming from both private and public sectors. Its vision is to improve the quality of life of El Nido's local stakeholders and to preserve the area's natural resource base. Some of their undertakings are resource management, reef restoration and education, water resource conservation and rehabilitation, initiatives in agriculture, development of tourism-support services, community-based health program – Malaria Control Project (CBHP-MCP), and ecotourism and encouragement of local crafts to name a few.

3.4.5.9 Impact of the project on existing properties in the area in terms of relocation and devaluation

The project is expected to lead to the increase of land values in Barangays Villa Libertad and Pasadeña, especially within the immediate vicinity of Lio Tourism Estate. This is a normal impact for areas where land development is active.

3.4.5.10 Affected properties

Construction of the project will help resolve the deficiency in available accommodations for the increasing number of tourists coming to El Nido. Tourist arrival was recorded at 36,975 in 2010 and 44,567 in 2011. At present, there are 581 hotel rooms in El Nido. According to the Municipal Tourism Officer, this number is hardly adequate especially during the peak season.

3.4.5.11 Gender Sensitivity in Employment and Livelihood Opportunities for the Local Community

Ten Knots is an equal opportunity employer. Through the creation of meaningful employment opportunities and the commitment to hire and promote locally, the people of El Nido and Taytay have a viable option to earn a decent living and stay in their own community. Scheduled trainings are offered to the local community to improve the skill set for potential employees not just for the resort, but also for other smaller tourist cottages in the area. Since 2005, resort supervisors have been training local people for basic skills in the areas of food & beverage, housekeeping, and kitchen. Working with professional trainers, local women are trained to become massage therapists. Over the years, banca owners from the town have

been regularly providing the transportation needs of El Nido Resorts guests [6]. The development will provide opportunities for direct and indirect livelihood for the surrounding communities. The development shall endeavor to provide gender-sensitive and sustainable livelihoods during the development life cycle up to operations. Some of these livelihoods may include community-based tourism and enterprises that are essential in the tourism supply chain such as agri-based development, food production and ancillary services.

Women from several barangays (villages) in El Nido have also been trained in weaving to produce native bags and slippers that are purchased by the resorts. The bags and slippers are given as complimentary room amenities, thereby ensuring continuous demand. El Nido Resorts tries to keep on reducing food miles by sourcing locally. Locally and organically produced vegetables comprise 60% of total kitchen purchases, while locally reared livestock comprise 90% of total kitchen purchases[7].

Table 48 provides a summary matrix of the project impacts on the socio-economic environment. Assessment of the degree of socio-economic impacts was done based on various socio-economic studies done in El Nido. The scales used are defined as follows:

HP (High Positive)	Largely beneficial to the community and greater number of stakeholders and may bring about/effect progressive development to the various socio-economic facets of the area
LP (Low Positive)	Encouraging effect to improve way of life for certain sectors of the community
MP (Medium Positive)	Helpful/gainful for particular/ certain sectors of the society/community
HN (High Negative)	Unfavorable and harmful to the community and may cause adverse effects/disruptions to the various socio-economic facets of a society
LN (Low Negative)	Not constructive for the community but is being administered/ addressed under the local governance
MN (Medium Negative)	Detrimental to the community but could be managed with the LGU and other institutions' regulatory mechanisms in place

[6] Source: http://www.elnidoresorts.com/elnido/sustainability/building-sustainable-communities/
[7] Source: http://www.elnidoresorts.com/elnido/sustainability/building-sustainable-communities/

Table 48. Summary Matrix of Impacts and Their Level of Significance

Parameters	Impact	Nature	Magnitude
Population size	Expansion will be exacerbated due to in-migration	HN	Very significant
Employment and Income	Job generation, more employment opportunities and better income; poverty alleviation	HP	Very significant
Economic activities	LGU earnings from taxes and economic spin-offs can heightened delivery of basic services, fuel-up and broaden existing livelihood activities and create more employment that can be translated to better income and quality of living.	HP	Very significant
Basic social services of the LGU	LGU will be challenged to put in place the required mechanisms to meet demands of development such as power supply and water system.	HP	Very significant
	Competition for social services and resources	HN	Very significant
Tourism Operation in El Nido (medium to small scale enterprise)	Decrease in profit and drain resources	HN	Very significant
Dependency burden	Wages will increase capacity to support dependents	HP	Very significant
Education	Wages will increase capacity to get education	HP	Very significant
Health and Sanitation	Wages can increase capacity to access better health services.	HP	Very significant
	Project can hasten and complement LGU-related programs.	HP	Very significant
	Tourism-related illnesses and diseases may magnify	HN	Very significant
Peace and Order	Introduction of new attitudes and behaviors dissimilar to the social environment of El Nido may threaten peace and order.	MN	Significant
Indigenous People	Economic opportunities in commerce, arts and crafts can improve their livelihood	MP	Significant
Land values	Will largely increase	MN	Significant
Community Support and Participation	Heightened if the locals (especially host barangays) are appropriately informed, consulted and actively involved in planning for their social development activities in their respective areas.	HP	Very significant

4 IMPACTS MANAGEMENT PLAN (IMP)

A Pollution Control Officer (PCO) will ensure that the project will comply with its ECC conditions and follow the recommendations under the environmental management and monitoring plans during the construction and operation phases of the project.

The recommended mitigating measures to address the identified project impacts are discussed in the following sections.

4.1 THE LAND

4.1.1 Land Use

Development of Lio Tourism Estate will result to change in land use in the northern part of El Nido. However, the development is consistent with the land use and zoning plan of the municipality, which earmarks the area for tourism development.

The possible increase in land values is a positive impact, as it will bring economic upliftment to land owners of adjacent properties.

4.1.2 Geology

The most significant source of project impact on geologic conditions is the excavation of earth materials during the pre-construction phase. This impact is temporary and expected to last during the construction phase. The Proponent and Contractor should ensure that slope protection measures are in place and proper drainage systems are installed and maintained throughout the construction and operation phases of the project.

Excavation and construction near beaches and streams should take into consideration the vulnerability of loose sediments to adjust by slumping and piping. As much as possible, construction work in these areas should be kept to a minimum.

Siltation and sedimentation from upland is expected throughout the construction and operation phases of the project. These are natural processes that need to be addressed in order to maintain the quality of beaches fronting the property. Siltation ponds will be placed in strategic places within the property to prevent sediments from reaching the beach.

4.1.3 Terrestrial Ecology

4.1.3.1 Terrestrial Flora

To address the project impacts on terrestrial ecology, plant individuals lost to clearing should be replaced with the same species as much as possible. Vegetation clearing should be kept to a minimum and only when necessary. This should be included in the contractor's construction contract.

Wildlings and seeds of trees that will be affected by the construction should be collected and tended in the nursery for use in replanting.

Landscaping of the hotel premises should be done with minimal use of exotic plants. Use of existing plants especially the threatened ipil and antipolo trees should also be encouraged. Wildlings and germinated seeds of threatened species can be used in landscaping the hotel surroundings.

The wetland locations should be spared from development for its ecological role as an important habitat of wildlife, among others. The wetlands should be integrated in the overall design of the hotel complex as

wetland/natural area where guests can do bird watching and boating. If road network will be constructed in these areas, large culverts should be used so as not to block the flow of water.

Use of chemical spray should be kept to a minimum and only when necessary in order to minimize impact on plant pollinators. The use or organic insecticide should be favored as it is more environment-friendly.

The following mitigating measures are recommended to address the project impacts on terrestrial ecology during the operation phase of Lio Tourism Estate:

- Replanting, translocation of notable vegetative habitats for wildlife, establishment of replanting areas should re-establish or enhance current levels of biodiversity after completion of the project.
- Encourage replanting and landscape development with the use of native species of plants. Fruiting trees might be preferred so as to increase frugivorous birds and other wildlife in the area. This would also enhance the birdwatching activities that is planned to flourish in the area. Birds are easily sighted in high numbers and species in their favourite fruiting trees. Once there are various fruiting trees in the project site, the insects would also follow as with the insectivorous birds (mixed flocking). During fieldwork for the EIA, a huge flock of green pigeons *Treron* sp. were often spotted in fruiting bangkal trees while the insectivorous Ashy Drongo was just around the corner busy swooping insects feasting on the bangkal fruits.
- The road traversing the property and much of the wetland areas can be utilized as a birdwatching (monitoring) route/platform for wetland species especially birds.
- During trekking and hiking activities, there should be standard regulations in the use of trails and if camping is allowed, strict observance towards proper waste disposal, noise levels, collection of plants or animals and campfires. There should also be limitation to the number of people allowed to hike or camp at a time.
- Release of exotic species or pet accompaniment should be regulated or prohibited as these pose threat to local flora and fauna. Pets, such as cats, are known to attack bird's nests and other wildlife.

4.1.3.2 Terrestrial Fauna / Wildlife

The following mitigating measures are recommended to address the project impacts on terrestrial wildlife during the construction phase:

- Areas to be cleared of vegetation should be fenced to avoid unnecessary expansion of clearing.
- Cleared vegetation should be replaced with indigenous plants (i.e. fruit bearing plants for bats and birds and flowering plants for nectar feeding birds and insects).
- Road widths should be minimized to reduce impacts to adjacent habitats and to avoid wildlife migration and dispersal.
- Operation of high noise-emitting equipment must be scheduled and a routing scheme must be devised to minimize impacts to wildlife.
- Vehicles and equipment must be subjected to regular maintenance to avoid noise pollution.
- Excavated soil should not be placed on native vegetation. Instead, the excavated soil should be placed on future road surfaces.
- Workers should be reminded not to engage in poaching activities. A system of penalties should be imposed on workers caught engaging in such activities. The same should be done for guests and resort workers who will engage in hunting, killing and selling of wildlife animals during the operation phase of the project.
- Environmental guides should be designated during the operation phase to guide resort guests in their nature trail activities.

Table 49 presents a summary matrix of mitigating measures to prevent project impacts on wildlife.

Table 49. Predicted impacts and recommended mitigating measures in the various stages of project development.

Project Phase	Potential Impact(s)	Mitigating Measure(s)	Impact Prediction
Pre-Construction	None	None	None
Construction	Clearing of vegetation	• Areas to be cleared of vegetation should be fenced to avoid unnecessary expansion of clearing. • Cleared vegetation should be replanted using indigenous plants (i.e. fruit bearing plants for bats and birds, and flowering plants for nectar feeding birds and insects). • Roads widths should be minimized to reduce impacts to adjacent habitats, and avoid wildlife migration and dispersal.	High
	Noise Pollution	• Operation of high noise-emitting equipment must be scheduled • Devise a routing scheme to minimize disturbance • Vehicles and equipment should be subjected to regular maintenance	Medium
	Dust Accumulation and Rock debris	• Water should be sprinkled first in areas to be excavated to minimize dust accumulation and spreading • Excavated soil should not be deposited on native vegetation but placed on proposed future road surfaces	High
	Siltation	• Excess gravel, cement and asphalt should be recycled as back filling materials. • Water the areas to be excavated	High
	Disturbance from housed personnel and field quarters	• Quarters can be constructed on existing cleared area • Implement a system of penalties for workers who engage in poaching activities • Workers should be placed in nearby barangays to reduce the number of personnel staying at the project site • Designate disposal areas	High
	Solid Waste Pollution	• Designate disposal areas within the premises of resort • Implement regulations on solid waste management • Implement a system for solid waste segregation and weekly collection of garbage • Implement a system of penalties for littering within the premises of the construction site	High
Operation	Solid Waste Pollution	• Designate disposal areas within the premises of resort • Implement regulations on solid waste management • Implement a system for solid waste segregation and weekly collection of garbage • Implement a system of penalties for littering within the premises of the resort	High
	Poaching	• Implement a system of penalties for visitors and locals who will engage in hunting, killing and selling wildlife animals from the premises of the resort	High

Project Phase	Potential Impact(s)	Mitigating Measure(s)	Impact Prediction
	Noise generated by the visitors	• Designate tourist guides who are aware of the wildlife animals inhabiting the premises of the resort in guiding the visitors • Create a daily schedule for visitors' tour particularly in Sites 1, 3 and 4 to avoid disturbances.	Medium
	Water Contamination (Pond)	• Put plants capable of accumulating heavy metals from the pond to prevent contamination of freshwater wildlife and avoid disruption of nutrient cycle • Regulate the number of fishes to be imported for breeding • Deposit gravel to increase the spawning habitat	High
	Contamination by pesticide	• Use organic fertilizer to avoid contamination or any adverse effects to terrestrial wildlife • Use nets to prevent ground dwelling animals (mammals) from eating the crops	
Abandonment	Solid Waste Pollution	• Supervise proper waste disposal • Rehabilitation of the site using indigenous plants	Low

4.2 THE WATER

4.2.1 Hydrology

The potable water supply during the operation phase of the project will primarily depend on deep wells, shallow wells and groundwater reservoirs. This will be supplemented with freshwater to be generated by a desalination plant.

Tapping into the groundwater supply of the area will create competition for water supply between the project and residents of the host barangays. With the absence of a piped water distribution system, the local residents rely on dug wells for their water supply. The Proponent will need to determine the sustainable groundwater yield of the wells and employ alternative sources of fresh water especially during the dry months when groundwater recharge is low.

Being located in a coastal area, groundwater in the project site is also susceptible to saltwater intrusion. Water resources in the coastal areas are also susceptible to changes in rainfall patterns and sea level rise. The Proponent should consider these factors in the well design as well as in the siting of the wells.

Construction of buildings and other concrete structures will also diminish the recharge of aquifers. To mitigate this impact, use of pervious materials for path walks and parking areas is recommended to allow as much runoff as possible to percolate and recharge the aquifer in the area. Low-density construction will also mitigate this impact.

4.2.2 Water Quality

Recommended mitigating measures to address project impacts on water quality during the construction phase are listed below:

- Transport and delivery of construction materials should ensure that no materials are accidentally discharged overboard.

- From the barge, the construction materials should be lifted either by heavy equipment or manually and stored in a secure place away from the beach.
- An oil sump should be provided in the fuel storage area.
- Installation of siltation or sedimentation ponds around the project site is a good way of filtering surface runoff prior to discharge into the sea.
- Sanitary facilities should be provided in the construction camp.
- Limit the number of workers staying in the project site to minimize impact on water quality and ecological conditions in the area.
- Jetty/pier should be constructed in an area with sufficient depth to minimize dredging. If water is shallow, constructing a longer pier/jetty to attain the required depth should be considered.

Recommended mitigating measures for project impacts on water quality during the operation phase are provided below:

- Septic tanks and sewage treatment plants should be installed so that wastewater is treated prior to discharge.
- Reuse of septic tank effluent for irrigation and toilet flushing is one way of minimizing discharge into the environment.
- Use of fertilizers for landscaping should be minimized in order to reduce impacts to surface water and groundwater.
- Incorporating a vegetation strip between the development and shoreline/ wetlands will create a buffer of natural vegetation that can leach out pollutants, reduce runoff velocity and filter sediments before runoff is discharged into the water body.

Similar to the island resorts operated by TKPI, wastewater in Lio Tourism Estate will be 100% recycled. The wastewater generated by the resort will be treated in the STP. The STP effluent will be used to irrigate the resort grounds and to flush the toilets.

4.2.3 Marine Ecology

Table 50 presents the potential impacts during construction and operations on coral reefs and associated marine organisms and the recommended mitigating measures to address the identified project impacts.

Table 50. Predicted impacts and proposed mitigating measures in the various stages of project development.

Project Phase	Potential Impact(s)	Mitigating Measure(s)	Impact Prediction
Pre-construction	None	None	**No impact**
Construction	Increased sediment deposition and turbidity	1) Implement riverbank and slope stabilization strategies before earth moving activities are conducted. 2) Placement of erosion and de-silting measures near the beach. 3) Deployment of silt curtains during jetty construction. 4) Conduct sedimentation, water quality and benthic community monitoring. 5) Use pre-fabricated construction materials whenever possible. 6) Development of an action plan in cases of severe effects clearly attributable to resort construction	**Moderate**

Project Phase	Potential Impact(s)	Mitigating Measure(s)	Impact Prediction
	Nutrient enriched freshwater run-off from vegetation clearing and landscaping activities	1) Re-vegetation of denuded areas. 2) Minimize fertilizer application. 3) Conduct water quality and benthic community monitoring.	**Minimal**
	Increased sewage and spillage of petroleum based products	1) Placement of regulations on proper waste disposal that will include all parties involved in both in-shore and offshore construction. 2) Provide proper waste disposal facilities for petroleum products, and solid wastes. 3) Provide sufficient toilet facilities for workers.	**Minimal**
	Solid waste generation	1) Utilize pre-cast construction system to minimize debris on the site. 2) Placement of regulations for site workers on proper segregation and disposal of solid wastes. 3) Provide trash bins in major construction areas. 4) Require site contractors to dispose of their solid wastes properly.	**Minimal**
	Marine vessel grounding	1) Mark shallow reef areas with buoys and provide updated nautical charts to captains of delivery barges. 2) Provide temporary anchoring buoys. 3) Allow delivery of construction materials only during good sea conditions.	**Minimal**
Operation	Release of chlorinated water	1) Implement a slow release of pool water. 2) Set to an effective minimum the addition of chlorine.	**Minimal**
	Increased sewage and spillage of petroleum products	1) Process all wastewater in the sewage treatment facility. 2) Utilize the treated water for gardening and cleaning purposes instead of releasing it directly to the marine environment after treatment. 3) Provide proper waste disposal facilities for petroleum based products and formulate safety protocols in the delivery, handling and storage of these chemicals.	**Moderate**
	Solid waste generation	1) Implement strict waste segregation policy and ensure that all guests are informed of this practice. 2) Strategically place color-coded trash bins around the resort. 3) Establish a material recovery facility where solid wastes can be processed daily.	
	Motorized marine vessel grounding	1) Mark shallow reef areas with buoys and construct a map of the coral reef areas in Lio Cove.	**Minimal**

Project Phase	Potential Impact(s)	Mitigating Measure(s)	Impact Prediction
		2) Provide a briefing for guests renting motorized marine vessel from the resort. 3) Whenever possible, only staff familiar to the site shall be allowed to operate motorized resort vessels.	
Abandonment	Disposal of wastes	1) Supervise proper waste disposal. 2) Ensure the appropriateness of the selected land fill site for remaining waste products. 3) Re-vegetation of the project site using native flora.	**Minimal**

The influx of tourists and the water-based activities in the area may potentially disturb important marine fauna known to use the near-shore coastal areas of the project site such as *Dugong dugong* and marine turtles. These species have been documented in the area and use it as developmental, feeding and nesting habitats. Marker buoys will delineate the activity areas. Certain activities may need to be prohibited during certain periods when these marine fauna are sighted in the area.

4.3 THE AIR

Recommended mitigating measures to address the project impacts on air quality and noise during the construction phase are discussed below:

- Construction activities are expected to generate dust especially during excavation and land grading. To mitigate this impact, bare areas should be watered down especially during the dry months. Tires of construction vehicles should be washed before leaving the construction area. Piles of construction materials should be covered with bund walls and netting.
- Gaseous emissions can be minimized through the regular maintenance of vehicles and equipment. Use of low-sulfur fuel is also recommended.
- Noise levels will also increase as a result of construction activities. Thus, the contractor should equip all noisy construction equipment with mufflers to minimize noise levels. Noisy construction activities should be done during daytime and should be avoided during nighttime.
- Noisy equipment that can cause nuisance to hotel guests such as generators should be located away from the hotel buildings.

Recommended mitigating measures to minimize project impacts on air quality and noise during the operation phase include the following:

- Gaseous emissions during the operation phase can be minimized through the proper maintenance of equipment as well as land and water-based vehicles. The use of low-sulfur fuel is also recommended.
- Noise impacts can be reduced during the construction phase by scheduling the use of noise-emitting equipment. Proper scheduling of equipment maintenance should also be done to minimize noise emissions during the construction phase.

4.4 THE PEOPLE

During the construction phase, work-related accidents can be minimized through the following recommendations:

1. To minimize work-related accidents
    - Developan adequate emergency procedure or measure
    - Provide first aid facilities
    - Orient/train staff on occupational health and safety
    - Provide required personal protection equipment for each worker
    - Formulate and implement a safety and health plan
2. To minimize traffic in the project site and vicinity:
    - Disseminate public notices in coordination with the LGU and barangay officials
    - Provide alternate access route during construction
    - Use appropriate marker buoys, warning signs and lights
3. To minimize disturbance caused by construction works such as noise, fugitive dust and traffic movement into and out of construction sites:
    - Limitwork to daytime hours to reduce noise
    - Maintain trucks/vehicles and equipment to reduce air pollution from exhausts
    - Use dust curtains
    - Providing alternate access route to the project site

Ten Knots should embark on a well-schemed social preparation plan before the start of construction of Lio Tourism Estate. This will aim to assure the project stakeholders of Ten Knots commitment to environmental protection and the implementation of the project's social development program. The social preparation will involve the LGU officials, the host community, and the direct and indirect beneficiaries of the project. The social preparation will also aim to prepare the project stakeholders for their roles, responsibilities and commitment in the successful implementation ofLio Tourism Estate.

There is also a need to help the LGU prepare for its role in the expanding tourism industry in El Nido town. There is a need to ameliorate the LGU's ability to deliver the basic social services (i.e. health, power, safety, sanitation, transportation, food security) required by the town's growing population. The LGU should improve its administrative capacities on fiscal management, revenue generation and local enterprise development. It should also create a more business friendly environment that fosters a sustainable climate for investment. It should take a more proactive role in responding to and complementing investment efforts that can be translated to better revenues resulting to better services to its constituents.

The El Nido LGU should also go beyond the economic and environmental considerations in pursuing the town's ecologically sustainable tourism program. Health must be included as an integral component to ensure the quality of life of the host community and well being of tourists. A successful tourism program should be related to the promotion of a healthy natural and social environment.

To achieve these goals, the LGU should strengthen its existing policies and ordinances relating to the tourism industry and its attendant concerns. These will include policies and ordinances on environmental protection, waste management, availability of power and water supply and protection of lives and property. Commencing such programs will eventually benefit the local stakeholders, the existing tourism establishments, the town's guests and visitors and the future development projects.

TKPI is expected to hire workers from Barangay Villa Libertad and Barangay Pasadena during the operation of Lio Tourism Estate. This can significantly contribute to spur the economic activities in the barangay. The wages received by employed local residents of Barangay Villa Libertad will create a second wave of economic impact as gainfully employed individuals will have higher demand for major produce and harvest such as fish, rice, vegetables and meat. Thus, food producers will also feel this impact.

Employing the local residents in the project will help alleviate the unemployment status in the barangay and the municipality. Direct and indirect work opportunities may emanate from the project such as additional boat rentals to ferry guests to tourist spots.

With the employment of local residents, there will be no adverse effect to the present demographic landscape of the municipality.

The economically active individuals who will be employed in Lio Tourism Estate will increase their capacity to provide longer years of education to their dependents.

Employment of workers from areas outside of Villa Libertad and Pasadena should be done with great care. As much as possible, these workers should not be encouraged to bring their families, as this will create a competition for resources and services in Barangays Villa Libertad and Pasadena and El Nido town. Orientation should also be given for the out-of-town workers to ensure that they are aware of the local culture and practices. The workers should also be required to follow local rules and regulations especially on environmental protection.

The municipal government and the host barangay will directly earn from the project through taxes and business permit. The project will also lead to the increase in land values and the LGU will earn from the economic spinoff of the hotel resort project, consisting of commercial and agricultural production.

Table 51 provides a summary matrix of social impacts and their level of significance.

Table 51. Summary matrix of social impacts and their level of significance

Parameters	Impact	Nature	Magnitude
Population size	Expansion will be exacerbated due to in-migration	HN	Very significant
Employment and Income	Job generation, more employment opportunities and better income; poverty alleviation	HP	Very significant
Economic activities Basic social services of the LGU	LGU earnings from taxes and economic spin-offs can heightened delivery of basic services, fuel-up and broaden existing livelihood activities and create more employment that can be translated to better income and quality of living.	HP	Very significant
	LGU will be challenged to emplace required mechanisms to meet demands of development such as power supply and water system.	HP	Very significant
	Competition for social services and resources	HN	Very significant
Tourism Operation in El Nido (medium to small scale enterprise)	Decrease in profit and drain resources	HN	Very significant
Dependency burden	Wages will increase capacity to support dependents	HP	Very significant
Education	Wages will increase capacity to get education	HP	Very significant
Health and Sanitation	Wages can increase capacity to access better health services.	HP	Very significant
	Project can hasten and complement LGU-related programs.	HP	Very significant
	Tourism-related illnesses and diseases may magnify	HN	Very significant
Peace and Order	Introduction of new attitudes and behaviors dissimilar to the social environment of El Nido may threaten peace and order.	MN	Significant
Indigenous People	Economic opportunities in commerce, arts and crafts can improve their livelihood	MP	Significant
Land values	Will largely increase	MN	Significant
Community Support and Participation	Heightened if the locals (especially host barangays) are appropriately informed, consulted and actively involved in planning for their social development activities in their respective areas.	HP	Very significant

Description of nature of social impacts

Scale/degree of intensity	Description
High Positive	Largely beneficial to the community and greater number of stakeholders and may bring about/effect progressive development to the various socio-economic facets of the area.
Low Positive	Encouraging effect to improve way of life for certain sectors of the community
Medium Positive	Helpful/gainful for particular/ certain sectors of the society/community.
High Negative	Unfavorable and harmful to the community and may cause adverse effects/disruptions to the various socio-economic facets of a society
Low Negative	Not constructive for the community but is being administered/ addressed under the local governance
Medium Negative	Detrimental to the community but could be managed with the LGU and other institutions' regulatory mechanisms in place.

5 SOCIAL DEVELOPMENT PLAN (SDP) AND IEC IMPLEMENTATION

The proposed social development framework plan for Lio Tourism Estate is presented in **Table 52**. The SDP framework focuses on health (sanitation and water system), livelihood and environment and is aimed towards uplifting the lives of residents of Barangays Villa Libertad and Pasadena.

Table 52. Social development framework plan for Barangay Villa Libertad and Barangay Pasadena

Concern	Key Elements	In-charge Government Agency/ Non-Government Agencies	Recommended Interventions for the Proponent
HEALTH			
Sanitation	Strengthen support on environmental sanitation and health services	Rural Health Office, Rural Sanitation Unit of the RHU, Barangay Health Units, Local Government Office, Municipal Engineering Office,Provincial Health Office	Waste management, improvement of the barangay health center, provision for medical and dental supplies, and services of health professionals that will be based in the locality.
Water System	Enhance existing water system and its management to serve more residents in the area	Rural Health Office, Local government authority (barangay), BENWASA	Technical and financial support to improve the water system and its management in both Barangays.
LIVELIHOOD			
Right of way to the sea of local residents	Local fishermen's access road to bring in their harvest/catch from the beach towards the barangay interior	Local Government Of El Nido (municipal and barangay), Municipal Agriculture and Fisheries Office, MFARMC	Conduct consultation and consensus-building sessions with concerned barangay officials and affected stakeholders; validation of results and decisions arrived at before finalization of the activity plan that will address the issue.
Uplift the living condition of local residents	Alternative livelihood for fisherfolks, farmers, women and the youth sector	Local Government Unit, Municipal Agriculture and Fisheries Office, DA, Provincial Agricultural Office, PESO, Technical Educational Skills Development Academy (TESDA), Department of Trade and Industry (DTI), Existing Livelihood cooperatives, accredited Non-Government Organizations	• Potential gender-sensitive and enterprise-based sustainable livelihood activities are agri-based development (fish culture, crab production, seaweed farming, sea cucumber farming), weaving and handicrafts making, and community-based eco-tourism activities (visitor management and tour guiding). • Provide capacity building interventions promoted by TESDA, TLRC and other vocational institutions to

Concern	Key Elements	In-charge Government Agency/ Non-Government Agencies	Recommended Interventions for the Proponent
			enhance existing skills of the women sector of the barangay such as pastry and bread making, food processing, handicraft-making, and bag making from recycled materials. • Provide manpower skills interventions and livelihood trainings to better equip individuals (specially, from the youth sector) for potential employment in the project. Construction and masonry, waste management, organic food production, landscaping and gardening, hospitality training to name a few.
ENVIRONMENT			
Protection and preservation of the natural environment	Equip the barangay local authorities and concerned sectors on how to package nature-based tourism activities as conservation tools.	Barangay Local Government Authority, Municipal Tourism Office, Protected Area Management Office, Youth organization, NGO, women sector	• Organize trainings and seminars in collaboration with the PASU and Tourism Office on basic resource management, project proposal writing, networking and linkaging, product promotion and marketing, nature interpretation and visitor management. • Provide interventions that will lead toward organizing and empowering people's organizations, school organizations and youth sector to become the environmental sentinel and educators of the locality and the municipality.

An Information, Education and Communication Plan (**Table 53**) was developed for Lio Tourism Estate to inform the project stakeholders about the status of project activities and how the proponent plans to implement mitigating measures to address the project impacts on the environment.

Table 53. IEC plan for Lio Tourism Estate

Target sector/s	Core Messages	Methodologies	Information medium/strategies	Indicative timeline and frequencies
Provincial and Municipal Government institutions, Protected Area Management Board (PAMB), Local Barangay Officials	EIA findings and mitigating measures Project update and status	Group method Multi-media	Group consultation and validation meetings / project briefings Press releases/ newspaper articles Web posting	3 months after the EIS commenced Once ECC has been issued by the DENR; Quarterly update during construction stage
Barangay Villa Libertad, Barangay Pasadena- direct impact areas	EIA findings and mitigating measures Project update and status	Group and individual method	Community dialogues and validation meetings Community Presentation and Validation meeting	Timing and frequencies of messages and interventions should be consistent and synchronized with the social preparation activity plan that will be formulated for the direct impact barangay.
	Expectations, Role, Responsibilities and Commitment – social preparation and development of local communities	Group method and use of Multi-media	Leveling-off and Consultation workshops, consensus-building and decision making sessions; action planning, negotiations and agreement	Quarterly update during construction stage; as the need arises during the various stages of the project
El Nido local stakeholders (tourism establishments and operators, private and public institutions, other government entities, NGOs, local media, local residents of the town)	EIA findings and mitigating measures Project update and status	Group method Multi-media	Focus group discussion Press releases/ newspaper articles Web posting Radio plugs	Once ECC has been issued by the DENR Quarterly update during construction stage

6 ENVIRONMENTAL COMPLIANCE MONITORING

6.1 SELF MONITORING PLAN

The self-monitoring plan of Lio Tourism Estate will aim to determine the level of project impact on the different environmental resources during the various project phases. The self-monitoring plan will focus on the following environmental aspects:

- Sedimentation
- Water quality
- Marine ecology
- Air quality

Sedimentation

The proponent will monitor for the presence of sediment plumes in the coastal area fronting the Lio property during the construction phase of the project. This is an indication of the siltation and sedimentation impacts of project activities. Visual inspection for the presence of sediment plumes will be undertaken during episodes of strong rain in rivers and creeks and beach fronting the Lio property.

Water Quality

To determine whether the project will have impacts on water quality during the construction phase, the proponent will monitor the following parameters in stations established during the EIA in 2012 and this EPRMP:

- Temperature
- pH
- Salinity
- Dissolved oxygen
- Total coliform
- Fecal coliform
- Oil and grease
- Biological oxygen demand

In situ measurements for temperature, pH, salinity and dissolved oxygen will be done while water samples will be collected for the analysis of total coliforms, fecal coliforms, oil and grease and BOD in a DENR accredited laboratory. The recommended frequency of sampling is twice a year during the construction and operation phases of the project – once during the dry season in April and once during the wet season in October. TKPI should allot about Php3,000 per sampling station for this activity.

Marine Ecology

Construction activities can affect the coral communities in areas fronting the Lio property. Monitoring for benthic cover, diversity and abundance of indicator reef species is recommended quarterly during the construction phase and semi-annually during the operation phase of the project. The recommended method is photo-transect that will be undertaken by a marine biologist specializing in reef fishes. The same sampling stations established during the EIA and EPRMP should be monitored.

Air Quality

Construction activities are expected to generate dust and noise that can affect air quality at the project site and vicinity. Monitoring for TSP, SO_2, NO_2 and noise are recommended twice a year (April and October) during the construction phase of the project in the sampling stations established during the EIA and EPRMP for Lio Tourism Estate. One-hour ambient air samples from the sampling stations should be sufficient to establish the presence of air pollution indicators in the project site.

6.2 MULTI-SECTORAL MONITORING FRAMEWORK

Considering that Lio Tourism Estate is not an environmentally critical project, it is not required to form a multi-sectoral monitoring team. Nevertheless, TKPI is committing to implement the self-monitoring plan of the project and report the results to DENR at the end of each monitoring activity.

6.3 ENVIRONMENTAL GUARANTEE AND MONITORING FUND COMMITMENT

Considering that Lio Tourism Estate is not an environmentally critical project, it will not be required to put up an environmental monitoring fund and environmental guarantee fund. However, TKPI is committing to conduct the recommended environmental monitoring program during the construction and operation of the project. Appropriate budget will be allotted for the conduct of the environmental monitoring program.

7 EMERGENCY RESPONSE POLICY AND GENERIC GUIDELINES

7.1 GENERIC GUIDELINES

Lio Tourism Estate shall adopt an emergency response policy as part of its environment, health and safety program (HSE). The emergency response plan shall comply with the pertinent Department of Labor and Employments' (DOLE) Occupational Safety and Health Standards (OSHS). The preparation of the emergency response policy shall include:

- Formulation of corporate HSE policy and guidelines
- Organization of the HSE section / department
- Formulation of HSE rules, reporting requirements and procedures
- Assessment of Hazards in work place
- Identification of HSE training needs of staff
- Training to include skills in emergency first response
- Establishment of first aid stations, other emergency facilities and procedures
- Provision of personal protection equipment
- Formulation of Regular HSE programs (e.g. fire drill, earthquake drill, rescue drills etc.)
- Continuing program for HSE skills upgrading
- Monitoring and evaluation system for HSE and emergency response program

7.2 EMERGENCY RESPONSE PLAN

7.2.1 Emergency response during the construction period

Keeping the area clean and free from unnecessary debris at all times will prevent accidents and emergencies during the construction period. Maintaining the place clean can also eliminate common accidents such as falling debris and workers stepping on nails and other pointed objects. The wearing of safety and protective gadgets such as hard hats, safety belts and gloves, rubber boots, goggles, etc. will be a mandatory requirement for workers.

7.2.2 Emergency response during the operation phase

Emergency response during the operation phase will include facilities emergencies as well as guest and personnel emergencies. Facilities emergencies will include threats to estate facilities such as fire, typhoons, earthquakes, tsunami, etc. while guest and personnel emergencies will include accidents or incidents of illness involving guests and staff. Emergency response for both types of emergencies is discussed below.

Fire emergency response plan

The fire emergency response plan for Lio Tourism Estate will adopt the existing Fire Emergency Response Plan being implemented in the four island resorts operated by TKPI (Lagen, Miniloc, Pangulasian and Apulit). In particular, each resort has individual fuel storage facilities. The Lio Tourism Estate shall have a fuel storage facility for 15,000li.

This plan is guided by the following principle: "preservation of life and property through the application of proper firefighting techniques by properly trained staff". The estate have established firefighting brigades composed of volunteer employees who are trained in basic firefighting techniques. The fire brigade is headed by a fire captain and consists of three major units and four support units listed in the table below.

Fire Captain	
M Units	**Support Units**
Firefighting unit Fire hose handlers Fire extinguisher handlers Water bucket handlers Water pump/generator operator	EMS / First aid unit Company doctor Estate nurse First air providers
Search and rescue unit Forcible entry men Stretcher men First aid providers	Communications / Dispatch unit Front office staff Telephone / radio operator
Evacuation unit Lead man "A" Lead man "B" Lead man "C"..	Security unit Security provider / OIC Off duty guards
	Transport unit Dinghy operators

TKPI will provide the necessary training for volunteer personnel who will compose the fire brigade in Lio Tourism Estate. The fire brigade shall be provided with the necessary equipment such as portable fire extinguishers, fireman's boots, helmets, coats, axe, masks, portable water pumps, etc.

The fire captain shall be responsible for training the members of the fire brigade. He shall also be responsible for the proper maintenance of firefighting equipment and mobilization of the major and support units during fire emergencies. The fire captain will direct onsite activities and shall give periodic updates to the estate manager.

The following fire alarm signals will be used to determine the scope of the emergency:

Fire Alarm One – fires that do not threaten a building and requires only one unit to extinguish the fire

Fire Alarm Two – fires that threaten a building and requires the assistance of firefighting units from outside (e.g. LGU)

Fire Alarm Three – fires that threaten a big portion of the estate facility and requires the evacuation of guests and personnel; a crisis management team needs to be convened.

Natural Hazard Emergency Response Plan

Natural hazards that may threaten the project site include earthquakes generated in other regions adjoining Palawan such as the Negros Trench and the Tablas Lineament. These earthquakes may cause ground shaking or induce rock fall in El Nido. Strong winds, waves and storm surge associated with typhoons are other natural hazards that pose threat to the project site.

Strong winds, waves and storm surge associated with typhoons are other natural hazards that pose threat to the project site. The staff of Lio Tourism Estate should be vigilant in monitoring weather conditions during the typhoon season that coincides with the southwest monsoon. Weather forecasts should be monitored daily through the PAGASA announcement in its website or over the radio and television. Other sources of information are www.cnnweather.com and www.typhoon2000.com.

Monitoring for earthquakes can be done through the PHIVOLCS website (www.dost.phivolcs.gov.ph). PHIVOLCS issues warnings and maintains a current listing of earthquakes in its web page. Links to other international agencies involved in earthquake monitoring (i.e. USGS) are likewise present in this website.

For emergency planning purposes, TKPI will need to determine the susceptibility of various parts of the estate to natural hazards. Areas that are identified to be highly susceptible to natural hazards should be prioritized when evacuation is necessary.

Information in disaster preparedness plan should be disseminated to the estate guests during the standard briefing upon arrival and should be reinforced with reminders and notices inside the guest rooms. The notice should inform the guest on what to do during emergencies, where to go and the evacuation procedures.

Response during medical emergencies

The estate doctor should prepare a medical emergency plan, which should aim to administer first aid during medical emergencies and to immediately arrange for medical evacuation if necessary. There should be a close coordination between the medical staff, the immediate staff involved at the site of the emergency and the estate manager, OICs concerned.

8 ABANDONMENT/DECOMMISSIONING/REHABILITATION POLICIES AND GENERIC GUIDELINES

If TKPI decides to abandon Lio Tourism Estate, it will prepare an abandonment plan with the objective of rehabilitating the project site to its pre-construction state as much as possible.

The abandonment shall commence with securing the necessary permit such as ECC or CNC from EMB and demolition permit from the LGU.

The materials removed from the facilities shall be managed according to its use, type and waste category. Recyclables and reusable materials shall be collected and sold or moved to other projects of TKPI. Non-recyclables and residual materials shall be brought to an approved final disposal site.

Should there be hazardous materials for disposal, these shall be managed in accordance with the provisions of existing guidelines and regulations (e.g. RA 6969).

TKPI shall have the option to donate to host communities the facilities such as buildings, water supply system, etc.

9 INSTITUTIONAL PLAN FOR EMP IMPLEMENTATION

The institutional plan for the implementation of the environmental management plan for Lio Tourism Estate is presented in **Table 54**,which identifies the agencies/entities responsible for environmental management during the construction and operation phases of the project.

Table 54. Agencies/Entities Responsible for the Environmental Management of Lio Tourism Estate.

Institutions	Roles and Responsibilities
TKPI	As Project Proponent, it shall have overall responsibility in the implementation of the EMP during all phases of the project. It shall be responsible for regular reporting the results of Compliance monitoring and self- monitoring to EMB Region 4-B. TKPI shall designate a PCO/Environmental Officer in accordance with existing guidelines. TKPI shall engage an environmental service provider (i.e. environmental laboratory) to carry out environmental monitoring works as needed.
EMB-Region IV-B	The EMB Region IV-B office shall be primarily responsible for enforcing environmental regulations and Ten Knot's compliance with the conditions of the Environmental Compliance Certificate (ECC)
PAMB ENTMRPA	The Protected Area Management Board of the El Nido Taytay Managed Resource Protected Area will issue an endorsement for Lio Tourism Estate. The PAMB will ensure that all conditions stipulated in the PAMB endorsement will be complied with by the Project Proponent. The PAMB will participate in the MMT as member if TKPI is required to put up an MMT.
Provincial Government of Palawan	The Provincial LGU through the Sangguniang Panlalawigan will issue an endorsement for Lio Tourism Estate. The Provincial LGU will ensure that all conditions set in the Provincial endorsement are complied with by the Project Proponent.
Palawan Council for Sustainable Development	The PCSD will issue an SEP Clearance for Lio Tourism Estate. It shall ensure that the Project Proponent will comply with all conditions of the SEP Clearance.
CENRO Taytay	The CENRO shall be the EMB Region 4-B's representative in the area. The CENRO shall be responsible for enforcement of the environmental regulations and monitoring of TKPI's compliance with ECC conditions.
Municipal Government of El Nido	The El Nido LGU through the Sangguniang Bayan shall issue an endorsement for Lio Tourism Estate. The LGU will also issue the Locational Clearance and Building Permit for the project.
LGU of Barangay Villa Libertad and Barangay Pasadena	Collaborate in the implementation of social development plan
General Contractor	Shall be responsible for implementing the EMP during construction. It shall engage an HSE Officer to supervise the implementation of the EMP and all its provisions.

TKPI will designate a PCO or an Environmental Officer who shall assume the responsibilities related to environmental management of the project right at the start of the project implementation. The PCO/EO shall work under the Environmental Unit of TKPI and shall be required to coordinate with the concerned departments/units relative to the implementation of the EMP and EMoP.

The PCO/EO shall be responsible for overseeing during the construction stage the contractor's compliance with the EMP. The PCO/EO shall also be responsible for leading the compliance monitoring and self-monitoring including the preparation of monitoring reports such as quarterly monitoring reports in accordance with existing guidelines. Other duties of the PCO/EO shall be coordination with the MMT, the barangay and municipal LGU and the DENR.

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Appendix 1. Result of Technical Scoping with DENR EMB Region IV-B on 10 July 2014

Appendix 2. Summary of issues and concerns raised during the site scoping.

Appendix 3.Total density/abundance of plant species from the study site

Species	No. of Individuals	Density
Acacia mangium	42	2.426343154
Albizzia falcataria	2	0.11554015
Albizzia lebbeck	74	4.274985557
Alstonia macrophylla	76	4.390525708
Anacardium occidentale	50	2.888503755
Antidesma ghaesembilla	80	4.621606008
Ardisia pyramidalis	30	1.733102253
Artocarpus blancoi	12	0.693250901
Artocarpus altilis	7	0.404390526
Artocarpus heterophyllus	5	0.288850376
Artocarpus odoratissimu	1	0.057770075
Azadirachta indica	1	0.057770075
Barringtonia asiatica	45	2.59965338
Barringtonia racemosa	52	3.004043905
Broussonetia luzonica	3	0.173310225
Buchanania arborescens	87	5.025996534
Callophyllum inophyllum	43	2.484113229
Cananga odorata	3	0.173310225
Canarium asperum	1	0.057770075
Cassia fistula	4	0.2310803
Cassia fruticosa	4	0.2310803
Ceiba pentandra	3	0.173310225
Cerbera manghas	4	0.2310803
Chrysophyllum caimito	2	0.11554015
Commersiona bartamia	3	0.173310225
Cratoxylum cochinchinense	15	0.866551127
Cratoxylum sumatranum	24	1.386481802
Desmodium umbellatum	11	0.635470826
Dillenia monantha	89	5.141536684
Diospyrus maritima	45	2.59965338
Diospyrus myrmecocalyx	34	1.964182553
Diospyrus pilosanthera	62	3.581744656
Dracontomelon edule	4	0.2310803
Erythrina orientalis	2	0.11554015
Ficus balete	1	0.057770075
Ficus nota	24	1.386481802
Ficus septica	13	0.751010976
Glochodin sp.	6	0.346620451
Gmelina arborea	7	0.404390526
Guettarda speciosa	4	0.2310803
Guioa subapiculata	3	0.173310225
Hibiscus tiliaceus	7	0.404390526
Instia bijuga	2	0.11554015
Kleinhovia hospita	4	0.2310803
Lagerstroemia speciosa	36	2.079722704
Leucaena leucocephala	27	1.559792028
Litsea sebifera	80	4.621606008

Species	No. of Individuals	Density
Macaranga tanarius	58	3.350664356
Mallotus ricinoides	9	0.519930676
Mangifera indica	16	0.924321202
Melanolepis multiglanduosa	18	1.039861352
Memecylon spp.	7	0.404390526
Morinda citrifolia	2	0.11554015
Nauclea orientalis	72	4.159445407
Peltophorum pentandrum	60	3.466204506
Persia gratissima	3	0.173310225
Plumeria acuninata	9	0.519930676
Polyscias nudosa	1	0.057770075
Pongamia pinnata	90	5.199306759
Premna serratifolia	8	0.462160601
Psidium guajava	4	0.2310803
Pterocarpus indica	3	0.173310225
Pterospermum diversifolium	2	0.11554015
Sandoricum koetjape	6	0.346620451
Semecarpus cuneiformis	62	3.581744656
Sterculia ceramica	34	1.964182553
Sweitenia macrophylla	4	0.2310803
Tamarindus indica	5	0.288850376
Terminalia catappa	50	2.888503755
Thespesia populnea	12	0.693250901
Trema orientalis	18	1.039861352
Vitex pubescens	41	2.368573079
Wrightia pubescens	3	0.173310225
Total	**1731**	**100**

Appendix 4.Total frequency of plant species from the study site

Species	Presence	Frequency	Relative Frequency
Acacia mangium	2	0.04	0.647249191
Albizzia falcataria	2	0.04	0.647249191
Albizzia lebbeck	6	0.12	1.941747573
Alstonia macrophylla	9	0.18	2.912621359
Anacardium occidentale	8	0.16	2.588996764
Antidesma ghaesembilla	11	0.22	3.55987055
Ardisia pyramidalis	5	0.1	1.618122977
Artocarous blancoi	2	0.04	0.647249191
Artocarpus altilis	1	0.02	0.323624595
Artocarpus heterophyllus	1	0.02	0.323624595
Artocarpus odoratissimu	1	0.02	0.323624595
Azadirachta indica	1	0.02	0.323624595
Barringtonia asiatica	2	0.04	0.647249191
Barringtonia racemosa	12	0.24	3.883495146
Broussonetia luzonica	1	0.02	0.323624595
Buchanania arborescens	15	0.3	4.854368932
Callophyllum inophyllum	10	0.2	3.236245955
Cananga odorata	1	0.02	0.323624595
Canarium asperum	1	0.02	0.323624595
Cassia fistula	2	0.04	0.647249191
Cassia fruticosa	3	0.06	0.970873786
Ceiba pentandra	1	0.02	0.323624595
Cerbera manghas	2	0.04	0.647249191
Chrysophyllum caimito	1	0.02	0.323624595
Commersiona bartamia	2	0.04	0.647249191
Cratoxylum cochinchinense	4	0.08	1.294498382
Cratoxylum sumatranum	7	0.14	2.265372168
Desmodium umbellatum	3	0.06	0.970873786
Dillenia monantha	15	0.3	4.854368932
Diospyrus maritima	5	0.1	1.618122977
Diospyrus myrmecocalyx	7	0.14	2.265372168
Diospyrus pilosanthera	14	0.28	4.530744337
Dracontomelon edule	1	0.02	0.323624595
Erythrina orientalis	1	0.02	0.323624595
Ficus balete	1	0.02	0.323624595
Ficus nota	2	0.04	0.647249191
Ficus septica	4	0.08	1.294498382
Glochodin sp.	1	0.02	0.323624595
Gmelina arborea	1	0.02	0.323624595
Guettarda speciosa	1	0.02	0.323624595
Guioa subapiculata	1	0.02	0.323624595
Hibiscus tiliaceus	5	0.1	1.618122977
Instia bijuga	1	0.02	0.323624595
Kleinhovia hospita	2	0.04	0.647249191
Lagerstroemia speciosa	6	0.12	1.941747573
Leucaena leucocephala	2	0.04	0.647249191
Litsea sebifera	9	0.18	2.912621359

Species	Presence	Frequency	Relative Frequency
Macaranga tanarius	5	0.1	1.618122977
Mallotus ricinoides	2	0.04	0.647249191
Mangifera indica	2	0.04	0.647249191
Melanolepis multiglanduosa	1	0.02	0.323624595
Memecylon spp.	1	0.02	0.323624595
Morinda citrifolia	1	0.02	0.323624595
Nauclea orientalis	15	0.3	4.854368932
Peltophorum pentandrum	13	0.26	4.207119741
Persia gratissima	1	0.02	0.323624595
Plumeria acuninata	1	0.02	0.323624595
Polyscias nudosa	1	0.02	0.323624595
Pongamia pinnata	17	0.34	5.501618123
Premna serratifolia	2	0.04	0.647249191
Psidium guajava	1	0.02	0.323624595
Pterocarpus indica	3	0.06	0.970873786
Pterospermum diversifolium	1	0.02	0.323624595
Sandoricum koetjape	1	0.02	0.323624595
Semecarpus cuneiformis	17	0.34	5.501618123
Sterculia ceramica	3	0.06	0.970873786
Sweitenia macrophylla	1	0.02	0.323624595
Tamarindus indica	1	0.02	0.323624595
Terminalia catappa	8	0.16	2.588996764
Thespesia populnea	3	0.06	0.970873786
Trema orientalis	2	0.04	0.647249191
Vitex pubescens	10	0.2	3.236245955
Wrightia pubescens	1	0.02	0.323624595
Total		**6.18**	**100**

Appendix 5. Results of laboratory analysis of water samples

Appendix 6. Mean estimated abundance of reef associated fish species (individuals/250m^2) from 7 sampling stations (Lio, El NIdo, August 2014). Note: data from CR1, CR2 and CR3 were obtained during an initial survey of the area in September 2011.

Family	Species	Category	CR1	CR2	CR3	CR4	CR5	CR6	CR7	MEAN TOTAL ABUNDANCE
Labridae	*Diproctacanthus xanthurus*	indicator	1	1	22	24	-	8	-	**56**
Chaetodontidae	*Chaetodon octofasciatus*	indicator	1	9	5	9	5	1	-	**30**
Chaetodontidae	*Chaetodon lunulatus*	indicator	-	-	-	2	2	7	3	**14**
Labridae	*Labrichthys unilineatus*	indicator	-	-	-	-	-	7	2	**9**
Chaetodontidae	*Chaetodon baronessa*	indicator	-	-	-	-	4	4	-	**8**
Chaetodontidae	*Chaetodon kleinii*	indicator	-	-	1	5	-	2	-	**8**
Pomacentridae	*Cheiloprion labiatus*	indicator	-	-	-	-	-	7	-	**7**
Chaetodontidae	*Chaetodon trifascialis*	indicator	-	-	-	-	-	1	4	**5**
Chaetodontidae	*Heniochus chrysostomus*	indicator	-	-	-	-	-	-	1	**1**
Pomacentridae	*Amblyglyphidodon curacao*	major	-	1	11	142	26	100	61	**341**
Pomacentridae	*Plectroglyphidodon lacrymatus*	major	-	3	2	25	4	82	131	**247**
Pomacentridae	*Pomacentrus adelus*	major	-	-	-	88	36	40	41	**205**
Pomacentridae	*Pomacentrus chrysurus*	major	2	1	77	35	1	16	-	**132**
Apogonidae	*Archamia* sp.	major	-	125	-	-	-	-	-	**125**
Pomacentridae	*Pomacentrus coelestis*	major	1	7	48	66	-	-	-	**122**
Pomacentridae	*Neoglyphidodon nigroris*	major	-	6	2	12	28	23	47	**118**
Pomacentridae	*Pomacentrus* sp. (adelus)	major	-	3	106	-	-	-	-	**109**
Pomacentridae	*Pomacentrus cuneatus*	major	5	95	2	-	-	-	-	**102**
Pomacentridae	*Pomacentrus tripunctatus*	major	77	12	-	-	-	-	-	**89**
Pomacentridae	*Pomacentrus simsiang*	major	14	44	10	-	-	-	-	**68**
Labridae	*Halichoeres melanurus*	major	-	4	24	21	2	8	2	**61**
Pomacentridae	*Pomacentrus moluccensis*	major	-	-	1	1	9	32	18	**61**
Pomacentridae	*Dascyllus reticulatus*	major	-	-	11	39	2	3	-	**55**
Pomacentridae	*Chromis viridis*	major	-	-	-	-	-	16	35	**51**
Labridae	*Labroides dimidiatus*	major	2	7	10	9	1	12	8	**49**
Apogonidae	*Cheilodipterus quinquelineatus*	major	13	-	-	28	-	-	3	**44**
Labridae	*Thalassoma lunare*	major	2	10	6	7	1	7	6	**39**
Pomacentridae	*Neopomacentrus anabatoides*	major	5	15	-	-	-	19	-	**39**
Pempheridae	*Pempheris oualensis*	major	-	-	-	-	-	-	31	**31**
Pomacentridae	*Dischistodus prosopotaenia*	major	3	9	7	7	-	-	2	**28**
Apogonidae	*Archamia macroptera*	major	-	-	-	-	-	27	-	**27**
Labridae	*Stethojulis trilineata*	major	-	1	9	1	-	-	15	**26**
Pempheridae	*Pempheris vanicolensis*	major	-	-	-	-	-	9	14	**23**
Pomacentridae	*Acanthochromis polyacanthus*	major	-	-	-	8	-	-	14	**22**
Labridae	*Coris batuensis*	major	-	2	10	8	-	-	-	**20**
Labridae	*Halichoeres nebulosus*	major	-	-	10	8	-	1	-	**19**
Pomacentridae	*Pomacentrus* sp. (cuneatus)	major	-	-	-	19	-	-	-	**19**
Pomacentridae	*Neoglyphidodon melas*	major	-	-	4	6	1	6	-	**17**
Pomacentridae	*Pomacentrus amboinensis*	major	-	2	3	11	-	1	-	**17**
Pomacentridae	*Pomacentrus littoralis*	major	-	17	-	-	-	-	-	**17**
Labridae	*Halichoeres chloropterus*	major	4	1	5	1	1	1	3	**16**
Apogonidae	*Apogon griffini*	major	1	-	-	8	4	-	-	**13**
Pomacentridae	*Pomacentrus alexanderae*	major	-	-	-	13	-	-	-	**13**
Pomacentridae	*Stegastes* sp. (orange head)	major	-	-	-	-	13	-	-	**13**
Labridae	*Halichoeres* sp. (white spots)	major	4	3	4	-	-	-	-	**11**
Pomacentridae	*Stegastes fasciolatus*	major	-	-	-	5	-	6	-	**11**

Family	Species	Category	CR1	CR2	CR3	CR4	CR5	CR6	CR7	MEAN TOTAL ABUNDANCE
Labridae	*Halichoeres hilomeni*	major	3	4	1	-	-	-	-	**8**
Labridae	*Macropharyngodon meleagris*	major	-	-	2	5	-	1	-	**8**
Labridae	*Stethojulis interrupta*	major	-	-	6	1	-	-	-	**7**
Pomacentridae	*Amphiprion clarkii*	major	-	-	-	7	-	-	-	**7**
Pseudochromidae	*Pseudochromis fuscus*	major	1	-	1	5	-	-	-	**7**
Apogonidae	*Apogon chrysopomus*	major	-	-	-	6	-	-	-	**6**
Pomacentridae	*Abudefduf sexfasciatus*	major	-	-	-	-	-	-	6	**6**
Pomacentridae	*Stegastes nigricans*	major	-	-	-	-	-	-	6	**6**
Chaetodontidae	*Chaetodon adiergastos*	major	-	-	1	1	-	-	3	**5**
Chaetodontidae	*Chaetodon auriga*	major	-	-	-	3	-	-	2	**5**
Labridae	*Halichoeres melanochir*	major	-	-	1	1	-	3	-	**5**
Zanclidae	*Zanclus cornutus*	major	-	1	-	1	-	1	2	**5**
Apogonidae	*Cheilodipterus artus*	major	-	-	-	-	-	-	4	**4**
Gobiidae	*Goby* sp.	major	4	-	-	-	-	-	-	**4**
Labridae	*Stethojulis* sp.	major	-	-	-	4	-	-	-	**4**
Labridae	*Thalassoma hardwicke*	major	-	-	-	-	-	4	-	**4**
Balistidae	*Sufflamen chrysopterus*	major	-	-	-	-	-	3	-	**3**
Blenniidae	*Plagiotremus rhinorhynchos*	major	-	3	-	-	-	-	-	**3**
Labridae	*Stethojulis bandanensis*	major	3	-	-	-	-	-	-	**3**
Pomacentridae	*Pomacentrus lepidogenys*	major	-	-	-	1	-	2	-	**3**
Pseudochromidae	*Pseudochromis bitaeniatus*	major	1	2	-	-	-	-	-	**3**
Tetraodontidae	*Arothron nigropunctatus*	major	-	1	1	-	1	-	-	**3**
Acanthuridae	*Zebrasoma scopas*	major	-	-	-	-	-	1	1	**2**
Chaetodontidae	*Chelmon rostratus*	major	-	1	1	-	-	-	-	**2**
Gobiidae	*Goby* sp. 2	major	2	-	-	-	-	-	-	**2**
Labridae	*Halichoeres argus*	major	-	2	-	-	-	-	-	**2**
Labridae	*Halichoeres marginatus*	major	-	-	-	-	2	-	-	**2**
Monacanthidae	*Cantherhines pardalis*	major	-	-	-	-	-	2	-	**2**
Pomacentridae	*Amblyglyphidodon ternatensis*	major	-	-	-	-	-	-	2	**2**
Pomacentridae	*Chrysiptera unimaculata*	major	-	-	-	-	2	-	-	**2**
Pomacentridae	*Dascyllus melanurus*	major	-	-	-	-	-	-	2	**2**
Pomacentridae	*Stegastes obreptus*	major	-	-	1	-	1	-	-	**2**
Ptereleotridae	*Ptereleotris evides*	major	-	-	2	-	-	-	-	**2**
Apogonidae	*Apogon apogonoides*	major	1	-	-	-	-	-	-	**1**
Apogonidae	*Apogon cyanosoma*	major	-	-	-	1	-	-	-	**1**
Balistidae	*Balistoides viridescens*	major	-	-	1	-	-	-	-	**1**
Blenniidae	*Salarias fasciatus*	major	-	-	-	1	-	-	-	**1**
Chaetodontidae	*Heniochus acuminatus*	major	-	1	-	-	-	-	-	**1**
Gobiidae	*Goby* sp. 3	major	-	1	-	-	-	-	-	**1**
Labridae	*Gomphosus varius*	major	-	-	-	-	-	1	-	**1**
Labridae	*Halichoeres richmondi*	major	-	1	-	-	-	-	-	**1**
Labridae	*Halichoeres solorensis*	major	-	1	-	-	-	-	-	**1**
Labridae	*Pseudocheilinus hexataenia*	major	-	-	-	1	-	-	-	**1**
Monacanthidae	*Pervagor janthinosoma*	major	-	-	-	1	-	-	-	**1**
Monacanthidae	*Pervagor melanocephalus*	major	-	-	-	1	-	-	-	**1**
Ostraciidae	*Ostracion cubicus*	major	1	-	-	-	-	-	-	**1**
Pinguipedidae	*Parapercis clathrata*	major	-	1	-	-	-	-	-	**1**
Pomacanthidae	*Pomacanthus annularis*	major	-	1	-	-	-	-	-	**1**
Pomacanthidae	*Pomacanthus sexstriatus*	major	-	-	-	-	-	1	-	**1**

Family	Species	Category	CR1	CR2	CR3	CR4	CR5	CR6	CR7	MEAN TOTAL ABUNDANCE
Pomacentridae	*Chrysiptera parasema*	major	-	1	-	-	-	-	-	**1**
Pomacentridae	*Plectroglyphidodon dickii*	major	-	-	-	-	-	1	-	**1**
Pomacentridae	*Pomacentrus burroughi*	major	-	-	-	-	-	-	1	**1**
Pomacentridae	*Pomacentrus smithi*	major	-	-	-	1	-	-	-	**1**
Pseudochromidae	*Labracinus melanotaenia*	major	-	-	-	1	-	-	-	**1**
Pseudochromidae	*Pseudochromis diadema*	major	-	-	1	-	-	-	-	**1**
Pseudochromidae	*Pseudochromis marshallensis*	major	-	-	1	-	-	-	-	**1**
Scorpaenidae	*Dendrochirus zebra*	major	-	-	1	-	-	-	-	**1**
Caesionidae	*Caesio* sp.	target	-	120	-	-	-	-	-	**120**
Scaridae	*Scarus hypselopterus*	target	-	-	-	95	-	1	-	**96**
Holocentridae	*Sargocentron rubrum*	target	4	1	-	43	-	-	-	**48**
Caesionidae	*Caesio cuning*	target	-	-	-	-	-	42	-	**42**
Scaridae	*Chlorurus sordidus*	target	-	9	4	10	-	2	17	**42**
Scaridae	*Scarus chameleon*	target	-	-	-	7	1	31	1	**40**
Siganidae	*Siganus argenteus*	target	-	-	-	-	-	28	-	**28**
Caesionidae	*Pterocaesio digramma*	target	-	-	-	-	-	20	-	**20**
Labridae	*Oxycheilinus digrammus*	target	-	-	-	10	2	2	2	**16**
Mullidae	*Parupeneus multifasciatus*	target	-	1	2	10	-	-	2	**15**
Labridae	*Cheilinus trilobatus*	target	-	-	7	2	-	2	1	**12**
Mullidae	*Parupeneus barberinoides*	target	-	-	-	12	-	-	-	**12**
Nemipteridae	*Scolopsis bilineatus*	target	-	1	1	6	-	-	-	**8**
Scaridae	*Scarus ghobban*	target	-	5	-	3	-	-	-	**8**
Sphyraenidae	*Sphyraena flavicauda*	target	-	-	-	-	8	-	-	**8**
Serranidae	*Cephalopholis microprion*	target	-	-	-	-	-	6	1	**7**
Acanthuridae	*Ctenochaetus striatus*	target	-	-	-	-	-	5	1	**6**
Serranidae	*Cephalopholis boenak*	target	1	2	2	1	-	-	-	**6**
Labridae	*Cheilinus chlorourus*	target	-	-	-	1	-	3	1	**5**
Nemipteridae	*Pentapodus aureofasciatus*	target	-	-	-	5	-	-	-	**5**
Nemipteridae	*Scolopsis ciliatus*	target	-	5	-	-	-	-	-	**5**
Acanthuridae	*Naso unicornis*	target	-	-	-	4	-	-	-	**4**
Labridae	*Hemigymnus fasciatus*	target	-	1	-	3	-	-	-	**4**
Lethrinidae	*Lethrinus* sp. 1	target	-	-	-	4	-	-	-	**4**
Lutjanidae	*Lutjanus bohar*	target	-	-	-	-	-	3	1	**4**
Lutjanidae	*Lutjanus vitta*	target	-	4	-	-	-	-	-	**4**
Holocentridae	*Neoniphon argenteus*	target	-	-	-	-	-	-	3	**3**
Labridae	*Epibulus insidiator*	target	-	-	-	-	1	2	-	**3**
Lutjanidae	*Lutjanus carponotatus*	target	-	-	-	1	1	-	1	**3**
Nemipteridae	*Scolopsis margaritifer*	target	-	-	-	3	-	-	-	**3**
Siganidae	*Siganus virgatus*	target	-	-	-	3	-	-	-	**3**
Acanthuridae	*Acanthurus mata*	target	-	1	-	-	-	1	-	**2**
Acanthuridae	*Ctenochaetus binotatus*	target	-	-	2	-	-	-	-	**2**
Fistulariidae	*Fistularia commersonii*	target	-	-	1	-	-	1	-	**2**
Labridae	*Hemigymnus melapterus*	target	-	-	-	1	-	1	-	**2**
Nemipteridae	*Scolopsis lineatus*	target	-	-	-	-	-	-	2	**2**
Nemipteridae	*Scolopsis monogramma*	target	-	1	1	-	-	-	-	**2**
Scaridae	*Scarus quoyi*	target	-	-	-	1	-	1	-	**2**
Serranidae	*Epinephelus fasciatus*	target	-	-	-	1	-	1	-	**2**
Serranidae	*Plectropomus leopardus*	target	-	-	-	1	-	1	-	**2**
Acanthuridae	*Naso vlamingii*	target	-	-	-	-	-	1	-	**1**

Family	Species	Category	CR1	CR2	CR3	CR4	CR5	CR6	CR7	MEAN TOTAL ABUNDANCE
Carangidae	*Selar* sp.	target	-	1	-	-	-	-	-	**1**
Haemulidae	*Plectorhinchus lessonii*	target	-	-	-	-	-	1	-	**1**
Holocentridae	*Sargocentron cornutum*	target	-	-	-	-	-	1	-	**1**
Labridae	*Choerodon anchorago*	target	-	-	-	1	-	-	-	**1**
Lethrinidae	*Gnathodentex aureolineatus*	target	-	-	-	-	-	-	1	**1**
Lethrinidae	*Lethrinus obsoletus*	target	-	-	-	1	-	-	-	**1**
Lethrinidae	*Lethrinus* sp. 2	target	-	-	-	1	-	-	-	**1**
Lutjanidae	*Lutjanus decussatus*	target	-	-	-	-	-	1	-	**1**
Lutjanidae	*Lutjanus fulvus*	target	-	-	-	-	1	-	-	**1**
Nemipteridae	*Pentapodus caninus*	target	-	1	-	-	-	-	-	**1**
Nemipteridae	*Pentapodus paradiseus*	target	-	-	-	1	-	-	-	**1**
Serranidae	*Cephalopholis formosa*	target	-	1	-	-	-	-	-	**1**
	TOTAL		**156**	**553**	**431**	**881**	**160**	**623**	**504**	**3,308**
	total families	31								
	total species	156								
	total indicators	9								
	total majors	94								
	total targets	53								

Appendix 7. Mean estimated biomass of reef associated fish species (kg/250m^2) from 7 sampling stations (Lio, El NIdo, August 2014). Note: data from CR1, CR2 and CR3 were obtained during an initial survey of the area in September 2011.

Family	Species	Category	CR1	CR2	CR3	CR4	CR5	CR6	CR7	MEAN TOTAL BIOMASS
Chaetodontidae	*Chaetodon baronessa*	indicator	-	-	-	-	0.17	0.17	-	**0.34**
Chaetodontidae	*Chaetodon lunulatus*	indicator	-	-	-	0.01	0.06	0.15	0.08	**0.29**
Chaetodontidae	*Chaetodon octofasciatus*	indicator	0.02	0.09	0.05	0.06	0.05	0.02	-	**0.28**
Labridae	*Labrichthys unilineatus*	indicator	-	-	-	-	-	0.12	0.03	**0.14**
Chaetodontidae	*Chaetodon trifascialis*	indicator	-	-	-	-	-	0.03	0.11	**0.13**
Chaetodontidae	*Chaetodon kleinii*	indicator	-	-	0.00	0.05	-	0.01	-	**0.06**
Chaetodontidae	*Heniochus chrysostomus*	indicator	-	-	-	-	-	-	0.03	**0.03**
Labridae	*Diproctacanthus xanthurus*	indicator	0.00	0.00	0.01	0.02	-	0.00	-	**0.03**
Pomacentridae	*Cheiloprion labiatus*	indicator	-	-	-	-	-	0.01	-	**0.01**
Pomacentridae	*Plectroglyphidodon lacrymatus*	major	-	0.02	0.01	0.35	0.05	1.08	1.76	**3.28**
Pomacentridae	*Amblyglyphidodon curacao*	major	-	0.01	0.00	0.16	0.09	0.68	0.23	**1.17**
Pomacentridae	*Neoglyphidodon nigroris*	major	-	0.01	0.00	0.01	0.31	0.21	0.49	**1.03**
Pomacentridae	*Pomacentrus adelus*	major	-	-	-	0.27	0.18	0.15	0.14	**0.74**
Labridae	*Coris batuensis*	major	-	0.03	0.13	0.48	-	-	-	**0.64**
Labridae	*Thalassoma lunare*	major	0.03	0.14	0.08	0.09	0.03	0.08	0.12	**0.57**
Pomacentridae	*Stegastes* sp. (orange head)	major	-	-	-	-	0.39	-	-	**0.39**
Labridae	*Stethojulis trilineata*	major	-	0.01	0.10	0.04	-	-	0.22	**0.37**
Labridae	*Macropharyngodon meleagris*	major	-	-	0.03	0.29	-	0.01	-	**0.34**
Pempheridae	*Pempheris oualensis*	major	-	-	-	-	-	-	0.34	**0.34**
Pomacentridae	*Pomacentrus chrysurus*	major	0.01	0.00	0.16	0.12	0.00	0.04	-	**0.33**
Labridae	*Halichoeres melanurus*	major	-	0.02	0.09	0.13	0.02	0.06	0.02	**0.32**
Apogonidae	*Apogon griffini*	major	0.02	-	-	0.17	0.08	-	-	**0.27**
Chaetodontidae	*Chaetodon auriga*	major	-	-	-	0.24	-	-	0.03	**0.27**
Tetraodontidae	*Arothron nigropunctatus*	major	-	0.05	0.11	-	0.11	-	-	**0.26**
Pomacentridae	*Stegastes fasciolatus*	major	-	-	-	0.12	-	0.14	-	**0.26**
Pomacanthidae	*Pomacanthus sexstriatus*	major	-	-	-	-	-	0.23	-	**0.23**
Pomacentridae	*Pomacentrus littoralis*	major	-	0.23	-	-	-	-	-	**0.23**
Pomacentridae	*Stegastes nigricans*	major	-	-	-	-	-	-	0.22	**0.22**
Pomacentridae	*Pomacentrus cuneatus*	major	0.01	0.19	0.00	-	-	-	-	**0.21**
Pempheridae	*Pempheris vanicolensis*	major	-	-	-	-	-	0.11	0.09	**0.20**
Pomacentridae	*Pomacentrus* sp. (adelus)	major	-	0.01	0.18	-	-	-	-	**0.19**
Balistidae	*Sufflamen chrysopterus*	major	-	-	-	-	-	0.19	-	**0.19**
Zanclidae	*Zanclus cornutus*	major	-	0.03	-	0.07	-	0.03	0.06	**0.18**
Pomacentridae	*Pomacentrus moluccensis*	major	-	-	0.00	0.00	0.02	0.11	0.05	**0.18**
Pomacentridae	*Dischistodus prosopotaenia*	major	0.00	0.01	0.00	0.01	-	-	0.13	**0.16**
Pomacentridae	*Acanthochromis polyacanthus*	major	-	-	-	0.05	-	-	0.10	**0.15**
Pomacentridae	*Dascyllus reticulatus*	major	-	-	0.02	0.10	0.01	0.01	-	**0.15**
Labridae	*Halichoeres chloropterus*	major	0.01	0.00	0.04	0.00	0.01	0.03	0.04	**0.13**
Labridae	*Thalassoma hardwicke*	major	-	-	-	-	-	0.13	-	**0.13**
Chaetodontidae	*Chaetodon adiergastos*	major	-	-	0.05	0.05	-	-	0.04	**0.13**
Pomacentridae	*Neopomacentrus anabatoides*	major	0.00	0.01	-	-	-	0.12	-	**0.13**
Labridae	*Labroides dimidiatus*	major	0.01	0.01	0.01	0.02	0.00	0.04	0.02	**0.10**
Labridae	*Halichoeres hilomeni*	major	0.02	0.07	0.01	-	-	-	-	**0.09**
Balistidae	*Balistoides viridescens*	major	-	-	0.09	-	-	-	-	**0.09**
Monacanthidae	*Cantherhines pardalis*	major	-	-	-	-	-	0.09	-	**0.09**
Labridae	*Halichoeres nebulosus*	major	-	-	0.03	0.06	-	0.00	-	**0.09**
Apogonidae	*Apogon chrysopomus*	major	-	-	-	0.09	-	-	-	**0.09**
Pomacentridae	*Pomacentrus coelestis*	major	0.00	0.01	0.05	0.03	-	-	-	**0.08**
Labridae	*Halichoeres marginatus*	major	-	-	-	-	0.07	-	-	**0.07**
Labridae	*Halichoeres melanochir*	major	-	-	0.00	0.01	-	0.05	-	**0.07**
Pomacentridae	*Amphiprion clarkii*	major	-	-	-	0.07	-	-	-	**0.07**
Apogonidae	*Cheilodipterus artus*	major	-	-	-	-	-	-	0.06	**0.06**
Acanthuridae	*Zebrasoma scopas*	major	-	-	-	-	-	0.03	0.03	**0.06**
Apogonidae	*Archamia macroptera*	major	-	-	-	-	-	0.06	-	**0.06**
Pomacentridae	*Stegastes obreptus*	major	-	-	0.02	-	0.04	-	-	**0.06**
Pomacanthidae	*Pomacanthus annularis*	major	-	0.05	-	-	-	-	-	**0.05**
Pomacentridae	*Pomacentrus tripunctatus*	major	0.04	0.01	-	-	-	-	-	**0.05**
Pomacentridae	*Neoglyphidodon melas*	major	-	-	0.00	0.01	0.00	0.03	-	**0.04**
Pomacentridae	*Abudefduf sexfasciatus*	major	-	-	-	-	-	-	0.04	**0.04**
Pomacentridae	*Pomacentrus simsiang*	major	0.01	0.02	0.01	-	-	-	-	**0.04**

Family	Species	Category	CR1	CR2	CR3	CR4	CR5	CR6	CR7	MEAN TOTAL BIOMASS
Pseudochromidae	*Pseudochromis fuscus*	major	0.00	-	0.00	0.03	-	-	-	**0.04**
Pomacentridae	*Chromis viridis*	major	-	-	-	-	-	0.02	0.01	**0.03**
Chaetodontidae	*Heniochus acuminatus*	major	-	0.03	-	-	-	-	-	**0.03**
Apogonidae	*Cheilodipterus quinquelineatus*	major	0.00	-	-	0.02	-	-	0.01	**0.03**
Blenniidae	*Salarias fasciatus*	major	-	-	-	0.03	-	-	-	**0.03**
Labridae	*Stethojulis interrupta*	major	-	-	0.02	0.01	-	-	-	**0.02**
Ostraciidae	*Ostracion cubicus*	major	0.02	-	-	-	-	-	-	**0.02**
Apogonidae	*Archamia* sp.	major	-	0.02	-	-	-	-	-	**0.02**
Scorpaenidae	*Dendrochirus zebra*	major	-	-	0.02	-	-	-	-	**0.02**
Ptereleotridae	*Ptereleotris evides*	major	-	-	0.02	-	-	-	-	**0.02**
Labridae	*Gomphosus varius*	major	-	-	-	-	-	0.01	-	**0.01**
Labridae	*Halichoeres richmondi*	major	-	0.01	-	-	-	-	-	**0.01**
Labridae	*Stethojulis* sp.	major	-	-	-	0.01	-	-	-	**0.01**
Pseudochromidae	*Labracinus melanotaenia*	major	-	-	-	0.01	-	-	-	**0.01**
Pinguipedidae	*Parapercis clathrata*	major	-	0.01	-	-	-	-	-	**0.01**
Gobiidae	*Goby* sp. 2	major	0.01	-	-	-	-	-	-	**0.01**
Monacanthidae	*Pervagor janthinosoma*	major	-	-	-	0.01	-	-	-	**0.01**
Monacanthidae	*Pervagor melanocephalus*	major	-	-	-	0.01	-	-	-	**0.01**
Labridae	*Halichoeres argus*	major	-	0.01	-	-	-	-	-	**0.01**
Pomacentridae	*Amblyglyphidodon ternatensis*	major	-	-	-	-	-	-	0.01	**0.01**
Pomacentridae	*Pomacentrus* sp. (cuneatus)	major	-	-	-	0.01	-	-	-	**0.01**
Pseudochromidae	*Pseudochromis bitaeniatus*	major	0.00	0.01	-	-	-	-	-	**0.01**
Pomacentridae	*Chrysiptera unimaculata*	major	-	-	-	-	0.01	-	-	**0.01**
Labridae	*Stethojulis bandanensis*	major	0.01	-	-	-	-	-	-	**0.01**
Pomacentridae	*Plectroglyphidodon dickii*	major	-	-	-	-	-	0.01	-	**0.01**
Blenniidae	*Plagiotremus rhinorhynchos*	major	-	0.01	-	-	-	-	-	**0.01**
Chaetodontidae	*Chelmon rostratus*	major	-	0.00	0.00	-	-	-	-	**0.01**
Pomacentridae	*Pomacentrus alexanderae*	major	-	-	-	0.01	-	-	-	**0.01**
Pomacentridae	*Pomacentrus lepidogenys*	major	-	-	-	0.00	-	0.00	-	**0.01**
Labridae	*Halichoeres* sp. (white spots)	major	0.00	0.00	0.00	-	-	-	-	**0.01**
Labridae	*Halichoeres solorensis*	major	-	0.01	-	-	-	-	-	**0.01**
Labridae	*Pseudocheilinus hexataenia*	major	-	-	-	0.00	-	-	-	**0.00**
Gobiidae	*Goby* sp.	major	0.00	-	-	-	-	-	-	**0.00**
Pomacentridae	*Pomacentrus amboinensis*	major	-	0.00	0.00	0.00	-	0.00	-	**0.00**
Pomacentridae	*Dascyllus melanurus*	major	-	-	-	-	-	-	0.00	**0.00**
Pseudochromidae	*Pseudochromis diadema*	major	-	-	0.00	-	-	-	-	**0.00**
Apogonidae	*Apogon apogonoides*	major	0.00	-	-	-	-	-	-	**0.00**
Gobiidae	*Goby* sp. 3	major	-	0.00	-	-	-	-	-	**0.00**
Pseudochromidae	*Pseudochromis marshallensis*	major	-	-	0.00	-	-	-	-	**0.00**
Apogonidae	*Apogon cyanosoma*	major	-	-	-	0.00	-	-	-	**0.00**
Pomacentridae	*Pomacentrus burroughi*	major	-	-	-	-	-	-	0.00	**0.00**
Pomacentridae	*Pomacentrus smithi*	major	-	-	-	0.00	-	-	-	**0.00**
Pomacentridae	*Chrysiptera parasema*	major	-	0.00	-	-	-	-	-	**0.00**
Holocentridae	*Sargocentron rubrum*	target	0.33	0.11	-	4.43	-	-	-	**4.87**
Scaridae	*Scarus chameleon*	target	-	-	-	0.08	0.16	2.88	0.11	**3.23**
Scaridae	*Chlorurus sordidus*	target	-	0.48	0.02	0.02	-	0.16	1.63	**2.31**
Caesionidae	*Caesio cuning*	target	-	-	-	-	-	1.32	-	**1.32**
Labridae	*Cheilinus trilobatus*	target	-	-	0.23	0.59	-	0.04	0.03	**0.90**
Siganidae	*Siganus argenteus*	target	-	-	-	-	-	0.79	-	**0.79**
Lutjanidae	*Lutjanus carponotatus*	target	-	-	-	0.38	0.14	-	0.11	**0.63**
Caesionidae	*Pterocaesio digramma*	target	-	-	-	-	-	0.55	-	**0.55**
Labridae	*Oxycheilinus digrammus*	target	-	-	-	0.43	0.02	0.02	0.07	**0.54**
Nemipteridae	*Scolopsis bilineatus*	target	-	0.04	0.04	0.46	-	-	-	**0.53**
Acanthuridae	*Ctenochaetus striatus*	target	-	-	-	-	-	0.44	0.07	**0.51**
Scaridae	*Scarus quoyi*	target	-	-	-	0.16	-	0.35	-	**0.51**
Fistulariidae	*Fistularia commersonii*	target	-	-	0.19	-	-	0.31	-	**0.50**
Serranidae	*Epinephelus fasciatus*	target	-	-	-	0.13	-	0.27	-	**0.40**
Haemulidae	*Plectorhinchus lessonii*	target	-	-	-	-	-	0.35	-	**0.35**
Nemipteridae	*Scolopsis ciliatus*	target	-	0.33	-	-	-	-	-	**0.33**
Lutjanidae	*Lutjanus bohar*	target	-	-	-	-	-	0.20	0.08	**0.28**
Mullidae	*Parupeneus barberinoides*	target	-	-	-	0.27	-	-	-	**0.27**
Lutjanidae	*Lutjanus decussatus*	target	-	-	-	-	-	0.25	-	**0.25**
Lutjanidae	*Lutjanus vitta*	target	-	0.24	-	-	-	-	-	**0.24**
Mullidae	*Parupeneus multifasciatus*	target	-	0.01	0.02	0.04	-	-	0.13	**0.20**

Family	Species	Category	CR1	CR2	CR3	CR4	CR5	CR6	CR7	MEAN TOTAL BIOMASS
Serranidae	*Plectropomus leopardus*	target	-	-	-	0.11	-	0.08	-	**0.19**
Nemipteridae	*Scolopsis lineatus*	target	-	-	-	-	-	-	0.18	**0.18**
Nemipteridae	*Scolopsis monogramma*	target	-	0.09	0.09	-	-	-	-	**0.18**
Labridae	*Cheilinus chlorourus*	target	-	-	-	0.05	-	0.08	0.03	**0.17**
Serranidae	*Cephalopholis microprion*	target	-	-	-	-	-	0.14	0.02	**0.16**
Scaridae	*Scarus hypselopterus*	target	-	-	-	0.15	-	0.01	-	**0.16**
Holocentridae	*Neoniphon argenteus*	target	-	-	-	-	-	-	0.15	**0.15**
Sphyraenidae	*Sphyraena flavicauda*	target	-	-	-	-	0.12	-	-	**0.12**
Labridae	*Choerodon anchorago*	target	-	-	-	0.12	-	-	-	**0.12**
Nemipteridae	*Pentapodus aureofasciatus*	target	-	-	-	0.12	-	-	-	**0.12**
Lutjanidae	*Lutjanus fulvus*	target	-	-	-	-	0.12	-	-	**0.12**
Nemipteridae	*Pentapodus paradiseus*	target	-	-	-	0.10	-	-	-	**0.10**
Acanthuridae	*Naso vlamingii*	target	-	-	-	-	-	0.10	-	**0.10**
Serranidae	*Cephalopholis boenak*	target	0.01	0.03	0.02	0.04	-	-	-	**0.09**
Lethrinidae	*Lethrinus obsoletus*	target	-	-	-	0.08	-	-	-	**0.08**
Lethrinidae	*Lethrinus* sp. 1	target	-	-	-	0.07	-	-	-	**0.07**
Carangidae	*Selar* sp.	target	-	0.07	-	-	-	-	-	**0.07**
Caesionidae	*Caesio* sp.	target	-	0.07	-	-	-	-	-	**0.07**
Serranidae	*Cephalopholis formosa*	target	-	0.07	-	-	-	-	-	**0.07**
Acanthuridae	*Acanthurus mata*	target	-	0.04	-	-	-	0.02	-	**0.06**
Acanthuridae	*Naso unicornis*	target	-	-	-	0.06	-	-	-	**0.06**
Labridae	*Epibulus insidiator*	target	-	-	-	-	0.02	0.04	-	**0.06**
Scaridae	*Scarus ghobban*	target	-	0.02	-	0.04	-	-	-	**0.06**
Nemipteridae	*Pentapodus caninus*	target	-	0.05	-	-	-	-	-	**0.05**
Labridae	*Hemigymnus melapterus*	target	-	-	-	0.00	-	0.05	-	**0.05**
Nemipteridae	*Scolopsis margaritifer*	target	-	-	-	0.04	-	-	-	**0.04**
Siganidae	*Siganus virgatus*	target	-	-	-	0.04	-	-	-	**0.04**
Labridae	*Hemigymnus fasciatus*	target	-	0.00	-	0.02	-	-	-	**0.02**
Holocentridae	*Sargocentron cornutum*	target	-	-	-	-	-	0.02	-	**0.02**
Lethrinidae	*Gnathodentex aureolineatus*	target	-	-	-	-	-	-	0.02	**0.02**
Lethrinidae	*Lethrinus* sp. 2	target	-	-	-	0.02	-	-	-	**0.02**
Acanthuridae	*Ctenochaetus binotatus*	target	-	-	0.00	-	-	-	-	**0.00**
	TOTAL		**0.57**	**2.78**	**1.97**	**11.37**	**2.29**	**12.74**	**7.12**	**38.84**

Appendix 8. Results of ambient air quality sampling