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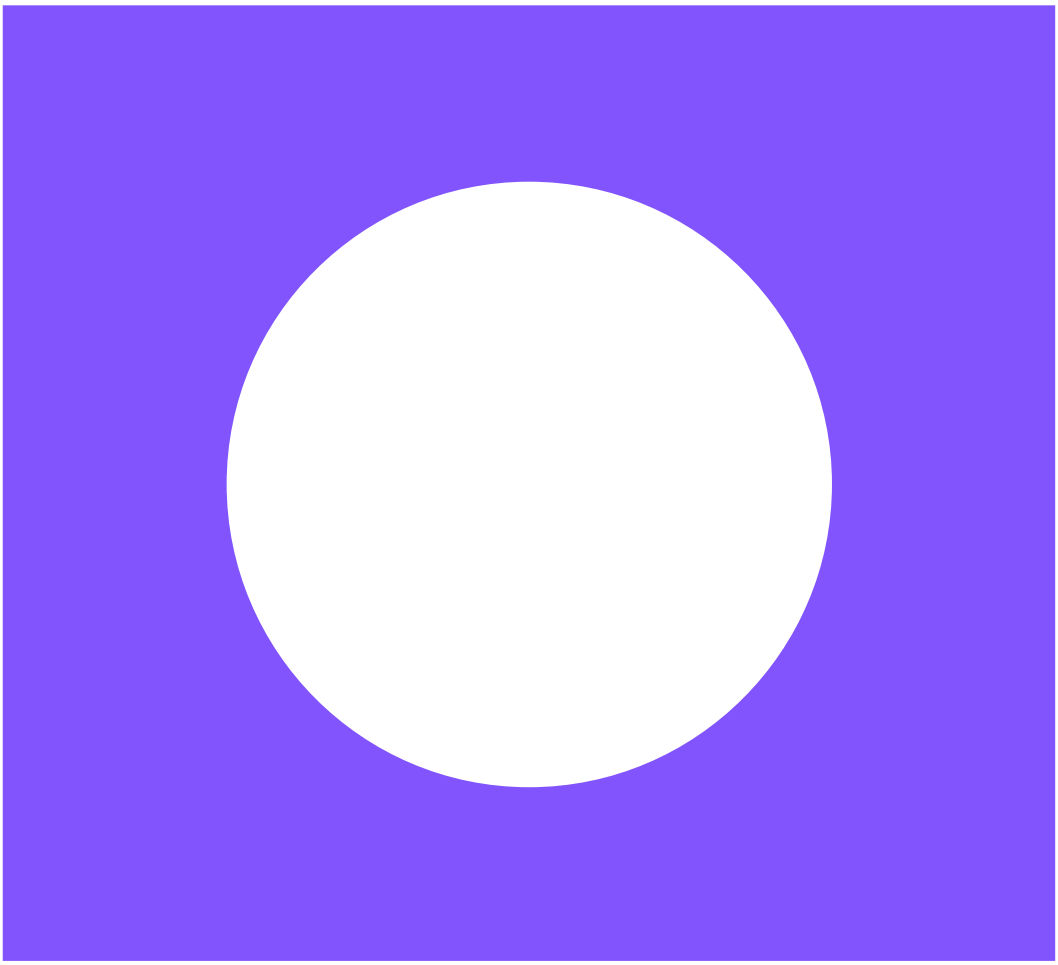

Greater Changhua Southwest Offshore Wind Farm in Taiwan

Cumulative Impact Assessment

16 May 2025

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Mott MacDonald
5F, No.92 Sec 2
Dunhua S. Road
Da'an District
Taipei City 10668
Taiwan

T +886 (0)2 8978 8978
mottmac.com

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Cumulative Impact Assessment

16 May 2025

Issue and Revision Record

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Executive summary

Greater Changhua Offshore Wind Farm SW Ltd. (herein referred to as “Project Company”) is a special purpose vehicle established by Ørsted Wind Power TW Holdings A/S (Ørsted) to develop the proposed Greater Changhua Southwest (SW) Offshore Wind Farm in Taiwan (herein referred to as the “Project” or “Greater Changhua 2”). The Project is located approximately 50km offshore of the area of Xianxi Township, Changhua County, Taiwan.

The Bureau of Energy (BOE) has designated this offshore wind farm area as zone #14, encompassing 126.3km^2. The site features water depths varying from 23.8m to 42.2m, with an average depth of 36.8m. Phase 2a, which is currently in operation, consists of 36 wind turbine generators (WTGs), each with an 8MW capacity. Phase 2b, presently under construction, will incorporate an additional 24 WTGs, each boasting a 14MW capacity. Upon completion, the Project's aggregate capacity will amount to 605.2MW.

As part of the Project’s financing approach, the Project may be required to demonstrate adherence to the Equator Principles (EP). Therefore, Mott MacDonald has been commissioned by Ørsted to undertake a Cumulative Impact Assessment (CIA), alongside other environmental and social services.

This report presents a CIA which has been undertaken to identify the Project related environmental and social impacts (as well as associated risks) in terms of their potential to contribute to cumulative impacts on valued environmental and social components (VECs) on which other existing or future developments may also have detrimental effects. In addition, the CIA aims to assess the significance of the Project’s above mentioned (cumulative) impacts to propose measures to avoid, minimise and/or offset these impacts to the extent practically possible.

The following VECs were discussed within this report in terms of baseline status and impact assessment:

- Marine habitat
- Marine flora and fauna
- Community livelihood: fisheries resources and zones
- Migratory birds (including seabirds at sea)

For the respective VECs discussed, a set of actions already in place or planned to be implemented for the VECs have been extracted from the published Environmental Impact Assessment (EIA) and relevant reports. Further recommendations are also made on strategies in terms of collaboration amongst developers for achieving effective mitigation and monitoring of cumulative impacts on the VECs in the broader context.

It was noted that comprehensive mitigation and monitoring plans have been identified in the EIA reports. Nevertheless, it is important for the Project and adjacent windfarm developments to coordinate management plans and share information with each other for a more robust and comprehensive management of the identified cumulative impacts.

1 Introduction

1.1 Overview

Greater Changhua Offshore Wind Farm SW Ltd. (herein referred to as “Project Company”) is a special purpose vehicle established by Ørsted Wind Power TW Holdings A/S (Ørsted) to develop the proposed Greater Changhua Southwest (SW) Offshore Wind Farm in Taiwan(herein referred to as the “Project” or “Greater Changhua 2”). The Project is located approximately 50km offshore from the coast of Changhua County, Taiwan.

The Project is planned in compliance with the “Offshore Wind Farm Site Application Regulation”, stipulated by the Energy Administration[1], Ministry of Economic Affair (EA, MoEA) on 2 July 2015. The regulation gives endorsement to offshore wind energy development for developers to promote nuclear-free homeland by the year of 2025.

In 2022, the National Development Council (NDC) published Taiwan’s Pathway to Net-Zero Emissions by 2050. The plan is to decarbonise the electrical sector and targeted 60% renewable energy come 2050[2]. As of 2023, the electricity generation comprised of 42.2% coal-fired, 39.5% liquefied natural gas (LNG)-fired, 6.3% nuclear, 9.5% renewable energy and 2.4% of other types of energy.

As part of the Project’s project financing approach, the Project may be required to demonstrate adherence to the Equator Principles (EP). Therefore, Mott MacDonald have been commissioned by Ørsted to undertake a cumulative impact assessment (CIA), alongside other environmental and social (E&S) services.

1.2 Aims and objectives

1.2.1 Overview

This CIA aims to:

- Identify the Project related environmental and social impacts (as well as associated risks) in terms of their potential to contribute to cumulative impacts on valued environmental and social components (VECs)[3] on which other existing or future developments may also have detrimental effects
- Assess the significance of the Project’s abovementioned (cumulative) impacts in order to propose measures to avoid, minimise and/or offset these impacts to the extent practically possible

The aims of the CIA are achieved by implementing the framework approach, as further described in Section 2, based upon the good practice guidance[4] as published by International Finance Corporation (IFC). The six steps outlined in the “Good Practice Handbook on Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets” (IFC CIA Handbook) have been followed.

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1 Formerly known as Bureau of Energy (能源署); renamed the Energy Administration in 26 September 2023.

2 Lau, Hon Chung and Steve C. Tsai (9 July 2022). A Decarbonization Roadmap for Taiwan and Its Energy Policy Implications. *Sustainability*. Sustainability | A Decarbonization Roadmap for Taiwan and Its Energy Policy Implications (mdpi.com). Retrieved 30 July 2024.

3 See Section 2.2 for definition.

4 IFC Good Practice Handbook: Cumulative Impact Assessment and Management, 2013

1.2.2 Scope and limitations

This CIA considers potential offshore developments along the western coast of Taiwan and the spatial and temporal boundaries defined for this CIA is elaborated in Section 3.1.

This CIA is limited to available resources either provided by the Project Sponsors or are publicly available, such as local Environmental Impact Assessment (EIA) reports which have been published on the Environmental Protection Administration (EPA) of Taiwan and other online resources. As the major impacts of windfarm developments mostly occur in the offshore area, this CIA focus more on marine aspects such as marine macrofauna and sensitive habitats, as well as the social impacts on fisheries.

Notably, the offshore windfarm (OWF) component of the Project is situated 50km away from the coast. At such distance from the coast, the main potential for the key/material cumulative impacts (eg underwater noise, bird collision risk) are largely from similar nearby offshore windfarms. The spatial proximity is one of the factors other coastal developments are not included in detail.

Furthermore, the subsequently identified VECs are primarily influenced by and pertinent to other offshore windfarm developments. Given the absence of significant interactions with other development types, the exclusion of these developments from this CIA is supported by their unlikely potential for cumulative impact.

Due to the above reasons, coastal developments have been scoped out of this CIA.

In this CIA, no quantitative analysis such as modelling, and calculations were undertaken. This report was prepared based on professional judgment and available information eg qualitative assessment on the cumulative impacts with reference to the findings of the approved EIA reports.

Of note, the status described for existing, planned, or reasonably foreseeable developments scoped in this CIA (Section 3.3) is based on information available as of November 2024.

1.3 Project background and location

The Project is being developed on the 14th Zone of Potential in Changhua County according to the Offshore Wind Farm Site Application Regulations announced by the EA MoEA on 2 July 2015[5]. The Project's offshore windfarm area will be approximately 126.3km^2 in size and located 50km offshore from Xianxi Township (線西鄉), Changhua County, on the western coast of Taiwan (see Figure 1.1).

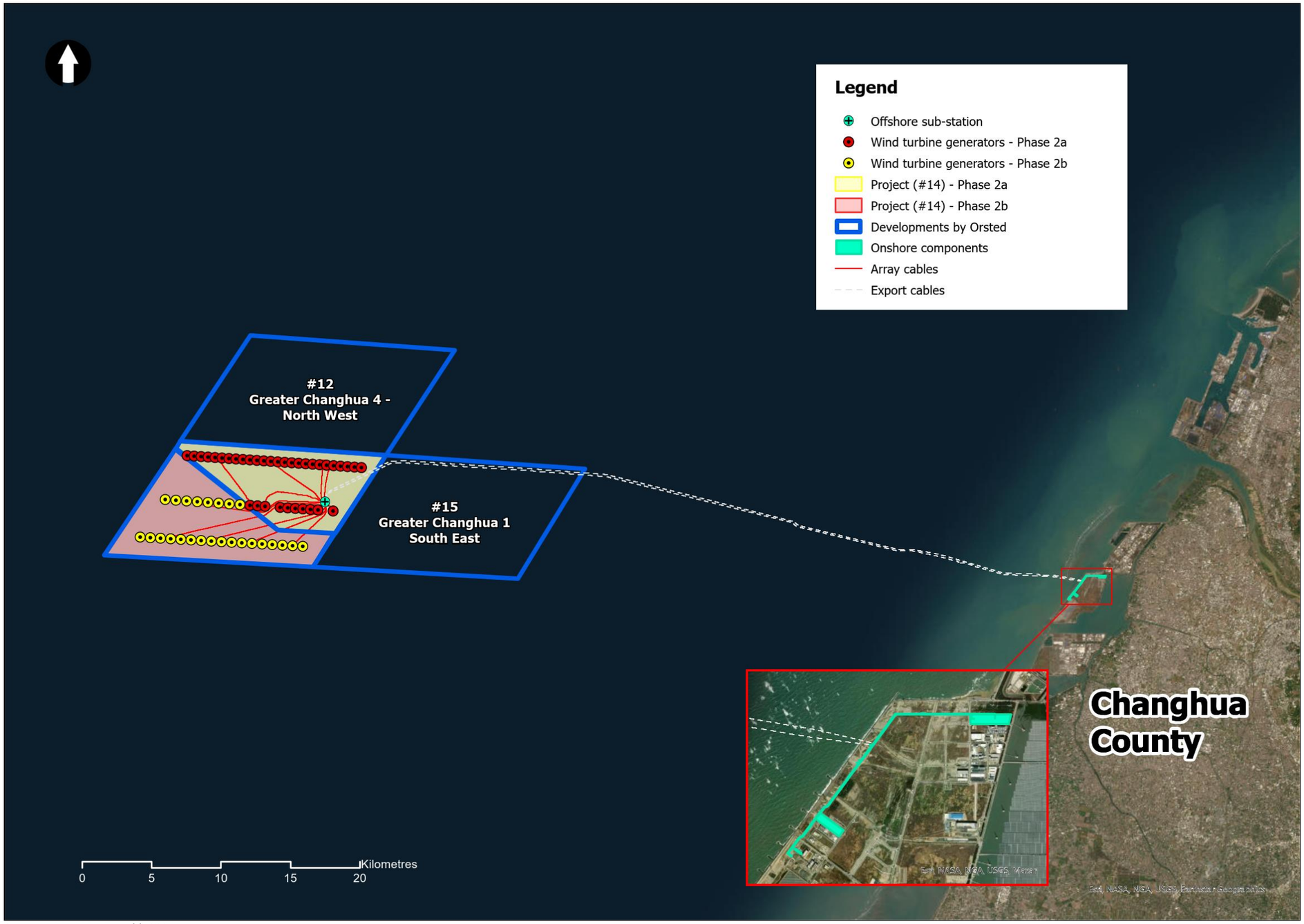
The Project is adjacent to other OWF developments which are also owned by Ørsted. These OWFs are namely:

- East of the Project – Greater Changhua South East, comprising of 75 WTGs, with a capacity of 605.2MW. This OWF development is known as "Greater Changhua 1". Greater Changhua 1 is currently operational, having obtained its electricity business license (EBL) covering all WTGs with the last batch obtained in Q3 2024.
- North of the Project – Greater Changhua North West, comprising of around 42 WTGs, with a capacity of 582.9MW. This OWF development is known as "Greater Changhua 4". Greater Changhua 4 is currently planning construction of its OWF components. The offshore construction is expected to commence in Q1 of 2025.

[5] Energy Administration, Ministry of Economic Affairs (2 July 2015). Offshore Wind Farm Site Application Regulations (離岸風力發電規劃場址申請作業要點). Retrieved 30 July 2024.

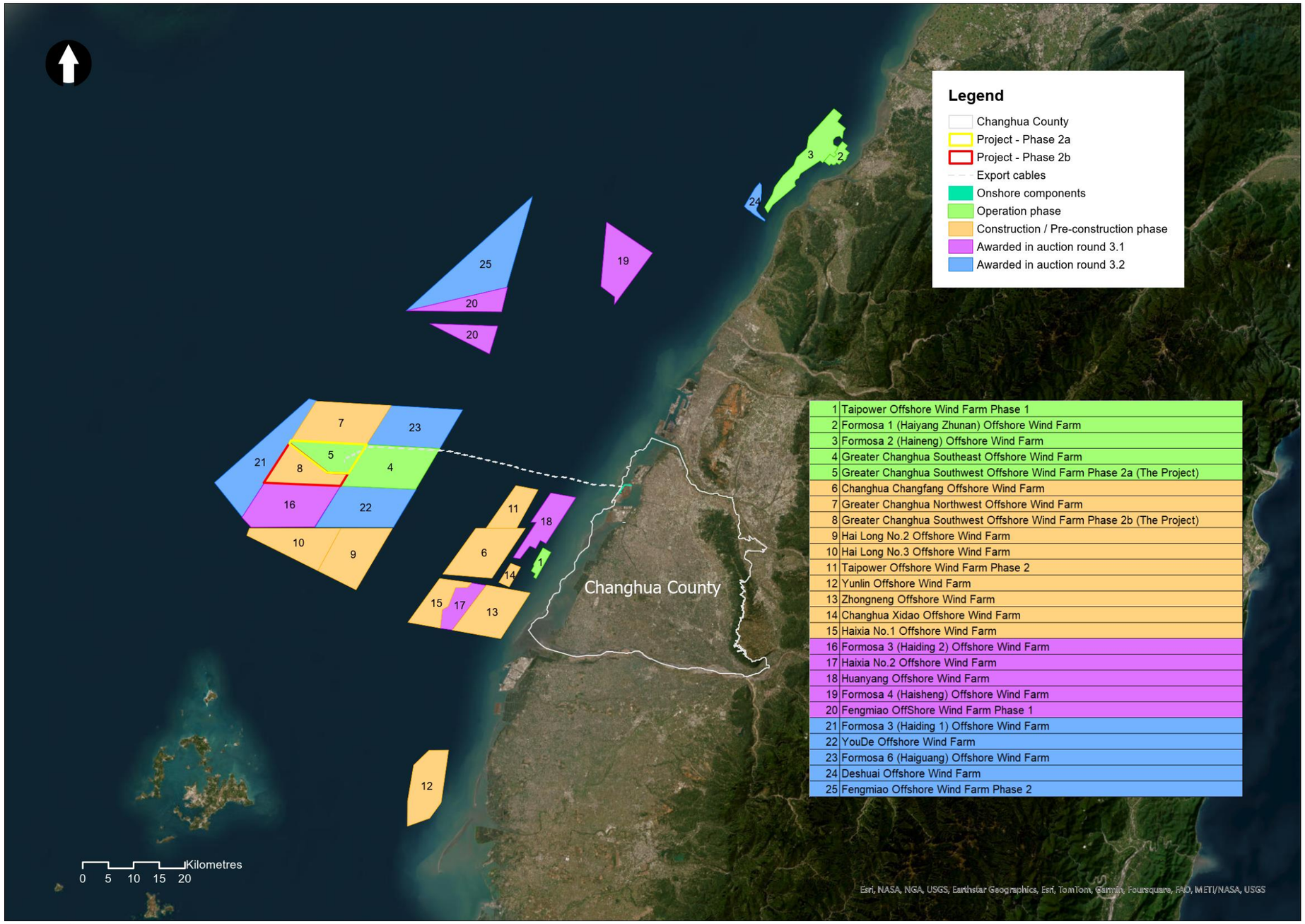
These are also illustrated in Figure 1.1 and Figure 1.2.

Figure 1.1: Location of the Project and proximity to Greater Changhua 1 and Greater Changhua 4



Source: Mott MacDonald, 2024

Figure 1.2: Project and surrounding windfarms



Source: Mott MacDonald, 2024

As seen in Figure 1.1, the Project comprises of two phases, namely:

- Phase 2a consists of 36 wind turbine generators (WTGs), each of 8MW capacity. All Phase 2a WTGs are in operational phase, having received an updated EBL for all its WTGs on 6 February 2024. The EBL expires on 9 May 2043.
- Phase 2b is currently under planning to commence the construction phase for its OWF components. The offshore construction is expected to commence in Q1 of 2025, alongside Greater Changhua 4. This phase will comprise of 24 WTGs, each of 14MW capacity.

The Project had successfully obtained regulatory approval for its EIA report (ie covering both phases) on 23 March 2018.

The planned aggregated capacity for the Project is 632MW (ie from a total of 60 WTGs), with Phase 2a generating 294.8MW and Phase 2b aiming to generate 337.1MW. The WTGs will be located at water depths approximately 23.8m to 42.2m below mean sea water level (MSWL). Each phase has its own grid connection point, connecting to two different onshore substations (OnSS) of Taiwan Power Company (TPC).

Other project components include inter-array and export transmission cabling to connect to TPC's electrical grid, as well as various operational support vessels and ancillary facilities. The operation period is planned for 20-25 years, based on the asset life.

1.4 Project components

1.4.1 Project component overview

The details of each Phase are presented in Table 1.1 below.

Table 1.1: Summary of the Project Phases' components and schedule

Aspect	**Project Phase**	
	Phase 2a – operation phase	**Phase 2b – construction phase**
Project components		
Windfarm capacity	294.8MW	337.1MW
Windfarm area	126.3km^2	
Number of WTGs (and capacity)	36 WTGs (8MW each)	24 WTGs (14MW each)
Offshore substation (OSS)	600MW high voltage alternating current (HVAC) offshore substation shared between the two Phases.	
Onshore substation (OnSS)	294.8MW HVAC OnSS, located in Lukang Township, Changhua County.	920MW OnSS shared with Greater Changhua 4, located in Lukang Township, Changhua County.
Transmission	66kV / 230kV / 161kV HVAC	66kV / 230kV / 345kV HVAC
Export cables	Offshore: One (1) 230kV export cable with approximate length of 57km to the landing point Onshore: One (1) 161kV export cable with approximate length of 3.5km from OnSS to grid connection point	Offshore: One (1) 230kV export cable with approximate length of 57km to the landing point Onshore: One (1) 345kV export cable with approximate length of 1.85km from OnSS to grid connection point
Grid connection point	Chang One A (TPC), located in Lukang Township, Changhua County.	ChangKong (TPC), located in Lukang Township, Changhua County.
Project schedule		
Construction commencement	Onshore: Q3 2019 Offshore: Q1 2021	Onshore: Q2 2023 Offshore: Q1 2025
Construction completion	Onshore	Onshore: Q2 2025 (targeted)

Aspect	Project Phase	
	Phase 2a – operation phase	**Phase 2b – construction phase**
	and offshore: Q2 2023	Offshore: Q2 2025 (targeted)
Commercial operation date (COD)	13 September 2023	Targeting Q3 2025

Source: Ørsted and Mott MacDonald

1.4.2 Spatial overlap with Greater Changhua 1 and Greater Changhua 4

As mentioned in Section 1.3, two adjacent OWFs to the Project are also developed by Ørsted. Certain components of the Project overlaps with these OWFs as follows:

- Submarine cable alignment: A large portion of the export cable of the Project, Greater Changhua 1, and Greater Changhua 4 utilize a common offshore cable alignment and also shares the same landing point. The shared offshore cable corridor section spans approximately 37.9km in length and 0.74km in width, accommodating submarine cables for all three projects.
- Onshore components: The substations of the Project's Phase 2a and Greater Changhua 1 is located on the same land plots, albeit their substations occupy separate buildings. The onshore cable alignment to the grid connection are the same as well.
- Project Phase 2b and Greater Changhua 4 have similar setup, whereby their onshore substations are within one single structure with identical onshore cable to the grid connection point.

1.5 Implementation schedule

The key milestones for the Project's implementation, with current assumptions for Phase 2b, are summarised in Table 1.2 below. Phase 2a's construction schedule is not shown as it has been operational since 13 September 2023.

Table 1.2: Project Phase 2b implementation schedule

Project milestone	**2023**			**2024**				**2025**		
	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3
Phase 2b										
Onshore construction										
Offshore construction										
COD										

Source: Ørsted and Mott MacDonald

1.6 Summary of land acquisition and access to marine areas

Phase 2a has its own onshore substations and Phase 2b shares onshore substation with Greater Changhua 4. All Greater Changhua 1, Greater Changhua 4 and Greater Changhua 2 (the Project) have or will require leasing of state-owned land (ie reclaimed industrial land) for the construction and operation of their onshore substation. No physical or economic displacement is expected for onshore works.

In order to gain access to marine areas and commence offshore works, two separate fishery compensation agreement (FCA) for Phase 2a and Phase 2b were signed with Changhua Fisheries Association (CFA) was signed on 7 September 2020. This FCA is noted to cover the marine access and rights as associated with Greater Changhua 1, Greater Changhua 4 and Greater Changhua 2 (ie this Project).

The access and activity restrictions as defined within the FCA with CFA are as follows:

Construction Phase – Phase 2b:

It should be noted that Phase 2a's onshore and offshore construction has already completed since Q3 2023. The access/activity associated with Phase 2a's construction is no longer currently applicable, and only presented here for information/reference.

- Wind farm area:
  - All fishing vessels are temporarily restricted to access the wind farm areas. This is whereby Phase 2a would have access restriction on its windfarm area for two (2) years during its construction. Phase 2b is expected to be completed within a shorter construction timeline, which is expected to restrict access to its windfarm area for a duration of six (6) months (ie the planned offshore construction period). However, the vessels engaged in bottom trawling and bottom gill net fishing are permanently prohibited within the wind farm areas from construction to operation phase (ie permanent loss of fishing ground).
- Cable alignment:
  - Bottom trawling and bottom gill net fishing are temporarily prohibited within the full offshore cable route during construction phase.
  - Apart from the vessels engaged in bottom trawling and bottom gill net fishing, all other fishing vessels are temporarily restricted from the cable segments under construction
    - The width of the construction exclusion zone is 600m wide along the export cable route. Given the Project's Phase 2a and Phase 2b export cable routes are both approximately 57km, therefore the total construction exclusion zone for the cable laying route during each phase is 34km^2 (ie which will take place at different times, since Phase 2a's construction is already completed).
- All vessels may pass the cable laying route given they have a minimum distance of 500m from the construction vessel conducting cable laying work.

Operation and Maintenance (O&M) Phase – Phase 2a and Phase 2b:

- Wind farm area:
  - The vessels engaged in bottom trawling and bottom gill net fishing are permanently prohibited within the wind farm area during operation phase (ie permanent loss of fishing ground). The total area of restriction once both Phase 2a and Phase 2b are in O&M phase will be 126.3km^2 with operation phase expected to be between 20 to 25 years.
  - Apart from the vessels engaged in bottom trawling and bottom gill net fishing, all other fishing vessels are restricted by 50m radius exclusion zones around the WTGs and

offshore substation. When under maintenance or an emergency, the exclusion zones extend to 500m radius.

- Cable alignment: Within FCA, all fishing activities are suggested[6] to be done only outside of a buffer/safety zone of 50m during non-maintenance. Fishing is temporarily restricted from cable segments undergoing maintenance or emergencies.
- All fishing vessels must keep a minimum safety distance of 500m in all directions from Project-related vessels during maintenance or emergencies

It is not expected that offshore access restriction will result in any physical displacement. This will cause temporary economic displacement, however, as fisher folk will be restricted from fishing in those areas.

Table 1.3 provides a summary of the land acquisition progress and access to marine areas. As mentioned above, Phase 2a is already operational and therefore, any construction phase activities applicable for Phase 2a are largely presented here for information/reference only (ie since construction is already completed).

Table 1.3: Summary of land acquisition and access to marine area

Location	Component	Phase applicability	Description/access restriction
Onshore component	Onshore cables	Phase 2a and Phase 2b	Total (permanent) area leased for cable is around 35,096m^2.
	Onshore substations	Phase 2a	The total area leased for Phase 2a's onshore substation is around 24,422m^2.
		Phase 2b	The total area leased for Phase 2b's onshore substation shared with Greater Changhua 4 will be around 29,075m^2.
Offshore component	Offshore cable during construction phase	Phase 2a and Phase 2b	● Fishing vessels conducting trawling and bottom gill net fishing will be temporarily restricted from the full offshore cable route (ie 34km^2 during each phase[7]). ● All other fishing vessels will be temporarily restricted from cable segments under construction. Ørsted will announce the area under construction to CFA 14 days prior to start of construction. ● All fishing vessels may pass the cable laying construction area provided that they maintain a minimum distance of 500m from the working vessel
	Offshore cable during operation and maintenance (O&M) phase	Phase 2a and Phase 2b	● All fishing activities are recommended to stay a safety distance of 50m from the cable area ● All fishing vessels are restricted from the cable segment under maintenance. Ørsted will announce the area under maintenance to CFA three days prior to the start of maintenance. ● All fishing vessels may cross the cable segment provided that they maintain a minimum distance of 500m from the working vessel. ● Under emergencies (eg cable burial depth or position changes, cable exposed), vessels conducting trawling and bottom gill net fishing will need to pause fishing activities.

[6] The use of the term 'suggested' here is as based on the wording of the FCA whereby it is stated (and can be interpreted) as 'suggested' or 'recommended' ('建議'). The clause is based on negotiations and agreement between the Project and CFA. In terms of how this clause is to be interpreted and implemented on the ground, this is likely required to be a mutual/specific discussion between the Project and CFA (and potentially, the Fishery Agency, where relevant/appropriate).

[7] Calculated based on 56.65km of total export cable route length, and width of construction exclusion zone being 600m.

Location	Component	Phase applicability	Description/access restriction
	Windfarm area during the construction phase	Phase 2a and Phase 2b	All fishing vessels will be temporarily restricted from fishing or crossing the windfarm area during construction.
	Windfarm area during the O&M phase	Phase 2a and Phase 2b	• Long-term restricted access to the whole windfarm area is only applicable for vessels doing trawling and bottom gill net fishing during the operation phase. The total area of restriction once both Phase 2a and Phase 2b are in O&M phase will be 126.3km^2. • For all other fishing vessels, 50m radius exclusion zones are set around the WTGs, underwater foundations and offshore substations during non-maintenance or non-emergencies. • During maintenance or emergencies, the exclusion zone radius increases to 500m.

Source: Summarised from the FCA and latest project description received on 24 July 2024

1.7 Project alternative analysis

Alternatives for this Project were proposed and reviewed in the EIA. Alternatives included the termination of the Project, site alternatives and technology alternatives.

The Project is designed to align with Taiwan's energy policy and its goal to be nuclear-free by 2025. It accelerates Taiwan's growth of offshore wind farms, promoting diverse energy sources, self-sufficiency, and environmental conservation. The Project aims to bring global insights to Taiwan's wind power industry through comprehensive exchange and collaboration. The Project also seeks to unite industry, government, and academia resources under a common goal. Once executed, it positions Taiwan to spearhead renewable energy development in the Asia-Pacific region. Thus, the termination of the Project is deemed to be disadvantageous. In conjunction, there are no site alternatives available for this Project.

In terms of technology alternatives, this Project allows for the installation of a wind turbine using either a jacket structure or a gravity seabed foundation. The latter is constructed from reinforced concrete or steel, to which the wind turbine's pillar is attached. It is further stabilised with ballast made of sand, iron ore, or rocks. This method is less disruptive to marine life as it does not require piling. However, it necessitates a solid geological seabed. The proposed wind farm site is in an area with sediment deposits from the Zhuoshui River in the Taiwan Strait. If gravity seabed foundations are used here, seismic activity could cause soil liquefaction, leading to a loss of ground shear stress and load-bearing capacity. Therefore, the Project is unable to adopt a gravity seabed foundation.

1.8 Document structure

This CIA is structured as follows:

- **Section 1** (ie this section) outlines the aims and objectives of the CIA and Project.
- **Section 2** of this document describes the methodology for undertaking this CIA, including the definition of valued environmental and social components (VECs) as well as the methodology of six step approach prescribed by the IFC CIA Handbook to develop CIA.
- **Section 3** defines the spatial and temporal boundaries as well as identify this Project's VECs
- **Section 4** presents a summary of VECs' baseline data, including marine habitat, marine flora and fauna, community livelihood, and migratory birds.
- **Section 5** assesses future conditions of the selected VECs, as a result of cumulative impacts of the Project with other developments.

- **Section 6** presents the management strategies designed to address the Project's incremental contribution to cumulative impacts on the selected assessed VECs.
- **Section 7** displays the reference of this document.

2 Approach and methodology

2.1 Overview

The approach used in this CIA was developed based on the recommendations found in the Guidance Note 1 (GN1) to the IFC Performance Standards (PS) 1, specifically in paragraphs GN37 through GN43, and in the CIA approach outlined in IFC's guidance document named "Good Practice Handbook on Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets" (thereafter known as "IFC CIA Handbook").

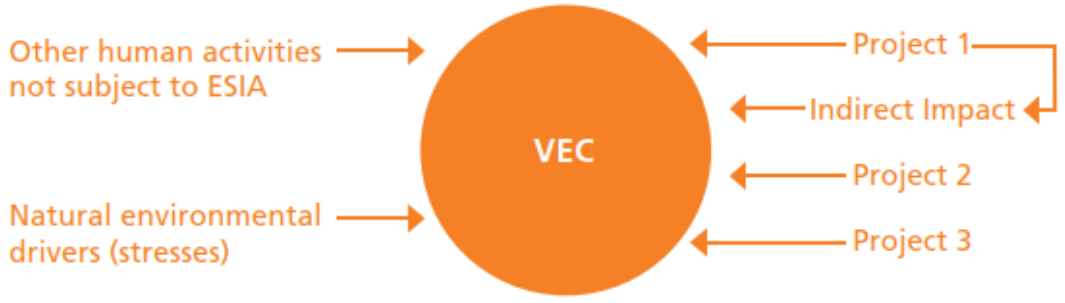
Of particular note, paragraph GN41 in IFC Guidance Note 1 recommends that clients assess cumulative impacts from: (a) further planned development of the project and other project-related developments; (b) any existing project or condition whose impacts may be exacerbated by the project; and (c) other development of the same type that are realistically defined at the time of the risks and impacts identification process. The IFC CIA Handbook further details the IFC GN 1 requirements and highlights the importance of a defined scope for CIA assessment by introducing the concept of VECs.

2.2 Valued environmental and social components

Valued environmental and social components (VECs) are environmental and social attributes (ie such as physical features, habitats, biodiversity, ecosystem services, natural process, social conditions, cultural aspects) which may be directly or indirectly affected by a specific development, that are often affected by cumulative effects of several developments. The VECs are often the ultimate receptors of the combined impacts as they tend to be at the end of ecological pathways.

The identification of VECs begins from a project-centric perspective, where the environmental and social attributes potentially adversely affected by a specific project are identified. The focus then shifts to be centred around the VEC, whereby the study area considered is the area in which the VEC occurs where other stress (eg other developments, natural and social drivers) may affect them (see Figure 2.1).

Figure 2.1: CIA's VEC-centric approach



Source: "Good Practice Handbook on Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets", IFC, August 2013 (Downloaded from https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/publications/publications_handbook_cumulativeimpactassessment)

In summary, this CIA aims to assess the cumulative impacts which might occur when the effects of the Project components, other projects and/or other activities or stressors overlap with each other by affecting the same VECs.

2.3 Six step approach

In developing this CIA, the following six steps (as prescribed by the IFC CIA Handbook) were used to guide the framework approach for assessment:

1. Determine spatial and temporal boundaries (refer to Section 3.1)
2. (a) Identify VECs (using publicly available and approved local EIA reports which have undergone consultation with affected communities and stakeholders as well as appraisals from the concerned regulatory agency) (refer to Section 3.2); and (b) identify all developments and external natural stressors affecting VECs (refer to Section 3.3)
3. Determine present condition of each identified VECs (refer to Section 4)
4. Assess cumulative impacts (refer to Section 5)
5. Evaluate the significance of cumulative impacts over the predicted future conditions (refer to Section 5)
6. Recommend feasible management strategies (refer to Section 6) to include:
    a. Adequate procedures to manage cumulative impacts
    b. Identify appropriate monitoring indicators
    c. Effective supervision mechanisms

The commentary and assessment of the above-mentioned six steps are presented within the subsequent sections of this report.

3 Step 1 & 2: Scoping

The cumulative impact assessment of the VECs will encompass the geographic and temporal extent of the Project's impacts and the impacts from the other relevant current or foreseeable future developments. According to the IFC CIA Handbook, the first boundaries are often set by professional judgment but improved as new information indicates that a different boundary is required for the analysis. Thus, in this Section it is described how the boundaries were modified according to the effects of significant impacts, to scientific concerns or stakeholders' opinion derived from previous consultations during the EIA stage.

The boundaries for this CIA were determined following the process below (Step 1):

- Determination of the preliminary boundaries according to the Project's significant impacts on the relevant VECs
- Identification of the existing, planned or reasonably defined developments located within the boundaries of the Project and that could potentially affect the relevant VECs
- Final delineation of the geographic and temporal boundaries, if necessary, after assessment of the cumulative impacts (Section 5)

This process is further described in the subsections below. Although it is discussed in a stepwise fashion, the identification of the spatial and temporal boundaries of a CIA is an iterative process that took place simultaneously with the identification of relevant VECs and of the existing and foreseeable future developments that can impact relevant VECs.

3.1 Step 1: Spatial and temporal boundaries

Following the advice in the IFC CIA good practice handbook[8], the spatial boundary for this CIA had been determined based on the following:

- Area(s) that will be directly affected by the project or activity (ie direct area of influence or DAI)
- Wider area which the affected VECs occupy (that is beyond the DAI)
- Distance or range (beyond the DAI) an effect can travel, and other impacts the identified VEC may be exposed to within its range

Hence, the spatial boundary of this CIA include:

- **Project area:** the area that is directly affected by the Project and its components. Components include WTGs, offshore and onshore substations and cables (see Section 1.3).
- **Other offshore windfarms and developments:** neighbouring offshore windfarms and developments located in the western coast of Taiwan that directly affect the VECs of the Project. Other windfarms include developments by the Project Company (see Figure 1.2) as well as other developers awarded licensed areas by the Taiwanese Bureau of Energy (BOE). The windfarms are delineated into four tiers based on the windfarm's developmental status (see Section 3.3):
  - Tier 1 projects are fully operational, including:
    - Phase 2a of the Project (ie Greater Changhua 2 Phase 2a)
    - Formosa 1 (Haiyang Zhunan)
    - Formosa 2 (Haineng),

[8] IFC Good Practice Handbook: Cumulative Impact Assessment and Management, 2013

    - Taipower Phase 1 OWFs, and
    - Greater Changhua 1
- Tier 2 projects are currently under construction/pre-construction, including:
    - Phase 2b of the Project (ie Greater Changhua 2 Phase 2b)
    - Greater Changhua 4
    - Hai Long No. 2 and No. 3 OWFs
    - Yunlin OWF and
    - Five others OWFs
    - Tier 2 projects' expected grid connection dates range from end of 2023 to end of 2026, thus construction is expected to span to the end of 2026.
- Tier 3a projects have been rewarded development permission and signed administrative contract in round 3.1 auction, including:
    - Formosa 4 (Haisheng)
    - Fengmiao Phase 1
    - Formosa 3 (Haiding 2)
    - Huan Yang, and
    - Haixia Phase 2 OWF.
    - Tier 3a projects aim to have grid connection between 2026 to 2027, thus construction is also expected to span from 2025 to 2027
- Tier 3b projects have been awarded development permission in round 3.2 auction[9], including:
    - Formosa 6 (Haiguang)
    - Fengmiao Phase 2
    - Formosa 3 (Haiding 1)
    - YouDe, and
    - DeShuai OWF.
    - Tier 3b projects aim to have grid connection between 2028 to 2029, with the construction expected to span from 2027 to 2029. Due to the timeline of these developments, it is unlikely to have any overlap with the Project's construction phase. Therefore, For the purpose of this CIA, the cumulative potential for construction activities as associated with Tier 3b projects is not assessed further within this assessment. Operational phase of Tier 3b projects located within spatial boundaries are still factored in the current assessment as appropriate.

Details of each wind farm's tier and life cycle may be found in Table 3.2. These windfarms are confirmed to hold spatial capacity within the Project area and hence are considered within this cumulative impact assessment's spatial boundaries.

- **Boundaries of marine ecologically appropriate areas of analysis (EAAA**): referenced from the Project's Critical Habitat Assessment (CHA)[10], the EAAA boundaries for marine flora and fauna, migratory birds (including seabirds at sea) and terrestrial flora and fauna are considered. These EAAAs are geographic areas investigated and assessed for relevant biodiversity values regularly occurring in the Project's footprint. The EAAA is typically larger than the area affected by the Project directly or indirectly. A summary of the derivation of the

[9] The signing of administrative contract had yet to be completed

[10] Project's Critical Habitat Assessment (Final), dated November 2024

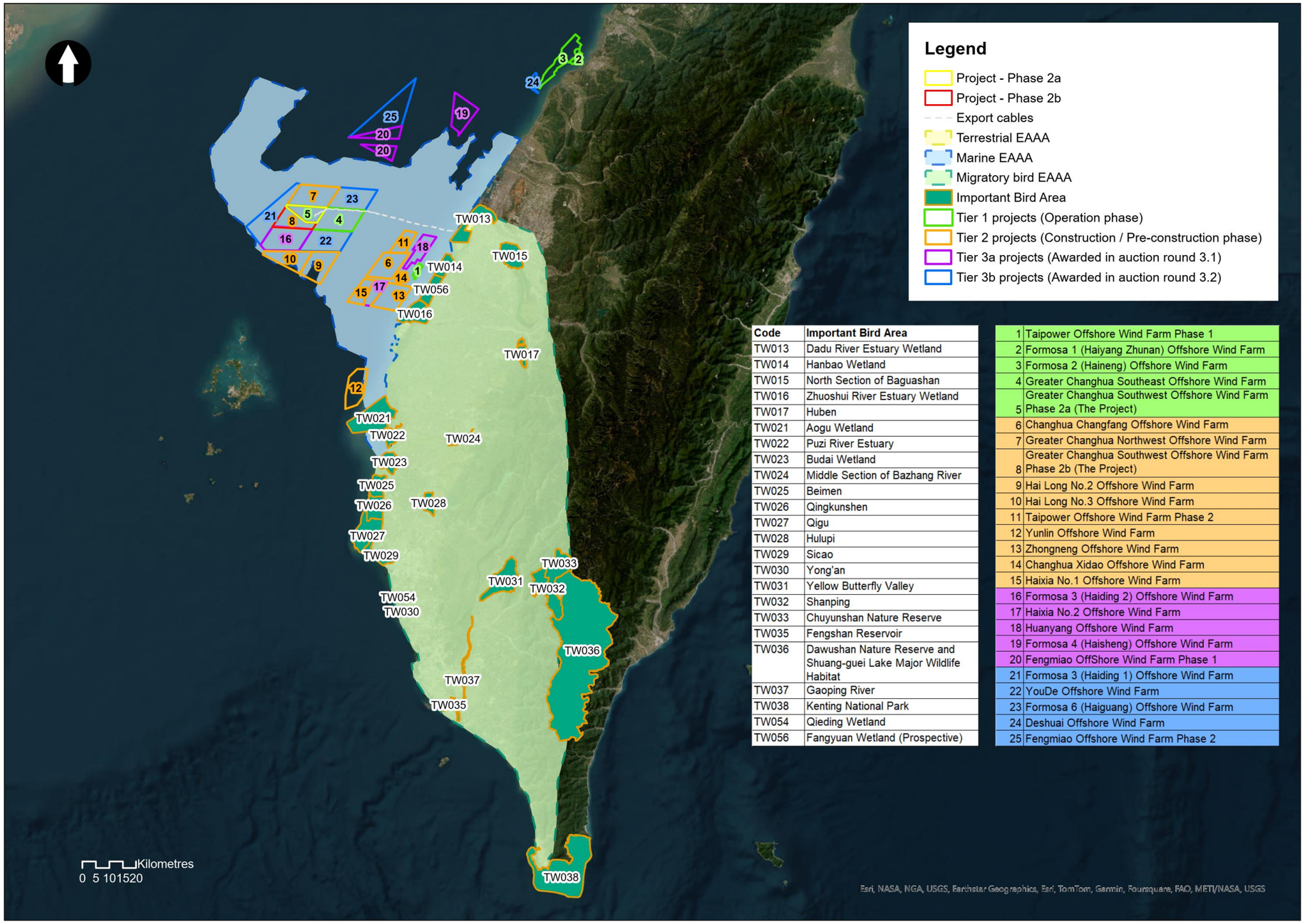
EAAAs has been summarised as below. Further details can be found within Section 2.2.1 of the Project's CHA.

- Marine EAAA: The marine EAAA considers the bathymetry of the Chang-Yuen ridge, bottom marine water temperature gradient, and the marine ecoregions of the world obtained from ArcGIS Hub. Furthermore, the species range of threatened species off the west coast of Taiwan and potential underwater noise impacts generated during piling and operation phase were also taken into consideration.
- Migratory bird EAAA: The migratory bird EAAA considers the IBAs in the south-western region of Taiwan, and the occurring bird species within the project boundary. Current available information relevant to the occurring bird species' spatial distribution and flight paths have also been considered.
- Terrestrial EAAA: The terrestrial EAAA includes the Xianxi area (線西區) and Lunwei area (崙尾區) of Changhua Binhai Industrial Park (彰濱工業區) in the coast of Changhua County of Taiwan, which is considered to be a discrete ecologically significant unit of space within the wider landscape.

Figure 3.1 depicts the spatial boundary considered for this CIA.

The temporal boundary of this CIA factors the limits of the approach described above, the available information of the Project and public information of other surrounding windfarm developments, as well as the advice of the IFC handbook. The temporal scale of the CIA includes the full lifecycle of the Project up to the end of operation (ie 25 years). Given the uncertainty surrounding baseline conditions at the time of future decommissioning, this is not included in the assessment at this time.

Figure 3.1: Spatial boundary of the cumulative impact assessment



Code	Important Bird Area
TW013	Dadu River Estuary Wetland
TW014	Hanbao Wetland
TW015	North Section of Baguashan
TW016	Zhuoshui River Estuary Wetland
TW017	Huben
TW021	Aogu Wetland
TW022	Puzi River Estuary
TW023	Budai Wetland
TW024	Middle Section of Bazhang River
TW025	Beimen
TW026	Qingkunshen
TW027	Qigu
TW028	Hulupi
TW029	Sicao
TW030	Yong'an
TW031	Yellow Butterfly Valley
TW032	Shanping
TW033	Chuyunshan Nature Reserve
TW035	Fengshan Reservoir
TW036	Dawushan Nature Reserve and Shuang-guei Lake Major Wildlife Habitat
TW037	Gaoping River
TW038	Kenting National Park
TW054	Qieding Wetland
TW056	Fangyuan Wetland (Prospective)

1	Taipower Offshore Wind Farm Phase 1
2	Formosa 1 (Haiyang Zhunan) Offshore Wind Farm
3	Formosa 2 (Haineng) Offshore Wind Farm
4	Greater Changhua Southeast Offshore Wind Farm
5	Greater Changhua Southwest Offshore Wind Farm Phase 2a (The Project)
6	Changhua Changfang Offshore Wind Farm
7	Greater Changhua Northwest Offshore Wind Farm
8	Greater Changhua Southwest Offshore Wind Farm Phase 2b (The Project)
9	Hai Long No.2 Offshore Wind Farm
10	Hai Long No.3 Offshore Wind Farm
11	Taipower Offshore Wind Farm Phase 2
12	Yunlin Offshore Wind Farm
13	Zhongneng Offshore Wind Farm
14	Changhua Xidao Offshore Wind Farm
15	Haixia No.1 Offshore Wind Farm
16	Formosa 3 (Haiding 2) Offshore Wind Farm
17	Haixia No.2 Offshore Wind Farm
18	Huanyang Offshore Wind Farm
19	Formosa 4 (Haisheng) Offshore Wind Farm
20	Fengmiao OffShore Wind Farm Phase 1
21	Formosa 3 (Haiding 1) Offshore Wind Farm
22	YouDe Offshore Wind Farm
23	Formosa 6 (Haiguang) Offshore Wind Farm
24	Deshuai Offshore Wind Farm
25	Fengmiao Offshore Wind Farm Phase 2

Source: Mott MacDonald, 2024

3.2 Step 2a: Identification of VECs

The concept of VECs is introduced by the IFC CIA Handbook (IFC, 2013). VECs are E&S attributes that are considered to be important in assessing project risks and can include physical characteristics, habitats, wild animal populations; ecosystem services; natural processes; social conditions; and cultural aspects. Consistent with the IFC CIA guidance, this CIA focused on VECs recognized as important on the basis of governmental regulation, scientific concerns and concerns from stakeholders.

The identification of relevant VECs (Step 2) for which cumulative impacts will be assessed and managed was done in two phases:

- Identification of potential VECs of relevance for this CIA (preliminary VECs)
- Identification of VECs of relevance for this CIA (applicable VECs)

The results of the activities undertaken during these two phases are presented in the subsections below.

3.2.1 Documents reviewed

Documents reviewed and used for this CIA were sourced from various websites / publicly available information and Ørsted. The documents include:

- Greater Changhua Southwest Offshore Wind Farm Project (大彰化西南離岸風力發電計畫):
  - EIA Report (環境影響說明書)
  - EIA Comparison Table of Changes (環境影響說明書變更內容對照表)
  - EIA Bird Monitoring Report (鳥類調查報告)
  - 1st Environmental Impact Deviation Report (環境影響差異分析報告)
  - 2nd Environmental Impact Deviation Report (第二次環境影響差異分析報告)
- Changhua and Yunlin Offshore Wind Farms Project (彰化雲林地區離岸式風力發電計畫) (including this Project and the other windfarm developments):
  - Environmental Survey Report (2nd revised version) (環境影響調查報告書 第二次修訂本)
- Greater Changhua Southwest Offshore Wind Farm Coastal Utilization Management Plan (大彰化西南離岸風力發電計畫海岸利用管理說明書)
- Hai Long No. 2 and No. 3 Offshore Wind Farm:
  - EIA Report
  - EIA Bird Monitoring Report (鳥類調查報告)
- Offshore Wind Farm Developments in Taiwan (https://www.4coffshore.com/offshorewind/ and https://www.thewindpower.net/windfarms_list_en.php)
- Project's CHA (2024), which included the review of published data and literature:
  - Integrated Biodiversity Assessment Tool (IBAT) (https://www.ibat-alliance.org/)
  - International Union for Conservation of Nature (IUCN) Red List of Threatened Species (http://www.iucnredlist.org)
  - BirdLife International Data Zone (http://birdlife.org)
  - Biodiversity A-Z org (https://biodiversitya-z.org)
  - Catalogues of Life in Taiwan (https://taibnet.sinica.edu.tw/home_eng.php)
  - Convention on Biological Diversity (CBD) website (https://www.cbd.int/)

  - eBird (https://ebird.org)
  - Fishbase (https://fishbase.se)
  - The Amphibia Web
  - World Wildlife Foundation (WWF) Ecoregions (https://wordwildlife.org)
- Project's Stakeholder Engagement Plan (SEP, 2024)
- Map of Taiwan's Wetlands (https://wetland-tw.tcd.gov.tw/en/GuideMap.php)
- Habitat Protection in Taiwan (https://conservation.forest.gov.tw/habitat)
- Marine Protected Areas in Taiwan (https://www.oca.gov.tw/ch/home.jsp?id=197&parentpath=0,5 and https://www.fa.gov.tw/upload/466/2019041710393310400.pdf)
- Protected Reef Areas and Artificial Reef Areas in Taiwan (https://www.fa.gov.tw/en/Reef/index.aspx)
- Fisheries Zones of Taiwan (https://www.fa.gov.tw/cht/ResourceFishRight/index.aspx)

3.2.2 Stakeholder engagement activities and consultations

As mentioned above, the documents reviewed include approved local EIA reports which underwent series of reviews and appraisals in terms of the physical, ecological and socio-economic aspects. These reports include stakeholder engagement activities and public consultations as well as EIA appraisals and reviews, which are presented in in Table 3.1 below.

In addition, the Project has continued engagements and consultations in compliance with international standards between 2016 to Q1 2024, which may be found in Table 5.3 of Project's SEP. Since the EIA stages, various stakeholders have engaged, which comprises of individuals and representatives from government authorities, local government and community from Changhua County, as well as non-governmental organisations (NGOs) and academia. The EIA reports and SEP were both consulted to verify the VECs were previously considered by specialists to be affected by significant Project's impacts.

Table 3.1: Stakeholder engagement activities and public consultation meetings undertaken for the Project's EIA

Event	Date
Online publication of Project information on the Environmental Protection Administration (EPA) website for 15 days	9 January 2016
Four meetings/visits with the Changhua Fishermen Association	10 February 2016 – 6 April 2017
Online publication of project development information and EIA survey aspects on the EPA website for 20 days	21 September – 12 October 2016
Public seminar (open meeting) for EIA report at drafting stage	21 & 24 October 2016
Public opinion survey of the Project (750 local community members, 209 fishers and 50 opinion leaders interviewed)	19 November – 11 December 2016
Online publication of major EIA chapters on the EPA website for 20 days	24 January – 14 February 2017
Opinion Presentation Meeting	20 June 2017
The 1st EIA Review Meeting	30 June 2017
The 2nd EIA Review Meeting	11 September 2017
The 3rd EIA Review Meeting	27 November 2017
EPA EIA Vetting Committee Meeting on the Project (the 327th meeting)	9 February 2018
Eight meetings with the Changhua Fishermen Association	17 July 2018 – 16 October 2018

Event	Date
Public Hearing for Coastal Utilization and Management of Greater Changhua 1 & Greater Changhua 2	8 August 2018
Review meeting on EIA report deviation comparison	20 November 2018
Public hearing for Coastal Utilization and Management of Greater Changhua 4	22 May 2019
EPA on-site audit meeting	29 October 2019
The 1st EPA Review Meeting	21 October 2021
The 2nd EPA Review Meeting	22 December 2021
EPA Vetting Committee (the 414th meeting)	2 March 2022
Pre-construction EIA public hearing of Greater Changhua 4	26 September 2022
Pre-CP application public hearing of Greater Changhua 4	16 December 2022
1st EIA Supervisory Committee Meeting	23 December 2022

Source: Unitech, 2018 and EIA Project Forum (https://eiadoc.epa.gov.tw/EIAFORUM/)

As of the current Project's plans, future stakeholder engagements and consultations include:

- 2024 onwards:
  - Project's Livelihood Restoration Programme (LRP) programmes and activities
  - Corporate social responsibility (CSR) programmes (eg scholar programmes or green energy education with academia)
  - Biodiversity and environmental monitoring related engagements, including:
    - Periodic review/meetings of Project's EIA conditions/commitments with government supervisory committee
    - Biodiversity forums co-organised with academia
    - Green Energy Scholarship Program 2.0: Sustainable Innovation Accelerator with researcher
  - Other stakeholder activities:
    - Engagement with fishermen's associations
    - Regular meetings with county governments, local township offices and environmental monitoring committee

Stakeholder engagement activities are planned and updated on an on-going basis. Hence, appropriately, the details of executed and planned stakeholder engagements will be presented and updated within the Project Company's SEP. As applicable, specific/further details on biodiversity related stakeholder engagement/consultation would also be updated within the Project Company's biodiversity action plan (BAP).

3.2.3 Identified VECs

3.2.3.1 Preliminary identified VECs

Considering the concept of VECs introduced by the IFC CIA Handbook, in accordance with the IFC CIA Handbook, this CIA initially gathered the potential VECs of concern from prior sectoral assessments (ie the Project's EIAs, Greater Changhua 4's CHA, CIA and LRP). VECs known or suspected to be affected by Taiwanese OWF projects include:

- Marine fauna (marine mammals and elasmobranchii)
- Offshore ornithology (migratory birds and seabirds at sea)
- Fisheries access and movement
- Local communities residing near project area

Regarding concerns from affected communities, it should be noted that there was no site visit or interviews / stakeholder engagements undertaken as part of this CIA to determine the stakeholder's opinion on the present condition of VECs. In turn, Mott MacDonald has relied on publicly available database (mostly approved EIA and deviation reports) containing typical issues common in the area. It was determined that this available database provides ample information and has already undergone consultations, EIA appraisals and reviews. In view of this, this database was considered an appropriate source of information to identify the main concerns expressed by affected local community (including fisher folk and local residents).

The Project EIA was also reviewed to verify which VECs were previously considered by specialists to be affected by project impacts. Hence, the preliminary VECs as presented below are shortlisted after a review of the Project EIA and selected review of neighbouring windfarms' EIAs.

- Preliminary VECs evaluated in respect of the Project include:
- Marine habitat
- Marine flora and fauna
  - Mammals, fish, reptiles, invertebrates and plants
- Community livelihood: fisheries resources and zones
- Migratory birds (including seabirds at sea)
- Terrestrial habitat
- Terrestrial flora and fauna
  - Mammals, reptiles, amphibians and plants
  - Terrestrial birds
- Legally protected and internationally recognized areas
- Marine water quality
- Air quality
- Ecosystem services related with community health and safety
- Community health and safety (related to project infrastructure and equipment design)
- Community health and safety (related to hazardous materials)
- Community health and safety (related to communicable diseases)
- Land use and local property owners
- Community daily routine and quality of life
- Public and private services and facilities

3.2.3.2 Applicable VECs

Starting with the preliminary VECs, an analysis of readily available information on baseline conditions of the VECs and on the Project's aspects and impacts was undertaken to conclude which VECs are relevant for this CIA. The applicable VECs address the following criteria:

- Potential to be affected by the Project in some or all phases (construction and operation)
- Identified as already under pressure by other developments and the Project will promote additional stress
- Identified as sensitive and relevant according to professional judgment, legal requirements (laws and directives) and stakeholder's opinion
- Existing natural or social stressors if any

Preliminary VECs within Section 3.2.3.1 that are not listed below are scoped out (ie not selected as applicable VECs). This is because they do not meet the above criteria or are already deemed

to have minor to negligible impact within selected publicly sourced EIAs of the Project and its nearby OWFs. 'Applicable VECs' are intended to be considered as priority for focus. The principle of the CIA is to prioritise the assessment on key VECs where there are material accumulation of cumulative impacts, resulting in a concern for the Project.

As a high-level summary of the scoping out of various VECs, some considerations are:

- Terrestrial based environmental VECs are scoped out because:
  - The Project's main components (ie the WTG area) are too far from the coast (ie approximately 56.65km) to have direct impacts (ie not to mention cumulative impacts).
  - Onshore activities of the Project (eg cabling laying, substation construction) are not likely to cause significant impacts
- VECs such as 'community health and safety' as well as 'public and private services and facilities' are scoped out because for the construction phase, the onshore works (eg substation and cable laying construction) is expected to mainly be allocated to contractors with a local workforce, while offshore accommodations will be on-board working vessels.
  - It is noted that another OWF by Ørsted, Greater Changhua 4, could be developed simultaneously with the Project. The estimated peak onshore and offshore workforce for the Project, together with Greater Changhua 4, is estimated to be approximately 1,060 workers for the construction phase (ie Q1 to Q2 2025). However, it should be noted that, offshore workers would comprise the majority of the workforce throughout the construction phase. For the peak labour, the composition of the offshore worker would be approximately more than 90% of the peak workforce, and the offshore workers will be staying in on-board vessel accommodations. The maximum number of onshore construction workers at any point would not exceed 220 persons. The maximum number of onshore (ie booster station) workers during the operation phase is 100 workers[11] (ie 2026 onwards). These workers are expected to be skilled labour and/or white-collar workers. These employees are expected to be accommodated within permanent facilities or rented properties within the nearby County. Based on current project information, there are no worker's accommodations/camps expected to be built[12]. Hence, at the Project level, this does not indicate a likely significant influx into the Project's (onshore) area.
  - In the Project's proximity (ie based on offshore working areas and onshore works), only a few of the Tier 2 and Tier 3a OWFs (four Tier 2 and two Tier 3a projects) could have potential to spatially overlap (ie likely to share similar worker influx areas). These are then considered in the context of potential temporal overlap of the possible offshore/onshore construction timeline. The projects with possible spatial and temporal overlaps are likely to be:
    - Tier 2 – Greater Changhua 4, Hai Long No. 2 and Hai Long No. 3 and Taipower OWF Phase 2 – targeting commercial operation in 2025 and 2026
    - Tier 3a – Formosa 3, Huanyang and Haixia No.1 – targeting commercial operation in 2026 and 2027
    - Due to timeline/progress and target grid connection dates (eg 2024 or earlier), other Tier 2 projects (eg Changfang, Xidao and Greater Changhua 1) are not likely to overlap temporally in terms of construction phase
  - The Project's construction phase is aimed to be Q1 to Q2 2025. From above, it should be noted that there would be limited potential for temporal overlap, particularly for Tier 3a projects, as overlap is only possible if the construction for these projects are substantially

[11] Estimated value from the Project's EIA, 2018 (p.7-181).

[12] Further details of subcontractor/supplier worker numbers and their worker's accommodation arrangements (and associated management) are updated on an on-going basis within Ørsted's future Labour Management Plan.

early (ie in 2025). The only other projects with a target 2025 commercial operation date (ie the Project's target date) is Phase 2A for Hai Long No. 2 (December 2025) and Greater Changhua 4 (Q4 2025).

- As understood, in terms of workers/contractor deployment, OWFs in Taiwan to date employ similar arrangements. This is whereby for offshore works, specialised offshore working vessels would have workers' accommodations on-board. Onshore works (eg substation and cable laying construction) is expected to mainly be allocated to contractors with a local workforce, and no worker's camps are expected to be built.
- During the construction phase, most of the working vessels would be mainly for the Project and nearby offshore windfarm developments, which would be far from coastal zones. It should be noted that these working vessels are mainly transiting through the coastal/ fishing areas en-route to their OWF area. For the construction of the export cables for the Project and other nearby windfarm developments, the working vessels would be in the coastal areas, but would be within the Changhua Northern Common Corridor. During the operational phase, it is expected that there would be minimal impact as there would not be as many working vessels as compared to during the construction phase. As such, there would not be any significant health and safety impacts due to marine traffic.
- It should also be noted that Lukang Township, where most onshore work will occur for these offshore windfarm projects, has a population of 84,678 people, as of December 2023. The maximum influx by the Project, assuming the Project and Greater Changhua 4 are to be developed together, is 220 persons for the construction phase and 100 persons for the operational phase.
  From Hailong's publicly disclosed social impact assessment (SIA)[13], the estimated total peak construction workforce for Hailong in 2025 is 216 persons. Conservatively considering Hailong's figure to be entirely as onshore workers, the total cumulative influx of onshore workers working within the Project's AoI is 0.5% of the total population for the construction phase. It should be noted that similar to the Project, Hailong's SIA also states that there are no dedicated onshore workers' accommodations expected.
- Therefore, at this stage, it is not expected that there will be significant workers' influx due to construction mobilisation (ie whether by the Project or the possible neighbouring windfarms) given the limited temporal overlap as well as the fact that no worker's camps/accommodations are expected for OWF projects.
- Further up-to-date details with regard to managing workers' accommodation can be found within the Project Company's Labour Management Plan[14].
- Further assessment as relevant to workers' influx could also be found within the Project's Focused Social Impact Assessment (FSIA)[15].

- Other social VECs, as mentioned above, the CIA is to meaningfully focus on aspects which are of material concern. Of the social VECs, it was determined that only 'Community livelihood: fisheries resources and zones' fulfilled the criteria as described above to be considered as a high priority to be covered within this CIA.

The applicable VECs for which cumulative impacts will be assessed and managed are listed below:

- Marine habitat
- Marine flora and fauna

[13] 0599176 Hailong SIA Rev5 (hailongoffshorewind.com)

[14] Project's Labour Management Plan Framework (Draft), September 2024

[15] Project's Focus Social Impact Assessment (Draft), November 2024

- Community livelihood: fisheries resources and zones
- Migratory birds (including seabirds at sea)

The present conditions of the relevant VECs within the temporal and spatial boundaries are described in Section 3.1.

3.3 Step 2b: Developments affecting the VECs

The preliminary spatial and temporal boundary of this CIA is defined by employing a modified[16] tiered approach for cumulative impact assessment suggested by Joint Nature Conservation Committee (JNCC) and Natural England[17]. Three main tiers following this approach have been identified:

- **Tier 1:** Developments that are built and operational
- **Tier 2:** Developments under construction
- **Tier 3:** Developments where construction has yet to commence. This tier is further split into:
  - **Tier 3a:** Developments officially awarded development permission in the Round 3.1 auction
  - **Tier 3b:** Developments that have received EIA/development approval only or known as possible future developments.

This tiered approach considers the current offshore developments, including wind energy developments, along the western coast of Taiwan (ie spatial boundary). The result of the second auction of Round 3 Zonal Development (ie Round 3.2 auction) announced on 5 August 2024[18] has also been included, where BOE selected five developers and ten OWFs. For the purposes of this CIA only those projects within Tier 1, 2 and 3 that have made information publicly available are included in this assessment.

The existing, planned or reasonably defined developments located within the spatial boundaries of the CIA that could potentially affect the relevant VECs were identified (Step 2). These developments, together with their respective assigned tier category (ie based on the methodology of tier approach for cumulative impact assessment) are summarised in Table 3.2, Figure 3.1 illustrates the location of these developments.

Table 3.2: Existing, planned or reasonably defined developments scoped in this CIA and their respective assigned tier category

Development	Developer	Project life cycle phase	Tier category
Offshore Wind Farm Developments at Hsinchu County, Miaoli County and Taichung City			
Formosa 1 (Haiyang Zhunan) Offshore Wind Farm	Formosa 1 Wind Power Co., Ltd.	Operational. Phase 2 construction completed since December 2019.	Tier 1
Formosa 2 (Haineng) Offshore Wind Farm	Formosa 2 Wind Power Co., Ltd.	Operational. Fully commissioned in March 2023.	Tier 1

[16] The tier approach for cumulative impact assessment suggested by Joint Nature Conservation Committee (JNCC) and Natural England consist of further tier levels that considers eg application submitted to the appropriate regulatory body that have not yet been determined; regulatory body are expecting an application to be submitted; projects that have been identified in relevant strategic plans or programmes. Due to limited publicly available information, these tiers were omitted from the above consideration.

[17] Scottish Power renewables (2013) JNCC and Natural England Suggested Tiers for Cumulative Impact Assessment

[18] This is further updated as based on the known results/outcomes as of the report writing. Which would take into account of developments which are confirmed to surrender their rights to develop their project, where they are awarded.

Development	Developer	Project life cycle phase	Tier category
Fengmiao Offshore Wind Farm Phase 1	Fengmiao Offshore Wind Power Generation Co., Ltd. Preparation Office	Awarded the Round 3.1 auction. Has not started development. The grid connection year is expected in 2027.	Tier 3a
Formosa 4 (Haisheng) Offshore Wind Farm	Formosa 4 International Investment Co., Ltd	Awarded the Round 3.1 auction. Has not started development. The grid connection year is expected in 2027.	Tier 3a
Fengmiao Offshore Wind Farm Phase 2	Fengmiao Offshore Wind Power Generation Co., Ltd. Preparation Office	Awarded the Round 3.2 auction. Has not started development. The grid connection year is expected in 2029.	Tier 3b
Meisen Offshore Wind Farm	Deshuai Xingdian Co., Ltd.	Awarded the Round 3.2 auction. Has not started development. The grid connection year is expected in 2028.	Tier 3b
Changhua Offshore Wind Farm Developments			
Greater Changhua 1	Greater Changhua Offshore Wind Farm SE Ltd.	Operational. Fully commissioned in August 2024.	Tier 1
Greater Changhua 2 Phase 2a (the Project)	Greater Changhua Offshore Wind Farm SW Ltd.	Operational. Fully commissioned in March 2023.	Tier 1
Greater Changhua 2 Phase 2b (the Project)	Greater Changhua Offshore Wind Farm SW Ltd.	Construction, the Project's Phase 2a expected commercial operation to begin in end of 2023. Phase 2b has been consented / approved. Has not started development.	Tier 2
Greater Changhua 4	Greater Changhua Offshore Wind Farm NW Ltd.	Targeting to commence offshore construction in Q1 2025 and reach grid connection by end of 2025.	Tier 2
Hai Long No. 2 Offshore Wind Farm	Hai Long 2 Wind Power Co., Ltd. Preparatory Office	Commenced onshore construction, targeting commercial operation to begin for December 2025 for 2A and December 2026 for 2B.	Tier 2
Hai Long No. 3 Offshore Wind Farm	Hai Long 3 Wind Power Co., Ltd. Preparatory Office	Commenced onshore construction, targeting commercial operation to begin for December 2026.	Tier 2
Formosa 3 (Haiding No.2) Offshore Wind Farm Site[19]	Formosa 3 (Haiding No.2) Wind Power Co., Ltd. Preparatory Office	Awarded the Round 3.1 auction. Has not started development. The grid connection year is expected in 2026.	Tier 3a
Wei Lan Hai Chang Hua (Huan yang) Offshore Wind Farm[20]	Taiwan Wind Holdings Co., Ltd.	Awarded the Round 3.1 auction. Has not started development. The grid connection year is expected in 2027.	Tier 3a
Formosa 6 (Haiguang) Offshore Wind Farm	Haiguang Power Generation Co., Ltd.	Awarded the Round 3.2 auction. Has not started development. The grid connection year is expected in 2029.	Tier 3b

[19] The Haiding No.2 Wind Farm Site is overlapped with the EIA approved 16Datian Wind Farm Site (from Skyborn Renewable Energy).

[20] The Huanyang Wind Farm Site is overlapped with the EIA approved Wind Farm Site of Fengyou Wind Farm Site (from Copenhagen Infrastructure Partners).

Development	Developer	Project life cycle phase	Tier category
YouDe Offshore Wind Farm	Youde Wind Power Generation Co., Ltd. Preparation Office	Awarded the Round 3.2 auction. Has not started development. The grid connection year is expected in 2029.	Tier 3b
Formosa 3 (Haiding No.1) Offshore Wind Farm Site	Formosa 3 (Haiding No.1) Wind Power Co., Ltd. Preparatory Office	Awarded the Round 3.2 auction. Has not started development. The grid connection year is expected in 2028.	Tier 3b
Changhua Nearshore Wind Farm Developments			
Changhua Demonstration	Taiwan Power Company (or 'Taipower')	Fully commissioning as of 31 August 2021.	Tier 1
Offshore Wind Farm Project Phase 1	Taiwan Power Company	Operation as of 2021	Tier 1
Changhua Changfang Offshore Wind Farm	Changfang Wind Power Co., Ltd.	Changfang Phase 1 is at partial generation, with full commissioning expected by 31 December 2024. Changfang Phase 2 is under construction, with commissioning expected by 31 December 2023.	Tier 2
Changhua Xidao Offshore Wind Farm	Xidao Wind Power Co., Ltd.	Xidao Phase 1 is at partial generation, with full commissioning expected 31 December 2024. Xidao Phase 2 is under construction.	Tier 2
Offshore Wind Farm Phase 2	Taiwan Power Company	Construction. Onshore construction commenced in June 2020. Full commissioning and grid connection expected in 2025.	Tier 2
Zhongneng Offshore Wind Farm	Zhongneng Power Co., Ltd.	Construction. Onshore construction commenced in January 2019. The grid connection year is expected in 2024.	Tier 2
Haixia No.2 Offshore Wind Farm	Skyborn Renewable GmbH and Lealea Group	Awarded the Round 3.1 auction. Has not started development. The grid connection year is expected in 2026.	Tier 3a
Offshore Wind Farm Project at Yunlin County			
Yunlin Offshore Wind Farm	Yunneng Wind Power Co. Ltd	Construction. Offshore construction commenced in 2021. The grid connection year is expected in end of 2024.	Tier 2
Other Coastal developments			
Changhua Coastal Park Service Center (彰化濱海工業區開發計畫)	MOEA	Operational as of 2010.	Tier 1
Construction of offshore wind power booster station and expansion of substation in Changhua Coastal Industrial Park (離岸風力彰工升壓站新設及彰濱變電所增設工程計畫)	Taiwan Power Company	Approved. Construction is anticipated to start in September 2020 and complete in end of 2025.	Tier 1/2

Development	Developer	Project life cycle phase	Tier category
Development of Changhua Fishing Port (彰化漁港開發計畫)	Changhua County Government	Under construction, anticipated to be completed in 2024	Tier 2

Source: Greater Changhua Southwest Offshore Wind Farm Project EIA Report, 2018; Taipower official website, assessed on 6 February 2023

4 Step 3: Baseline conditions of identified VECs

This Section presents Step 3 which discusses information on the baseline status of the selected VECs, and aims to describe their current conditions, spatial boundaries and potential response to project-related stresses/impacts and assess trends. Historical information about the VECs was gathered from various sources and used to assess the baseline conditions.

In this CIA, the presented baseline is limited to information that can be used to assess changes in VEC conditions due to cumulative impacts with other anthropogenic sources of impacts in the spatial and temporal boundaries; which subsequently contributed to the assessment of cumulative impacts (Section 5) and the development of management measures (Section 6).

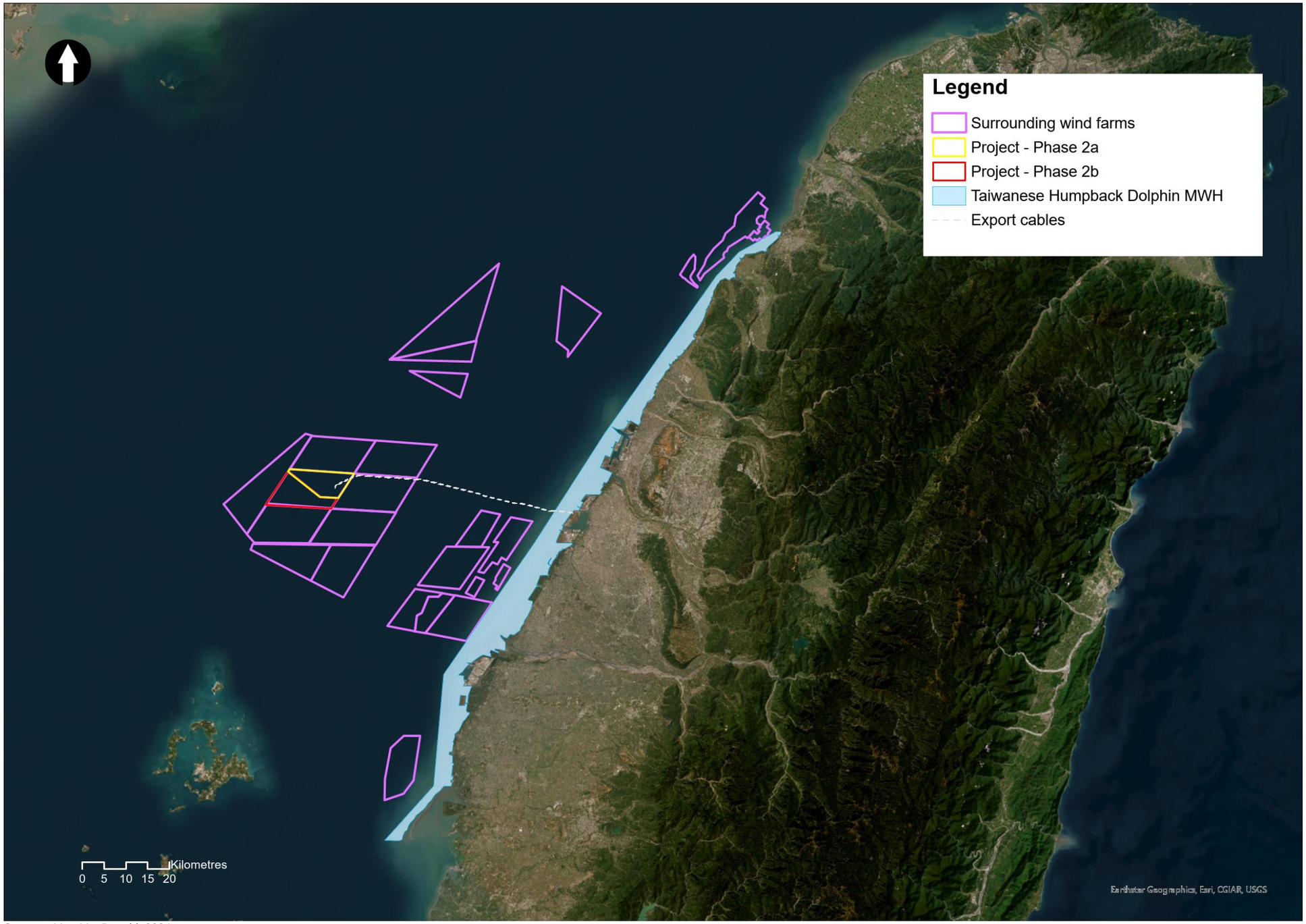
4.1 Marine habitat

Along the western strait of Taiwan, there are marine habitats including Taiwanese Humpback Dolphin Major Wildlife Habitat (MWH) (中華白海豚野生動物重要棲息環境), Protected Reef Areas (保護礁區), Artificial Reef Areas (人工魚礁區) and Marine Protected Area (海洋保護區) including the Fisheries Resources Conservation Areas (漁業資源保護區).

The following two categories of marine habitats have been identified, (i) Taiwanese Humpback Dolphin MWH; (ii) marine category along western coast (ie Protected Reef Areas and Fisheries Resources Conservation Area).

The submarine cables of most of the OWF developments located off the western coast of Taiwan would overlap with the Taiwanese Humpback Dolphin MWH. Figure 4.1 illustrates how submarine cable of OWF projects pass through the Taiwanese Humpback Dolphin MWH. The Taiwanese Humpback Dolphin MWH was first proposed on 21 April 2014 and was formally gazetted by the Ocean Affairs Council with effect from 1 September 2020. It was identified that Taiwanese Humpback Dolphin (*Sousa chinensis ssp. taiwanensis*), an Endangered species (ie under category I) in Taiwan and considered Critically Endangered under the IUCN Red List of Threatened Species (Wang, J.Y. & Araujo-Wang, C, 2018).The Taiwanese Humpback Dolphin inhabits a narrow strip of waters off the western coast of Taiwan, between Miaoli County and Jiangjun fishing port of southern Taiwan. The species distribution comprises shallow coastal waters at depths up to 30m, between 2 and 2.5km from the coast (Wang *et al.*, 2017). The range of the Taiwanese Humpback Dolphin is situated outside of the Project's windfarm array but overlaps the export cable route as well as potential construction and operational vessel routes.

Figure 4.1: Project footprint, surrounding OWF areas and boundary of the Taiwanese Humpback Dolphin MWH



Source: Mott MacDonald, 2024

There are a total of 89 Artificial Reef Areas[21] and 62 Protected Reef Areas[22] established in Taiwan. At Changhua County, there are eight Protected Reef Areas, in which five are located near Xianxi Township and Lukang Township. The Protected Reef Areas and Artificial Reef Areas have been implemented to address the overuse of fisheries resources, as artificial reef has been recognised for the rebuilding of the fishing grounds and enhancement of marine environment. The establishment of Protected Reef Areas and Artificial Reef Areas aims to (1) restock fisheries resources and (2) develop complex ecological environments. In Artificial Reef Areas, artificial reef structures (mainly concrete structures) have been deployed along the coast to deter illegal trawling activities.

As of August 2024, there are 70 Marine Protected Areas in Taiwan, with a total approximate area of 5,401km^2, accounting for 8.38% of Taiwan's offshore borders and domestic water area[23]. The definition of marine protected area in Taiwan refers to "an area extending seaward from mean hightide mark to a certain range, with special natural features, important cultural heritage and sustainable use of ecological resources, protected by law or other effective means". The marine protected areas are subject to different levels of control, from multifunctional use of the most lenient to most stringent use of no entry.

Fisheries Resources Conservation Area is designated as a type of MPA in Taiwan. The conservation area aims to restrict the length or seasonality on the capture of marine commercial goods. There are currently 29 Fisheries Resources Conservation Area in Taiwan, three of which are located in Changhua County[24]. They are Shengang Mud Shrimp Breeding Conservation Area, Shengang (2) Mud Shrimp Breeding Conservation Area and Wanggong Mud Shrimp Breeding Conservation Area (see Table 4.1).

Table 4.1: Summary of Fisheries Resources Conservation Area in Changhua County

Description	Shengang Mud Shrimp Breeding Conservation Area	Shengang (2) Mud Shrimp Breeding Conservation Area	Wanggong Mud Shrimp Breeding Conservation Area
Year of establishment	2006	2006	2013
Area (m^2)	36	2	41
Habitat of core area	Mudflats within the intertidal zone		
Levels of protection	No take		

Source: Taiwan Marine Protected Area (https://mpa.oca.gov.tw/Default.aspx, https://www.oca.gov.tw/en/home.jsp?id=99&parentpath=0,5/)

4.2 Marine fauna and flora

The baseline conditions of marine fauna and flora within the study area of the cumulative impact assessment considers the project footprint and its relevant marine EAAA defined within the Project's CHA[25].

Regarding the relatively broad seascape and the wide-ranging behaviour of many marine species, it is considered that 2483 species of marine fauna and flora are likely to be present within the marine EAAA, and as such the study area of Project's CIA. Marine flora and fauna within the marine EAAA are assigned to the following IUCN conservation status categories:

[21] https://www.fa.gov.tw/view.php?theme=Info_on_AF_and_PF&subtheme=&id=1

[22] https://www.fa.gov.tw/view.php?theme=Info_on_AF_and_PF&subtheme=&id=2

[23] https://mpa.oca.gov.tw/Default.aspx https://www.oca.gov.tw/en/home.jsp?id=99&parentpath=0,5/

[24] The establishment and management of Fisheries Resources Conservation Areas (Fisheries Agency, Council of Agriculture, Executive Yuan) (coa.gov.tw)

[25] Project's Critical Habitat Assessment (Final), dated November 2024

- Critically Endangered: 20
- Endangered: 54
- Vulnerable: 81
- Near Threatened: 81
- Least Concern: 2082
- Data Deficient: 165

A total of 334 marine species were recorded during the baseline surveys of the EIA reports. During the Project's marine mammal surveys conducted between April 2016 and March 2017, five groups of the globally Near Threatened Indo-Pacific Bottlenose Dolphin (*Tursiops aduncus*), consisting of three to six individuals in each group were recorded within the Project site boundary.

- According to the EIA report of Greater Changhua Southwest Offshore Wind Farm Project, the Taiwan Cetacean Stranding Network together with Taiwan Cetacean Society have started to record stranding events in Taiwan since the beginning of 1995. In the coastal areas of Changhua and Penghu, 56 stranding events were encountered during the EIA baseline survey with a cumulation of 59 individuals of 11 cetacean species.
- Transect surveys covering the OWF site were conducted to inform the Project's EIA. Where any marine mammals are observed, geospatial coordinates, estimated group size, behaviours and environmental data were collected alongside photographic records for individual identification.
- Indo-Pacific Bottlenose Dolphin is listed as Category II – Rare and vulnerable species under the Wildlife Conservation Act in Taiwan and globally listed as Near Threatened in IUCN Red List. The Indo-Pacific Bottlenose Dolphin would usually inhabit shallow coastal water near continental shelf and oceanic islands. The entire Taiwan Strait (including the project site) is located well within the range of extent of the Indo-Pacific Bottlenose Dolphin. The Taiwan Strait is well suited as a foraging ground for the Indo-Pacific Bottlenose Dolphin. During the 20 sea surveys between April 2016 to March 2017, five groups of Indo-Pacific Bottlenose Dolphin (*Tursiops aduncus*), in groups of two to 10 were recorded in travelling.
- Taiwanese Humpback Dolphin, was first described in 2002 and is considered a subspecies of the Indo-Pacific Humpback Dolphin, occurring only in the eastern Taiwan Strait. However, it did not receive a formal description until 2015, and formal recognition from the Society of Marine Mammals Taxonomy Committee in 2016. The species is listed as Critically Endangered in the IUCN Red List. During the 20 transect ship surveys between April 2016 to March 2017 within the Project's offshore area, no sighting of Taiwanese Humpback Dolphin was recorded during the EIA surveys.
- Taiwanese humpback dolphin (*Sousa chinensis ssp. Taiwanensis*), Taiwanese Wedgefish (*Rhynchobatus immaculatus*) and Taiwan picnic seabream (*Acanthopagrus taiwanensis*) are identified as critical habitat triggering marine species[26] within the Project's CHA

4.3 Community livelihood: fisheries resources and zones

Affected fishers communities – includes villages/townships where affected fishers, their workers and households conduct fishing activity, as well as specific fishing ports with associated fish sector value chain workers. As such, these areas include:

- Fishers located in general Changhua County, primarily consisting of fishers who are members of Changhua Fishermen Association (CFA). This is whereby the CFA have

administrative oversight and access to the exclusive fishing rights zone along the coastline of Changhua.

- Fishers, workers and their associated household members (who participate/support in fishery business/activities), whose fishing operations are based out of the following coastal townships[27]:
  - Lukang Township (鹿港鎮) (with Lunweiwan fishing habour 崙尾灣漁港)
  - Xianxi Township (線西鄉) (with Wenzi fishing habour 塭子漁港)
  - Fangyuan Township (芳苑鄉) (with Wanggong fishing harbour 王功漁港)
- Besides holding all of the fishing ports (ie home ports of fishing vessels), the above townships are also where the physical 'onshore footprint' (ie landing point, onshore substation, and onshore cables) are located.

Changhua County is located in the western coastal area of Taiwan with a 60km long coastline. Its geographical location provides potentials and resources to develop fisheries industry, together with the support in fisheries facilities by the government.

The number of fisher folk households in Changhua County is 4,960 with 15,015 full-time or part-time fisheries worker, according to the 2023 statistics published from Changhua County Government[28]. For Xianxi Township, there are 1,486 fisher folk households with 2,614 fisheries workers, while in Lukang Township, there are 643 fisher folk households with 1,942 fisheries workers. Generally, Xianxi Township and Lukang Township contribute a total of 43% fisher folk households and 30% fisheries workers in Changhua County. As of 2022, there is a total of 25,391 members registered in Changhua Fishermen Association, 12,429 of them are male and 12,962 of them are female.

The Directorate-General of Budget, Accounting and Statistics, Executive Yuan of Taiwan conducts a fishery census once every five years. According to fishery census report for 2020[29] (Accounting and Statistics, Executive Yuan, dated 20 June 2022), there were 34,129 fisher folk households of sole proprietorship with the average annual income of 1,525K TWD, while there were 862 fisher folk households of non-sole proprietorship with the average annual income of 30,004K TWD.

In Changhua County, different type of fisheries have been practised including offshore fisheries, coastal fisheries, marine aquaculture, inland water fisheries and inland water aquaculture. Offshore fisheries are fishery operations occurring between 12 to 200 natural miles from the shoreline, while coastal fisheries are operations within 12 nautical miles from the shoreline[30]. Most of the fisher folk households practise inland water aquaculture and coastal fisheries, while fewer households practise inland water fisheries and offshore fisheries. However, more fisher folk households adopt coastal fisheries instead of inland water aquaculture in Lukang Township. The total fishery production of Changhua County in 2022 was 12,367 tonnes, of which Inland

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[27] It is recognised that there are other coastal townships within Changhua country. As mentioned above, in terms of the Project's physical 'onshore footprint', these are limited to the three (3) townships listed. From the aspect of community and economic/livelihood impacts, these are not scoped/based geographically but rather covered through assessment of the affected fisher group(s). These are assessed as pertaining to fishers within the CFA (ie the primary fishers operating within/along Changhua) and the home ports of fishing vessels (ie within the above identified townships). Hence, the location of the physical residences of these fisher households (ie which could be located in other coastal townships or even inland and/or in Changhua city) is not considered a material/relevant aspect for assessment associated with economic/livelihood aspects.

[28] Changhua County Government - Agricultural Statistics Announcement (農業類預告統計資料發布區)

[29] Fishery census report for 2020 (109 年農林漁牧業普查初步統計結果), Accounting and Statistics, Executive Yuan, dated 20 June 2022

[30] 國立海洋生物博物館-海洋生態系 (nmmba.gov.tw)

Water Aquaculture and Marine Aquaculture accounted for more than 97% of the production, with the contribution of 868 tonnes (7.02%) and 11,164 tonnes (90.27%) respectively[31].

Vulnerable groups may be present within the project area's fishing communities. Fishermen households may be considered vulnerable due to their gender, age, physical or mental disability, or disadvantaged by their economic or social status. The presence of vulnerable groups will be verified during consultations and assessment as part of the Project's human rights impact assessment (HRIA) and livelihood restoration plan (LRP). The assessment as relating to vulnerable groups is not considered priority issues for detailed discussion within this report as based on the CIA approach (ie as described in Section 4.2). These, however, will be appropriately focused at the project level through the HRIA and LRP, as mentioned above.

Table 4.2: Statistics of fisher folk household and population, fisheries workers and fishery production in Changhua County, Xianxi Township and Lukang Township

Parameter	Changhua County	Xianxi Township	Lukang Township
Number of fisher folk households in 2023	4,960	1,486	643
Offshore fisheries	43	3	-
Coastal fisheries	2,382	1,478	341
Marine aquaculture	754	4	-
Inland water fisheries	57	-	31
Inland water aquaculture	1,724	1	271
Population of fisher folk (persons) in 2023	15,002	2,614	1,942
Offshore fisheries	127	21	-
Coastal fisheries	5,905	2,587	1,050
Marine aquaculture	2,828	5	-
Inland water fisheries	152	-	100
Inland water aquaculture	5,990	1	792
Fisheries workers (persons) in 2023	15,015	2,614	1,942
Offshore fisheries	143	21	-
Coastal fisheries	5,886	2,587	1,050
Marine aquaculture	2,817	5	-
Inland water fisheries	154	-	100
Inland water aquaculture	6,015	1	792
Fishery production (tonnes) in 2023	12,848	-	-
Offshore fisheries	217	-	-
Coastal fisheries	344	-	-
Marine aquaculture	901	-	-
Inland water fisheries	-	-	-
Inland water aquaculture	11,386	-	-

Source: Fisheries Agency Ministry of Agriculture, 2024[32]

Currently, there are two fishing ports within Changhua County, Wang-Gong and Lun-Wei-Wan, with a total of 10 berths. Both parts are Type II fishing ports[33] and are located in the tidal

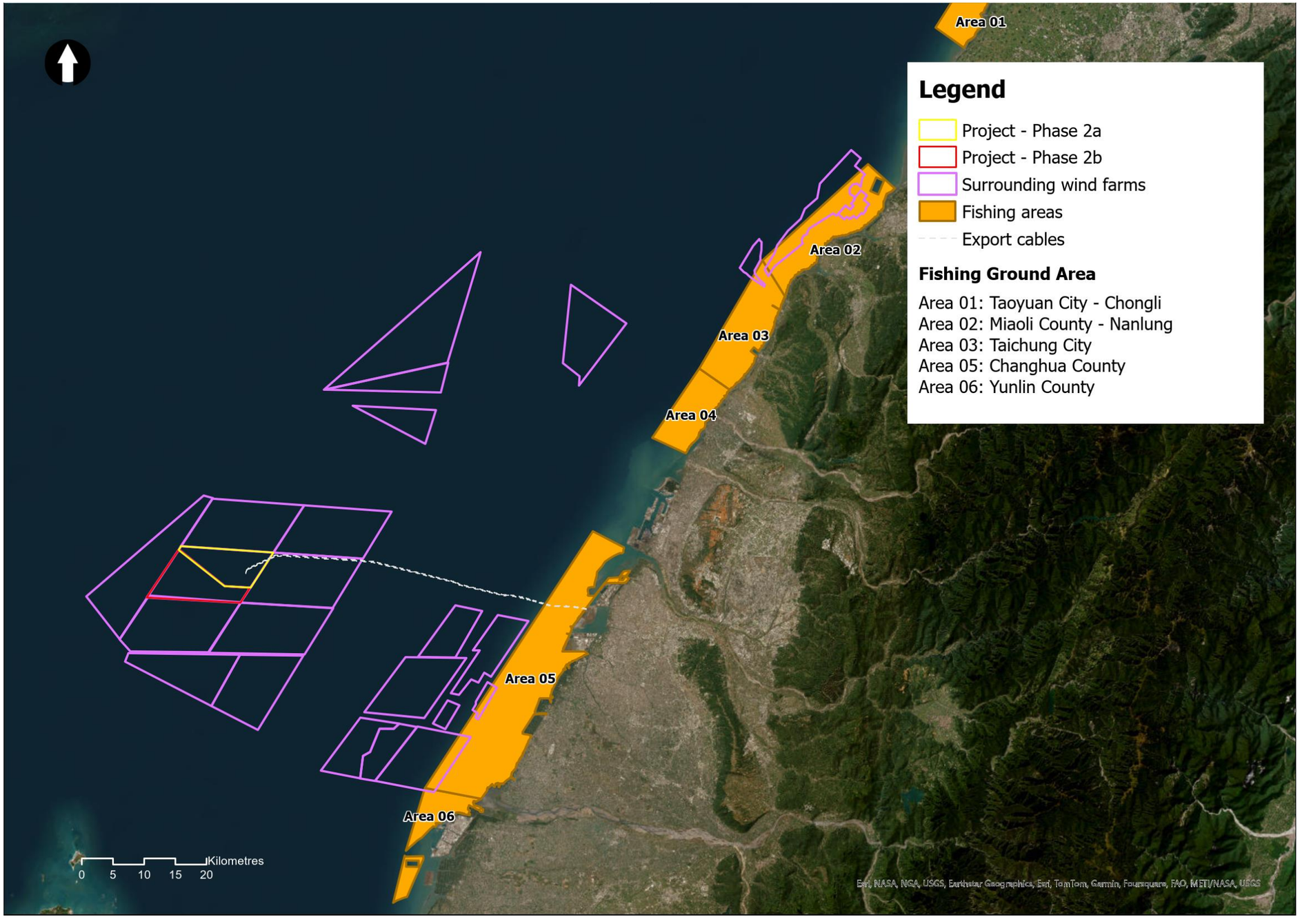
[31] Ministry of Agriculture - Fisheries Statistics Annual Report in 2022 (2022 漁業統計年報)

[32] 民國 112 年 (2023) 漁業統計年報 (Fisheries Statistics Annual Report for 2023) https://www.fa.gov.tw/view.php?theme=FS_AR&subtheme=&id=26

[33] Type II fishing ports include all the fishing ports that do not belong to Type I. The characteristic of Type I is national and to meet the special needs of fishery development. The definition of Type I can be found at: Enforcement Rules of Fishing Port Act

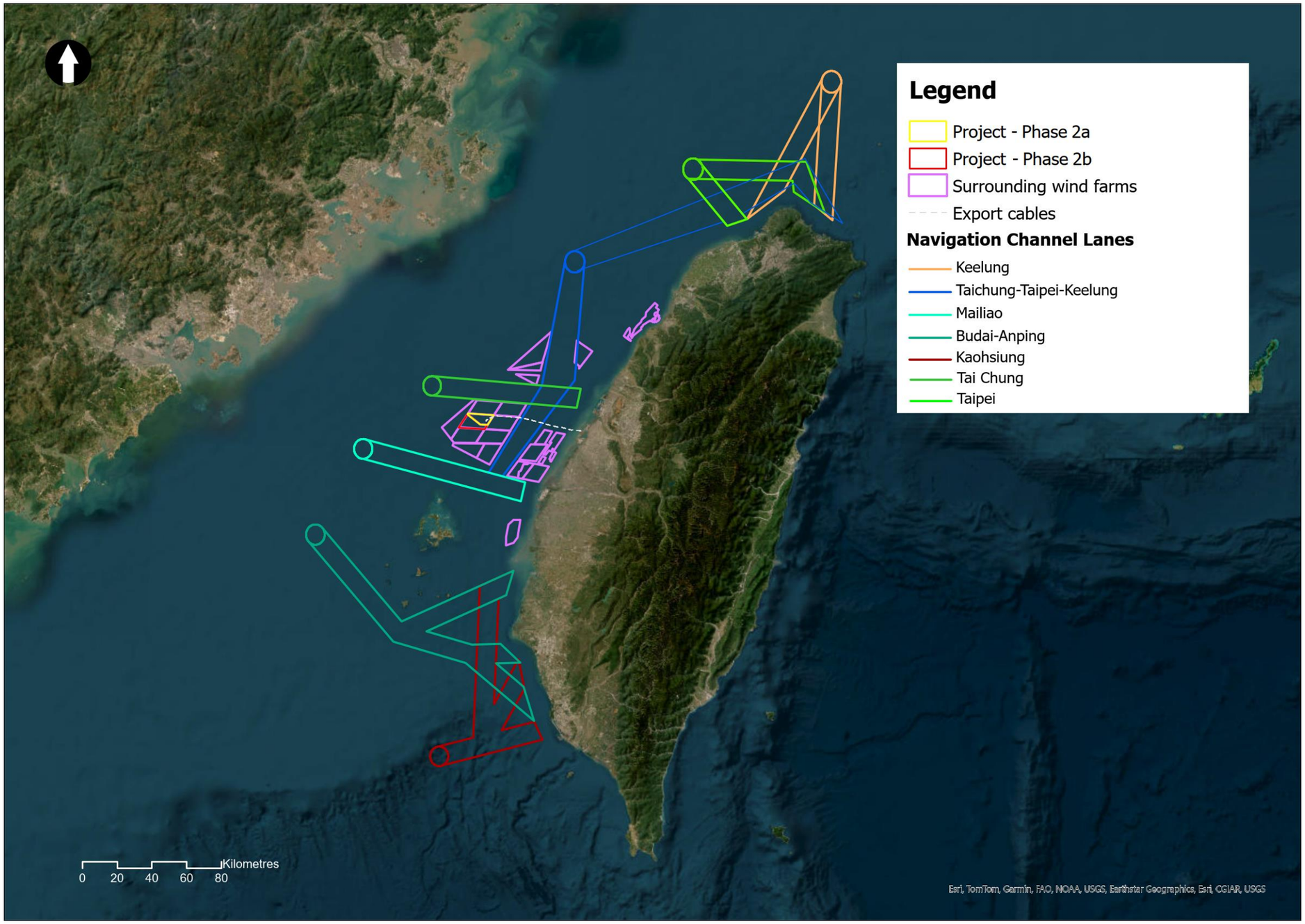
harbour. Due to the large tidal range in Changhua County, entry and exit of fishing boats are limited by the tides and it is estimated that there are only four to six hours available for entry and exit in a day. Navigation channels have been designated to segregate fishing boats, working vessels and other ships, as indicated in Figure 4.3. Shipping lanes between the major ports in the waters off western Taiwan have also been revised to facilitate the development of OWFs.

Figure 4.2: Project footprint and fishing areas



Source: Mott MacDonald, 2024

Figure 4.3: Project footprint and navigation channels



Source: Mott MacDonald, 2024

4.4 Migratory birds (including seabirds at sea)

The baseline conditions of migratory birds and seabirds at sea within the study area of the cumulative impact assessment considers the Project footprint and its relevant ecological appropriate area of analysis (EAAA).

Given the wide-ranging behaviour of migratory birds and seabirds at sea, it is considered that 17 globally threatened species (ie listed as Endangered and Vulnerable on the IUCN Red list) and a total of 229 species are likely to be present within the migratory bird EAAA. The IUCN conservation status can be categorised as follows:

- Critically Endangered: 3
- Endangered: 5
- Vulnerable: 10
- Near Threatened: 11
- Least Concern: 200

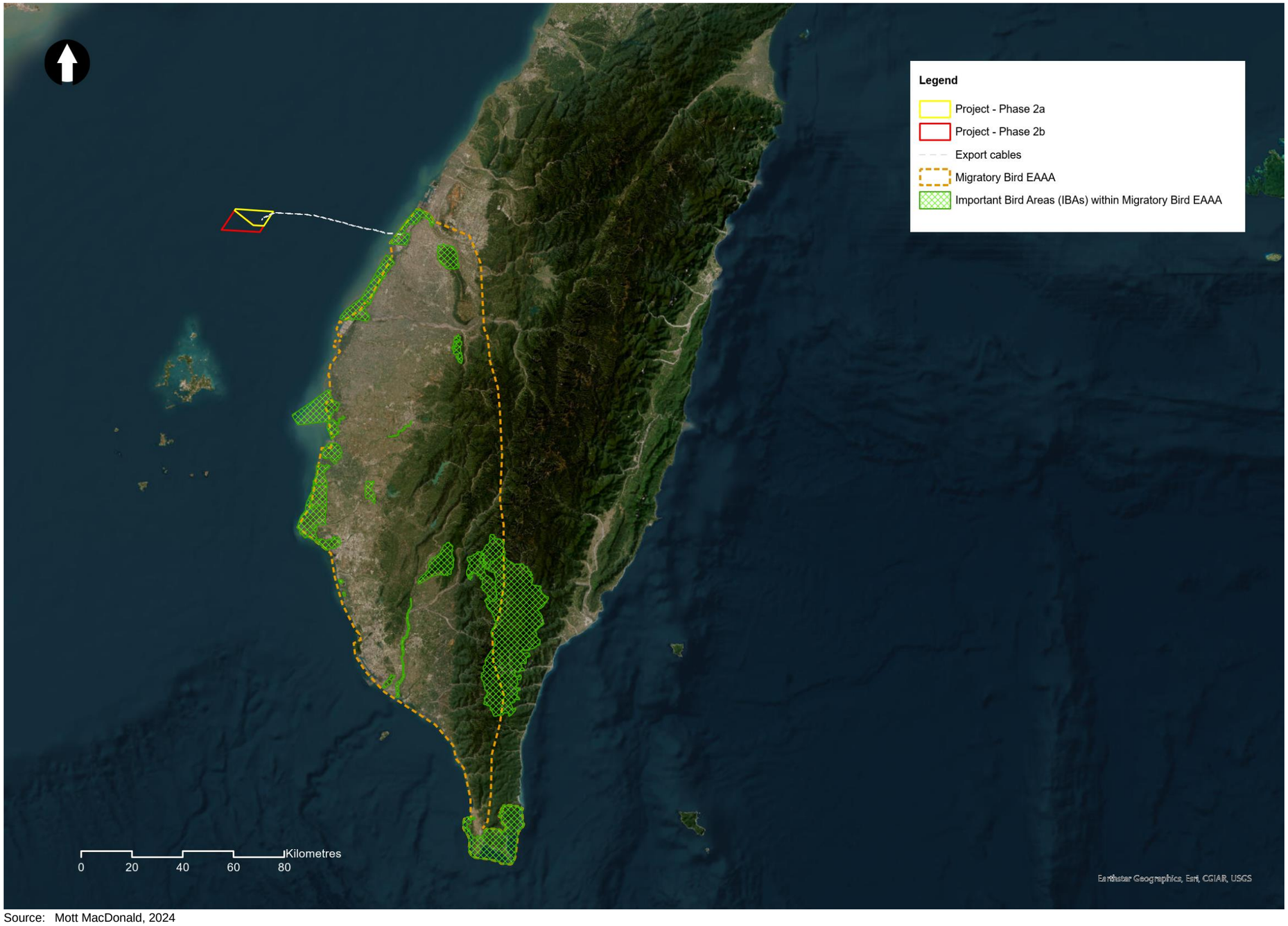
Of note, the black-faced spoonbill (BFS, endangered species), Saunders' gulls (vulnerable species), Chinese Crested Tern (critically endangered species), Oriental stork (endangered species) and Kentish Plovers (migratory species) are identified within the Project's Critical Habitat Assessment (CHA) as critical habitat triggering species.

During the baseline surveys conducted for the Project's EIA between 2016 to 2017, a total of 65 species were recorded. For the nearby developments around the Project, baseline findings from the Greater Changhua 1, Greater Changhua 4, Hai Long No. 2 and 3, Haiding projects are also extracted from the respective project's EIA report.

- From the Greater Changhua 4 EIA and EIS report, a total of 58 species were recorded during baseline surveys. This includes two globally endangered species ie Far Eastern Curlew (*Calidris tenuirostris*, also nationally endangered) and black-faced spoonbill (*Platalea minor*).
- From the Greater Changhua 1 EIA and EIA report, a total of 63 species were recorded during baseline surveys, including one globally and nationally endangered species ie Great Knot (*Calidris tenuirostris*).
- From the Hai Long No. 2 and 3 EIA reports, a total of 92 species were recorded from the baseline marine bird surveys.
- From the Haiding EIA report, a total of 97 species were recorded during the baseline marine bird surveys, including the globally endangered species ie black-faced spoonbill (*Platalea minor*).

The mudflat located at the south of Dadu Estuary, where the Dadu Estuary Important Wetland is recognised as an Important Bird Area (IBA) due to high abundance of congregating migratory birds. Other IBAs on the west coast of Taiwan that fall within the migratory EAAA are depicted in Figure 4.4, with diverse and large flocks of migratory birds and seabirds utilising these areas as foraging, resting and breeding grounds. Besides, migratory birds are also scattered around the coastal area of Changhua Coastal Industrial Park, where the intertidal zone is found. During low tides, migratory birds are usually scattered at the mudflat of intertidal zone for foraging, while during high tides, they fly towards south to fishponds or other habitats for resting.

Figure 4.4: Important Bird Areas (IBAs) within the migratory birds (including seabirds at sea) EAAA



Source: Mott MacDonald, 2024

5 Step 4 & 5: Cumulative impacts and significance

This section presents steps 4 and 5 which assesses future conditions of the selected VECs, as a result of cumulative impacts of the Project with other developments within spatial and temporal boundaries as defined in Section 3.1. The Section describes the key potential impacts that could affect the long-term sustainability of the VECs, if these impacts interact with each other, and also determines the significance of impacts based on qualitative analysis to verify if cumulative changes are a concern.

In a CIA, the impacts are measured in terms of the VEC response and, ultimately, any significant changes to its condition (VEC-centred perspective); not in terms of the intensity of the stress added by a given development (Project-centred perspective). Hence, this CIA focuses on estimating the future condition of VECs due to cumulative impacts and in determining the significance of the forecasted change in the VECs condition based on the likelihood that a threshold will be reached and exceeded. This likelihood for change is due to the incremental (cumulative) impact and in terms of the vulnerability and/or risk to the sustainability of the VECs assessed. In the absence of defined thresholds or in the face of an inability to determine limits of acceptable change, and based on available scientific evidence, professional judgment was employed to suggest appropriate[34] thresholds or limits.

Where possible, incremental change is represented by endpoints or indicators as recommended in the IFC CIA Handbook, using as reference the Appendix 1 in said document[35]. Relevant indicators of cumulative impact for respective VECs are as follows:

Table 5.1: Cumulative impact indicators for respective VECs and the associated impacts

VEC	Phase of Project	Indicator of cumulative impact	Potential impacts identified
Marine habitat	Construction	Habitat fragmentation or disturbance	Disturbance effect from construction activities
	Operation	Area of habitat loss	Project footprint falls permanently into sensitive marine habitat
Marine flora and fauna	Construction	Change in / fragmentation / displacement of marine flora/fauna population	• Project footprint causes permanent loss/change in the habitat of marine fauna • Underwater noise • Increased marine traffic and the associated risk of collision with construction vessels • Water quality degradation due to sediment suspension
	Operation	Population or range fragmentation of marine flora/fauna	Effect of electromagnetic field (EMF)
		Creation of artificial habitats through WTG foundations	Project footprint produces new habitats of marine fauna

[34] A precautionary approach considering uncertainty was assumed when thresholds were being suggested.

[35] Appendix 1 of the IFC CIA handbook provides examples of endpoints or indicators typically used on standard ESIAs vis-á-vis those that would be recommended or used in a CIA.

VEC	Phase of Project	Indicator of cumulative impact	Potential impacts identified
Community livelihood: fisheries resources and zones	Construction	Shifts in livelihoods	• Spatial conflict between fishing ground and construction area • Increased marine traffic • Displacement of fisheries resources
	Operation	Shifts in livelihoods	Reduction of fisheries resources
Migratory birds (including seabirds at sea)	Operation	Change in migratory/sea bird population	Collision with wind turbine blades and barrier effect

Source: Mott MacDonald, 2024

In broad terms, significance can be characterised as the product of the degree of change predicted (the magnitude of impact) and the value of the receptor/resource that is subjected to that change (sensitivity of receptor). For each impact the likely magnitude and the sensitivity of the receptor are defined. Generic criteria for the definition of magnitude and sensitivity are summarised below.

Impacts will be categorised as major, moderate, minor or negligible (Table 5.2) based on consideration of the parameters such as:

- Duration of the impact (Table 5.3)
- Spatial extent of the impact
- Likelihood
- Compliance with legal standards and Good International Industry Practice (GIIP)

Sensitivity is specific to each VEC as is defined in Table 5.4.

Table 5.2: Criteria for magnitude of impact

Magnitude	Definition
Major	• Fundamental change to the specific conditions assessed resulting in long term or permanent change, typically widespread in nature and requiring significant intervention to return to baseline • Would violate national standards or Good International Industry Practice (GIIP) without mitigation • Impacts has a net loss or is a detriment to biophysical or socio-economic conditions
Moderate	Detectable change to the specific conditions assessed resulting in non-fundamental temporary or permanent change
Minor	Detectable but small change to the specific conditions assessed
Negligible	• No perceptible change to the specific conditions assessed • Impacts has no net benefit or loss to biophysical or socio-economic conditions.

Source: Mott MacDonald, 2023

Table 5.3: Criteria for temporal scale

Assessment criteria		Definition
Duration (period of the event causing the effect)	Short term	Impacts occurs during the extent of preconstruction and construction through to project commissioning
	Medium term	Impacts occurs during the first 10 years of operations
	Long term	Impacts extending greater than 10 years, over the life of the Project and beyond

Source: Mott MacDonald, 2023

Table 5.4: Sensitivity criteria

Sensitivity	Criteria
Significant	Receptor (human, physical or biological) with little or no capacity to absorb proposed changes and/or minimal opportunities for mitigation. For example, critically endangered species and their supporting habitats within protected areas.
Not significant	Receptor with capacity to absorb proposed changes and/or good opportunities for mitigation. For example, widespread Vulnerable species and natural habitats that can be restored in the short term.

Source: Mott MacDonald, 2023

5.1 Marine habitat

The cumulative impacts of the Project with other existing/foreseeable OWF and coastal developments in the study area for this VEC are mainly related to habitat disturbance and fragmentation due to construction activities.

5.1.1 Construction phase

5.1.1.1 Impacts from submarine cables

Submarine cables from the OWF developments within the study area would overlap with the Taiwanese Humpback Dolphin MWH at the coastal strip of northwest to west Taiwan (Figure 4.1). The construction activities include construction vessels which would generate underwater noise which can impact the Taiwanese Humpback Dolphin MWH. This may potentially cause behavioural changes/ reactions such as temporary loss of feeding/ breeding habitats, which will lead to habitat displacement. Furthermore, the increase in construction vessels may also increase potential collision risks with the Taiwanese Humpback Dolphin, leading to injury or deaths.

While construction activities for these submarine cables scattering along the Taiwanese Humpback Dolphin MWH could cause a moderate disturbance impact on the Taiwanese Humpback Dolphin MWH, the impact is expected to be temporary and localised (ie a short period of disturbance within small portion of the overall habitat area).

Phase 2b of the Project is designed to have one export submarine cables along a single export cable alignment leading to the landing point. These cable each have a maximum length of 57km from offshore substation to landing points. Assuming a conservative cable trench width of 2m[36], approximately 4km of the submarine cable will pass through the Taiwanese Humpback Dolphin MWH (see Figure 4.1). Given that the Taiwanese Humpback Dolphin MWH is defined to have a size of 673km^2, the area in which the Project's export cable alignment (ie consisting of two cable trenches) overlap with the Taiwanese Humpback Dolphin MWH is 0.008km^2. This is equivalent to 0.001% of the total Taiwanese Humpback Dolphin MWH area. In terms of the total area taken up by Phase 2b's export cables, it will be 0.114 km^2, which is 0.002%[37] out of the whole marine EAAA (which has an area of 5535km^2).

Impacts from submarine cable construction will also be temporary, with marine habitats affected in the short term during construction phase. The cable laying techniques involves landing the cable and covering it with rock for protection (ie rock-dumping work). The offshore construction, including cable laying works, is expected to be completed within 6 months (Q1 to Q2 2025). A

[36] Based on the Project EIA's dredging width for the submarine cables.

[37] This is a conservative figure, as the cable laying route is not subjected to permanent habitat loss. The seabed area disturbed for cable laying is only temporary, and will be reinstated after the cable laying (ie a few weeks for each section) is completed.

sequential construction approach for the submarine cable will be adopted, where the cable laying work for Phase 2 and Greater Changhua 4 will be staggered.

Relevant measures have been undertaken in design phase to minimise the impact of submarine cables construction. The alignment of submarine cables of this Project 2b as well as the other windfarm developments (ie Greater Changhua OWFs, Hai Long OWFs, Changfang Xidao, Taipower's OWF Phase 2, and Zhongneng) are designed to array within a common area, namely the Changhua Northern Common Corridor, to the landing point at seawall of Changhua Coastal Industrial Park's Lunwei Area.

Therefore, the spatial and temporal (ie temporary disturbance for short sections of the cable route) impact of the cable laying works are expected to be similar. Furthermore, the cable laying area impacts are largely only during construction phase (ie laying works in nearshore areas). The aggregated extent of possible overlap on a conservative basis would be the Project and the other windfarm developments having cable laying construction works for all six projects concurrently. Even with a conservative estimation on the aggregated extent of possible overlap, the spatial and temporal impact of cable construction on the Taiwanese Humpback Dolphin MWH is expected to be very minor to negligible. On a percentage basis, this would be <0.2% of temporary impacts (eg assuming each of the other windfarm projects is similar to the Project, which has an overlapping area of 0.008km^2 between the cable alignment and the Taiwanese Humpback Dolphin MWH). Furthermore, with the common corridor design, it will minimise the extent of submarine cable construction for individual windfarm projects and associated impact of habitat disturbance and fragmentation on the Taiwanese Humpback Dolphin MWH. This measure will also minimise impact of marine benthic and intertidal habitat loss.

5.1.1.2 Impacts from WTG installation and offshore substation

Permanent habitat loss would occur from the construction of WTGs and offshore substations. However, this loss is outside the Taiwanese Humpback Dolphin Major MWH, with approximately 50km buffer due to the construction. Given the homogeneity of open water habitats in the area and the minimal loss of open waters, which is outside the Major Habitat of Taiwanese White Dolphin and in an area of low marine mammal usage, significant impacts on marine mammal populations are not expected. Using the Project's indicative foundation design (ie 3 legged jacket), the seabed area affected by the foundation required for one WTG and one offshore substation is conservatively taken to be 1600m^2. The Project had planned for 60 WTGs and an offshore substation (OSS). Therefore, the Project's offshore WTG are expected to take up a total of 0.0976 km^2 of seabed area, which is 0.002% out of the whole marine EAAA (which has an area of 5,535km^2).

Additionally, nearby windfarms developers have committed to several mitigation measures for the impact on Taiwanese Humpback Dolphin MWH:

- Construction vessels within 1500m radius of known Taiwanese Humpback Dolphin habitat are to maintain a speed below six knots.
- Vessels will try to avoid entering known Taiwanese Humpback Dolphin 'hotspots' during their peak activity periods.

5.1.1.3 Impacts from coastal developments

As a note, for the development of Changhua fishing port, the planned breakwaters are overlapped with the Taiwanese Humpback Dolphin MWH. However, there are construction design and mitigation measures (ie low-noise construction method) factoring this committed within Changhua fishing port's third EIA deviation report. Beside the port's EIA describing that significant adverse impact to the Taiwanese White Dolphins is not expected, the activities and

impacts (ie type/nature, spatial, temporal) of the port is not expected to have significant cumulative potential with those of the Project.

Overall, impact on the Taiwanese Humpback Dolphin MWH, as well as the impact to corals and fish populations, are anticipated to be minor and short-term.

5.1.2 Operation Phase

During the operation phase, WTG could potentially provide positive impact to marine environment. The Project and other windfarms will also have their cables buried, whereby the seabed will be reinstated. Therefore, no permanent loss of the Taiwanese Humpback Dolphin MWH is expected. Based on publicly available information, Hai Long No. 3's EIA Bird Monitoring Report indicates that the greater Changhua outer seas (ie where the Project is located), greater Changhua coastal seas and Yunlin OWF would aggregate up to 1178 WTGs. This total encompasses all projects under Tier 2, Tier 3a and Tier 3b located in the Changhua County offshore area. Hence, conservatively assuming similar foundations to the Project design, substation area and submarine cable length and width for all projects, the total area taken up by the projects (ie excluding the Project itself) within the marine EAAA will be around 5.56km^2, or 0.1% of the entire marine EAAA.

The footprints of the Project and other Changhua windfarm developments have avoided the artificial reef areas assigned for habitat enhancement, which are located around the nearshore area at the northern part of Changhua County. The foundation of the installed WTGs would also function similar to artificial reef and provide positive impact to the marine environment. The eight Protected Reef Areas at nearshore of Changhua as well as the Marine Protected Areas including Fisheries Resources Conservation Areas along the coast were also avoided by the planned windfarm and coastal developments, thus potential impact of the Project and the other developments on marine habitat during operation phase is expected to be negligible. Impact significance to this VEC is considered to be not significant.

The cumulative impact on marine habitat during construction phase and operation phase are summarized in **Table 5.5**.

Table 5.5: Summary of cumulative impact on marine habitat

Phase of Project	Indicator of cumulative impact	Potential impact identified	Mitigation measures	Residual impact magnitude – from the Project	Residual impact magnitude – from other developments	Impact duration	Significance of cumulative impact after mitigation measures implemented
Construction	Habitat fragmentation or disturbance	Disturbance effect from submarine cable installation	• The submarine cables of Changhua windfarm to array within a common corridor • The cable laying activities to be conducted in sequential sections	Minor as conducted by sequential laying in sections	Reduced to minor cable arrayed in common area	Short term	Not significant
Operation	Area of habitat loss	Project footprint falls permanently into sensitive marine habitat	• The seabed will be reinstated after submarine cable construction • WTG foundations can function similar to artificial reef	Negligible as no habitat loss	Negligible as no habitat loss	Nil	Not significant

Source: Greater Changhua Southwest Offshore Wind Farm Project EIA Report, 2018; Mott MacDonald, 2024

5.2 Marine flora and fauna

The cumulative impacts that affect this VEC in the study area are relevant to changes or displacement in wildlife population mainly due to increased underwater noise, degrade water quality and risk of vessel collisions during construction phase, as well as habitat loss/disturbance mainly due to areas occupied by developments (eg WTGs, offshore substation, submarine cable, cable tower, breakwaters) and electromagnetic field (EMF) generated during operation phase.

5.2.1 Construction phase

5.2.1.1 Underwater noise

Underwater noise during construction phase would be generated mainly by WTG foundation installation, offshore substation foundations, and the operation of construction vessels. The potential impacts of underwater noise to marine fauna (especially to marine mammals) include temporary/ permanent hearing loss, as well as behavioural change/ reactions.

Phase 2a's WTG foundations and the Project's offshore substation foundation for both Phase 2a and Phase 2b have been completed using pin-pile jacket. Phase 2b will adopt suction bucket foundation installation techniques, so no piling will occur in the upcoming construction. The suction bucket foundation installation techniques is expected to generate significantly less underwater noise as compared to pile driving. This is due to an underwater suction pump being deployed to pump water for the caisson to sink into the seabed, rather than percussive hammer pilling. However, the suction pump noise is not expected to reach levels that could cause physical harm to marine mammals, it may potentially exceed the established behavioural disturbance threshold of 120 dB re 1 µPa for continuous, non-impulsive noise sources (Bureau of Ocean Energy Management, 2024). Due to reduced noise and minimal seabed disturbance of these foundation types relative to pile-driven foundations, the underwater noise impact on marine mammal is expected to be limited.

In recognition of the cumulative impact from nearby windfarms, Greater Changhua 4 will also apply suction bucket foundations for the WTG foundation to minimise the environmental impacts on marine mammal. Furthermore, to enhance the protective measures, the neighbouring offshore windfarms will deploy qualified Taiwan Cetacean Observers (TCOs) to carry out marine mammal monitoring during construction phase. This practice is in compliance to the TCO Regulation and Management Manual established by the Ocean Conservation Administration, as well as fulfils EIA requirements. As detailed in Table 6.1, this is an EIA prescribed mitigation measure for minimising impact on marine mammals in proximity to construction activities. With all the abovementioned mitigation measures in place, the residual impact of underwater noise from the Project is deemed to be minor.

Regarding other developments, concurrent offshore piling of WTG foundations across nearby windfarm developments could generate significant impact of cumulative underwater noise on marine mammals. In addition, low-noise piling activities for the fishing port development will generate only a small extent of underwater noise. As described within their respective EIAs, other projects such as Formosa 3 and Hai Long 2 and 3 are also required to set up underwater mitigations (eg bubble curtains) to meet underwater noise limits (ie sound exposure levels not to exceed 160 dB at 750m away from piling). Under this context, given that the closest possible distance between the Project with the piling location of Formosa 3 or Hai Long 2 and 3, the potential for significant adverse cumulative impact for underwater noise is limited. This is also subjected to the coincidental concurrent occurrence of piling at the WTG locations at each development's boundary edge. This scheduling conflict could be largely avoided via communications and collaboration between nearby windfarm developers.

Overall residual magnitude of cumulative impact of underwater noise on this VEC would be deemed minor and short-term with implementation of management measures to minimise cumulative noise from construction activities.

5.2.1.2 Risk of collision with construction vessels

Risk of collisions between construction vessels and marine fauna would potentially affect this VEC. Furthermore, for marine species which are unable to swim or crawl, they would be less likely to escape collision from vessels, potentially increasing the risks of injury of death of marine fauna. Significant numbers of construction vessels and associated supporting and emergency rescue vessels are anticipated to be travelling across the windfarm sites and the shore for this Project and other windfarm developments. Navigation of these vessels may result in potential collisions with marine mammals, fish and sea turtle species which have a wide range of use and movements in the Taiwan Strait, leading to injury or death and thus potential change in population of these vulnerable marine animals.

In view of the abovementioned potential impact of vessel strike on marine fauna, Phase 2b has committed to limit vessel speed near the Taiwanese Humpback Dolphin MWH and setup a navigation safety plan, as detailed in Section 6.2. It is also noted that the neighbouring windfarm, Greater Changhua 4, will only share one vessel fleet for two projects' offshore construction. These measures are expected to minimise the impact of vessel strikes during the construction phase of the Project to insignificant levels. However, the cumulative number of construction vessels from all concurrently constructing OWF projects and cumulative effect of vessel strike are uncertain. Although construction vessel channels have been designated along the offshore windfarm sites (Figure 4.3), cumulative impact of vessel collision risk on this VEC could be moderate if there is no further management on capping of construction vessels to feasible numbers across the projects.

5.2.1.3 Water quality degradation due to sediment suspension

Water quality is expected to be degraded due to suspended solids during the construction phase, mainly due to foundation installation and cable laying works. Polluted water quality may cause migration or loss of fish resources, degrade marine habitat for critical habitat triggering species like the Taiwanese picnic seabream, and impact foraging capabilities and food sources for marine mammals.

The Project's EIA report simulated suspended solids in seawater during offshore foundation works. Results showed that the suspended solids increase from rock-dumping work remain within the natural range of marine environment. Moreover, due to the diffusion effect of currents and flows, the suspended solid concentration is expected to return to the original background level within 24 hours after completing the scouring protection construction.

Furthermore, there would also be an increase in suspended solids due to the construction works of the other nearby windfarms with overlapping offshore construction periods with the Project. These include the Greater Changhua 4, Haiding and Hai Long offshore windfarms. It is expected that the highest increase in suspended solids (ie worst case scenario) would be during simultaneous offshore construction works for these projects. Based on the Project's EIA report, suspended solids within the seawater during simultaneous offshore foundation and cable laying works of the Project, Greater Changhua 4, Haiding and Hai Long windfarms were simulated. Based on the results, the seawater quality impact due to the simultaneous WTG foundation construction and cable laying works are expected to be minor to insignificant.

It is worth noting that that the Project shares the same construction management team and vessel fleet as Greater Changhua 4. The team will confirm that there is no concurrent offshore foundation work to minimise water quality impact on marine fauna.

In addition, mitigation measures (ie such as anti-turbidity/silt curtains) for water quality are also implemented for the Project as well as prescribed within the EIAs of the abovementioned windfarm developments. Overall, degraded water quality due to sediment suspension during construction is expected to be minor and short-term, hence the cumulative impact is not significant to this VEC.

5.2.1.4 Effect of project footprint on marine habitat of marine fauna

Seabed areas occupied by WTGs, offshore substation and submarine cables may result in habitat loss for marine benthos. Benthic habitat loss caused by WTGs and offshore substations will be permanent, whereby cable laying will be reinstated after cable burial to allow the marine environment to return to its original stage. It should also be noted that the marine benthos survey results of the Project's EIA found that marine benthos at the seabed areas of both the windfarm site and along submarine cable alignment were of low biodiversity importance.

As articulated in Section 5.1.1.1, the Project's overall extent of habitat loss from Phase 2a and Phase 2b, even if both permanent and temporary losses are aggregated, is small (ie 0.007% of the entire marine EAAA) given the limited area size occupied by the windfarm components relative to the wider ecological area bearing similar attributes (ie the surrounding marine EAAA area). Given the size and scale of the marine habitat region, the cumulative habitat loss due to the Project and its surrounding windfarm development are still levels of magnitude below what might be considered significant. It is also worth noting that the foundations of the WTGs are considered to have a potentially positive impact in benthos habitat creation during the operational phase.

5.2.2 Operation phase

5.2.2.1 Effect of electromagnetic field

During the operation phase, electric currents in the inter-array submarine cables and submarine cables connecting the WTGs to the cable landing point may induce an electromagnetic field EMF), influencing the behaviour of marine ecology. With the Project's construction design approach, the potential significant adverse impact from EMF can be minimized, where:

- The submarine cable route from WTG to landfall shall take the shortest distance feasible.
- The submarine cable will be buried 1 to 2 m (2 m within the nearshore area) to reduce electromagnetic field (EMF) effects.

It is noted that the EIA reviewing committee usually request the windfarms[38] using the Changhua Northern/Southern Common Corridor (ie 彰化離岸風電海纜上岸共同廊道) to commit burying the submarine cables at least 1.5 meter. As such, the EMF cumulative impact on marine flora and fauna during operation phase is minor and not significant.

The cumulative impact on marine flora and fauna during construction phase and operation phase are summarized in Table 5.6.

5.2.2.2 Effect of project footprint on marine habitat of marine fauna

As identified within the construction phase, seabed areas occupied by WTGs, offshore substation and submarine cables may result in habitat loss for marine benthos during the construction phase.

On the contrary, the foundations of WTGs and offshore substations could potentially have positive effect for marine benthos as the structures provide hard substratum for colonisation of

[38] #1, #4, #5, #6, #7, #8, #9, #10, #11, #12, #14, #15, #16, #17, #18, #21, #22 and #23 in Figure 1.2

benthic communities. For the Project, protective seabed rock berms for scour protection will be adopted to protect the foundation of WTG. The rock berms are designed to protect the wind turbine foundation. Meanwhile, it can serve as artificial reef, providing marine habitat. On the other hand, habitat loss caused by submarine cables construction will be temporary as the seabed substrate will be reinstated above the buried cables and benthic organisms can be re-colonised within the area. Likewise, the positive impact of WTG foundations and offshore substation, as well as the temporarily negative impact of submarine cable construction will be applicable to the neighbouring windfarms. As such, cumulative impact on marine benthos during operation phase is minor and short term.

5.2.3 Summary of impacts and significance

Table 5.6: Summary of cumulative impact on marine flora and fauna

Phase of Project	Indicator of cumulative impact	Potential impact identified	Mitigation measures	Residual impact magnitude – from the Project	Residual impact magnitude – from other developments	Impact duration	Significance of cumulative impact after mitigation measures implemented
Construction	Change in / displacement of population	Underwater noise	Refer to Table 6.1	Minor	Minor	Short term	• Not significant for underwater noise, water quality and project footprint; • Potentially significant at the region's cumulative level for risk of collision, depending on level of adherence of other windfarms to their committed EIA measures and potential construction periods overlap. Project's cumulative contribution consider 'minor' if mitigations applied.
		Risk of collision with construction vessels	Vessel speed control Navigation safety plan	Minor	Moderate	Short term	
		Water quality degradation due to sediment suspension	Anti-turbidity/silt curtains	Minor	Minor	Short term	
		Effect of project footprint on marine habitat of marine fauna	Cable alignment will be reinstated after cable burial	Minor	Minor	Short term	
Operation	Population or range fragmentation	Project footprint causes permanent loss/change in the habitat of marine fauna	The foundations of WTGs and offshore substations could provide hard substratum for colonisation of benthic communities.	Minor	Minor	Short term	Not significant
		Effect of electromagnetic field (EMF)	• The submarine cable route from WTG to landfall shall take the shortest distance feasible. • The submarine cable will be buried 1 to 2m (2m within the nearshore area) to reduce EMF effects.	Minor	Minor	Long term	

Source: Greater Changhua Southwest Offshore Wind Farm Project EIA Report, 2018; Mott MacDonald, 2024

5.3 Community livelihood: fisheries resources and zones

Cumulative impacts that affected this VEC are related to shifts in livelihoods, mainly caused by spatial conflicts between fishing and construction activities, underwater noise from pile driving, and habitat loss/ disturbance.

In the spatial aspect, the fishing ground under the Changhua County Exclusive Fishing Right does not overlap with the windfarm site (ie approximately 50km from the coastline) of this Project or other offshore wind developments in Changhua.

The area of the Changhua Northern Common Corridor (ie utilised by the Project, other Greater Changhua projects, Hai Long and Formosa 3) for submarine cable installation does overlap with the fishing ground, but the spatial and temporal overlap will be limited to the construction phase. Potential impact of shifts in livelihood of fishery are anticipated during construction of cable trenches and laying of submarine cables. Nevertheless, the impact will be short-term and localised as the construction activities (ie cable laying) will be conducted in sections with the completed area being reinstated.

In terms of fishery activities, the Project's WTG area may potentially impact offshore fishers operating vessels categorized as CT0, CT1, CT2, and CT3, due to its offshore location. The construction phase is anticipated to result in temporary restrictions affecting offshore vessel owners within the WTG project area. Over the long term, spanning from construction to operational phases, vessels engaged in trawling and gill net fishing are expected to experience impacts. Furthermore, the implementation of fishing method restrictions could indirectly affect the livelihoods of crew members working within the Project's offshore components, primarily due to potential reductions in fish catch.

For cable alignment area, during operation phase, all fishing activities are suggested to be done only outside of a buffer/safety zone of 50m during non-maintenance. Fishing is temporarily restricted from cable segments undergoing maintenance or emergencies. All fishing vessels must keep a minimum safety distance of 500m in all directions from Project-related vessels during maintenance or emergencies.

Exclusion zones (ie area where non-Project vessels, including fishing vessels, are not allowed to access) will be established around the WTGs (ie 50m radius from the WTG foundation) during non-maintenance and non-emergency periods for the operational phase. The zone extends to 500m in all directions from the exterior boundaries of the turbine, foundation, and/or offshore substation when under maintenance. For other offshore fishing vessels (ie non-trawling and gill net fishing offshore fishing vessels), they are restricted by a 50m radius around the WTG turbines and foundations of offshore windfarms during the operation phase. Assuming all the known wind farm developments adopt the same access restrictions, the estimated cumulative restricted area around the WTGs and substations for the various offshore windfarms would be around 8km^2. For the offshore fishing area, from 12nm to 200nm in distance from the coast, and with Changhua County's coastline being 76km, Changhua County's offshore fishing area is around 26,478km^2. Overall, 0.03% of the offshore fishing area is restricted to non-trawling and gill net fishing offshore fishing vessels during the operation phase. In addition, offshore fishing vessels that can reach this range are also likely to be able to access a much wider area of sea (ie for fishing operations), and thus will not experience significant impact from the additional operational windfarms. Therefore, the cumulative impact on fishing activities and resources during operation phase is considered as minor and not significant due to the restriction areas.

In accordance with Taiwanese regulations, windfarm developers are mandated to provide compensation to fisher folk to mitigate potential economic impact on fisheries. It is understood that this is applicable to all OWFs within the spatial boundary. Direct (monetary) compensation

is provided for vessel owners registered under the local fishermen's association (ie CFA), as parties whose 'exclusive fishing rights' had been affected. The potential economic impact on other project-affected persons (PAPs) (ie which include vulnerable groups and women) will be assessed and mitigated further in the livelihood restoration plan (LRP) and human rights impact assessment (HRIA), whilst applicable biodiversity offsets (if required) will be discussed in the biodiversity action plan (BAP).

In 2018, the Project's WTG site as well as its adjacent windfarms had low marine vessel density of one (1) to two (2) vessels passing the Project's windfarm area per day, while the nearshore area had high marine vessel density (See Figure 5.1). Due to the increasing OWF developments, the fisher folk might be affected by the significant increase in marine traffic that navigates between the windfarm sites and the shore. There is a risk of collision between fisheries operating boats and construction vessels, which would potentially affect the VEC. However, it should be noted that the working vessels (with exception of cable laying works) of Project 2b and other windfarm developments are mainly transiting through the coastal area en-route to their OWF area. The existing coastal fishing areas where fisher folk will most likely conduct activities already have high levels of marine traffic. It is expected that the fisher folk will avoid the heavy traffic areas to minimise collision risk and aggregate at certain parts of the fishing ground. As mentioned in Section 3.2.3.2, most of the Project's neighbouring windfarms are also likely to have staggered offshore construction periods with Project 2b's offshore construction phase. Hence, marine traffic is likely to increase temporarily during certain overlapping construction periods, particularly nearshore (ie since the offshore WTG areas of the windfarm are relatively far apart).

However, if there is no management of a cumulative number of constructions associated vessels to avoid collision risk with fishing operations, increase in marine traffic will thus lead to potential moderate impact on displacement in fisheries livelihoods in the short term (during the construction phase). Increased maritime traffic and underwater noise from pile driving may cause disturbance to fish habitats and subsequent displacement of fish and interference with spawning activities. These activities may result in shifting of productive fishing grounds and affect the livelihood of fisher folk in the short term. However, it has been observed from a windfarm in operation in Western Taiwan that the area with wind turbines located had relatively better fish aggregation effect than nearby neighbouring artificial reef (Huang, et al., 2021). It is worth mentioning that the foundations of the WTGs can serve the function of artificial reefs, providing substratum for colonization of marine fauna and thus positive impact on fisheries resources.

For the operation phase of this Project and other windfarm developments, there may be loss in fisheries resources or fishing ground as the WTG sites of this Project and other windfarm developments will be occupying marine habitats for fishes. However, it is expected that there would not be a significant loss in fishing grounds as the windfarms are not located within the area of Exclusive Fishing Rights (EFR), Protected Reef Areas and Artificial Reef Areas. Furthermore, in accordance with observations where areas with wind turbines possess better fish aggregation effects than neighbouring artificial reefs, the new exclusion zones around the WTGs can serve as fish sanctuaries, helping to buffer and enhance fishery resources in the surrounding areas. Thus, the cumulative impact on this VEC during operation phase is considered minimal.

The mitigation measures of the Project and neighbouring OWF developments will include:

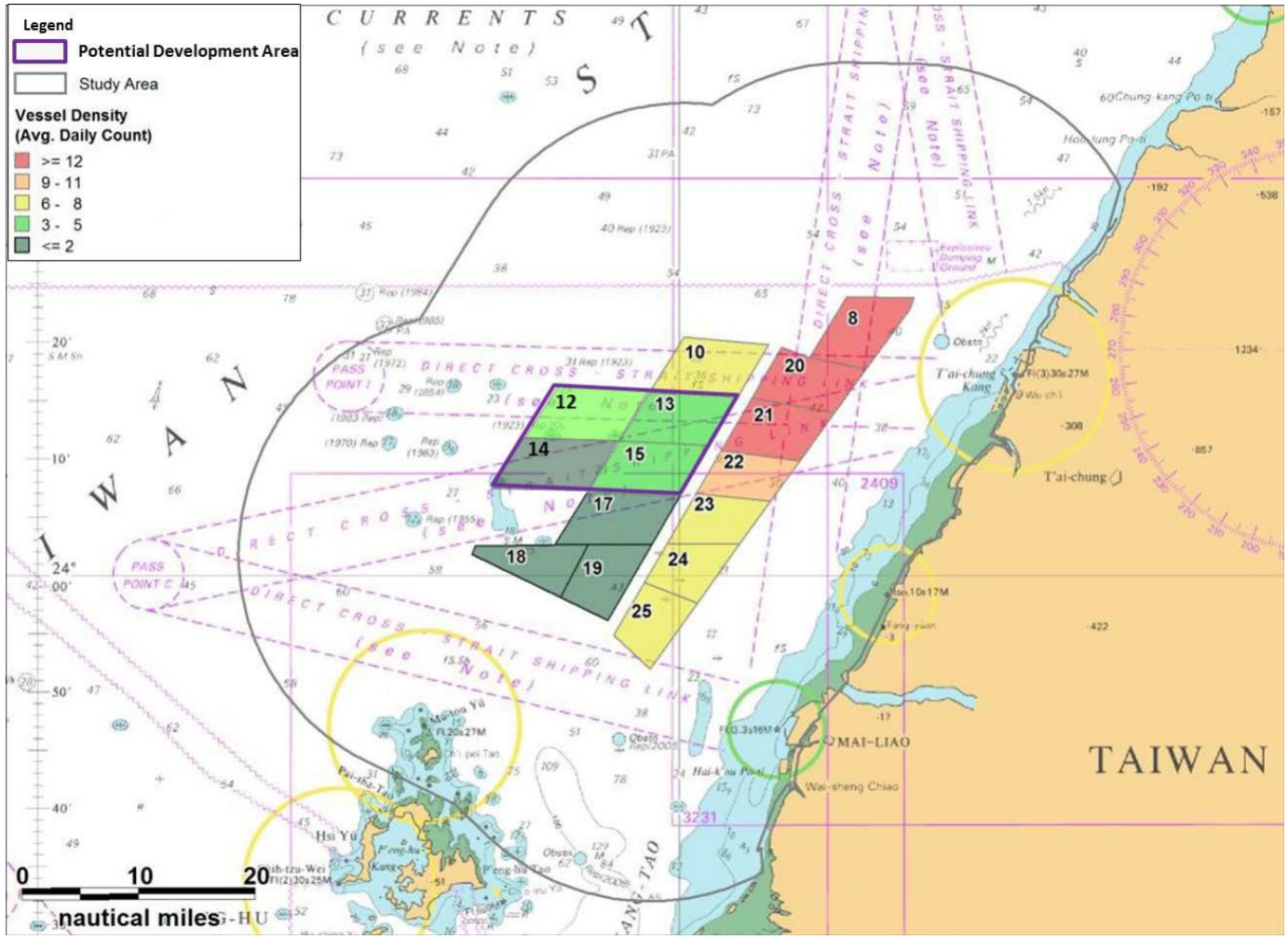
- Limiting vessel speed nearshore
- The Project utilises the same construction management team as Greater Changhua 4 to coordinate construction schedule and minimise marine traffic disruptions and collision risks

- Controlling vessel movements along a predefined marine transportation route are expected to minimise the impact of potential collision with fishing vessels.
- Vessel captains to adjust their routes based on traffic and weather conditions.

Other measures nearby offshore windfarms aim to adopt include assisting fisher folk to adopt new fishing techniques around WTG foundations and aiding the access to windfarm areas for fishing for the fisher folk.

For this VEC, the overall cumulative impact is considered as minor and not significant when management of working vessels and fishing grounds are implemented. The cumulative impact on community livelihood during construction phase and operation phase are summarised in Table 5.7. For operation phase, the impact duration is categorised as ‘Nil’ as the cumulative impact of this VEC is considered minor.

Figure 5.1: Statistical map of marine vessel density in Changhua offshore area



Source: Greater Changhua Southwest Offshore Wind Farm Project EIA Report, 2018

Table 5.7: Summary of cumulative impact on community livelihood – fisheries resources and zones

Phase of Project	Indicator of cumulative impact	Potential impact identified	Mitigation measures	Residual impact magnitude – from the Project	Residual impact magnitude – from other developments	Impact duration	Significance of cumulative impact after mitigation measures implemented
Construction	Shifts in livelihoods	Spatial conflict between fishing ground and construction area	• Limiting vessel speed nearshore • Controlling vessel movements along a predefined route are expected to minimise the impact of potential collision with fishing vessels. • The WTG site of this Project avoids the area of Exclusive Fishing Right	Minor	Minor	Short term	Not significant if management of working vessels is implemented
		Increased marine traffic		Minor	Moderate	Short term	
		Displacement of fisheries resources		Minor	Minor	Short term	
Operation	Shifts in livelihoods	Reduction of fisheries resources		Minor	Minor	Nil	Not significant

Source: Greater Changhua Southwest Offshore Wind Farm Project EIA Report, 2018; Mott MacDonald, 2024

5.4 Migratory birds (including seabirds at sea)

The key threat of the cumulative development of offshore windfarms to migratory birds and seabirds would be bird collision with WTG. Due to risk of collision with WTG and barrier effect from this Project and other windfarm developments in the area, the cumulative effects of the changes in migratory bird population are of importance for this VEC within the study area. It is noted that of the species identified in Section 4.4, the black-faced spoonbill (BFS, migratory wading birds), Saunders' gulls (migratory seabirds), Chinese Crested Tern (migratory seabirds), Oriental Stork (migratory wading birds) and Kentish Plovers (migratory wading birds) are considered within the Project's CHA as critical habitat triggering species.

From visual observation in the daytime, seabirds, which include Saunders' gulls, mostly flew close to the surface of the ocean, where the observed flight altitudes within the windfarm are all below 10m Above Sea Level (ASL)[39].

By considering the overlap of average bird flight altitude with the rotation range of wind turbine blade, flexibility of habitat use, survival rate of adult and national conservation status. Results showed that migratory waterbirds (Charadriidae and Scolopacidae) and breeding seabird (Sternidae) are considered vulnerable groups. Breeding seabird group is considered as of high vulnerability because of three Sternidae species of conservation concern (Greater Crested Tern, Bridled Tern and Roseate Tern) being recorded among Ørsted's windfarms in Changhua[40].

From radar survey for nocturnal birds, a total of 20 bird flight activities were recorded in four vertical radar surveys from No. 4, 5, 7, 8, and 23 windfarms (Figure 1.2). Based on the 20 records of flying altitude, the flight height was mainly distributed between 25-100 metres (45%), followed by 0~25 metres (30%), and between 100~300 metres (15%), with approximately 60% under 300 metres which is within the range of possible impact hazards. Only 10% is above 300 metres, which shows that the flying height of night birds is 60% with substantial potential impact risk in collision with the WTG in the range of 25m~300m.

It is recognized that migratory birds may be at risk of collision with wind turbine blades during the Project's operation phase. The collision risk model (CRM) conducted within the Project's EIA Report predicted the annual collision number to be less than 1% threshold value of population. Drawing from publicly available reports, Hailong No.3 EIA Bird Monitoring Report[41] has further conducted CRM for various bird species across potential windfarms in western Taiwan. This overarching CRM analysis encompassed a total of 1178 WTGs situated in greater Changhua seas of western Taiwan. The WTGs covered within the CRM are:

- 670 WTGs are situated within the greater Changhua outer seas, which include the Project, Greater Changhua 1, Greater Changhua 4, Hai Long No. 2 and 3, Haiding and others shown in Figure 1.2.
- 402 WTGs are situated in greater Changhua coastal seas, which include windfarm developments like Huanyang, Changfang Xidao and others.
- 106 WTGs belong to Yunlin OWF, which is the southernmost windfarm within this CIA's spatial boundary.

Results of the CRM conducted for BFS (ie as based on potential windfarms in western Taiwan) was presented in the Hailong No.3 EIA Bird Monitoring Report, and summarised in Table 5.8 below. It is noted that the collision counts presented below are the same and applicable to 6MW, 8MW or 10MW size WTGs.

[39] No. 4, 5, 7, 8, and 23 windfarms in Figure 1.2

[40] No. 4, 5, 7, 8, and 23 windfarms in Figure 1.2

[41] 海龍二號離岸風力發電計畫環境影響說明書環境影響調查報告書 (鳥類調查報告), 2020

Table 5.8: BFS collision risk modelling of western Taiwan windfarms

Windfarms	Number of WTGs	Collision count based on avoidance rate			
		95%	98%	99%	99.5%
Greater Changhua outer seas	670	2	1	0	0
Greater Changhua inner seas	402	4	2	1	0
Yunlin OWF	106	0	0	0	0

Source: Hailong No.3 EIA Bird Monitoring Report, 2020

For the Yunlin OWF, which is also the southernmost windfarm within the spatial boundary, no collisions occur at any of the avoidance rates[42]. On the northernmost end of the spatial boundary, the two operational windfarms (ie Haineng and Haiyang Zhunan) account for 69 WTGs. Haineng (Formosa 2) OWF's EIA environmental impact survey report (dated 16 May 2018) found no BFS passing through its Project area via satellite tracking between 2012 to 2015 and 2016 to 2018. Hence the collision rate was calculated to be zero (0) as well.

The various assessment (ie in particular, the cumulative impact assessed at the western Taiwan level) had indicated that the collision risk on the BFS species would not be significant and is unlikely to affect the growth trend of natural population.

CRM were also conducted for Saunders' gulls within the Project's EIA amendment report[43]. The CRM had indicated that collision risk was simulated to be less than one collision annually. The Saunders' gulls is considered to be a non-breeding seabirds that winters in Taiwan. Non-breeding seabirds' groups are considered of low vulnerability and the group's high adult survival rate implies that loss from collision could be non-significant on the breeding population. Similarly, within the same set of CRM conducted, the collision risk for Kentish Plovers was also predicted to be less than one collision annually.

In terms of broader literature review, it is noted that:

- In the United Kingdom, study on bird avoidance behaviour and collisions around offshore windfarms has been done to support consenting applications for offshore wind development (Skov *et al*. 2018). The results showed that the study empirical avoidance rates of five target seabird species were over 99%. Though the study was not conducted in Taiwan, it can be inferred that bird species do exhibit avoidance behaviour to avoid colliding with wind turbines.
- Another radar survey conducted by Denmark researcher, Horns Rev in 2003-2005 revealed similar findings on the change of flight direction to avoid collision with the WTG at Nysted windfarm, with a 99% bird avoidance rate. The distance between the turbine layouts at Nysted is less than 500m, and the row spacing of the Nysted's turbines is only 850m. While, for this Project, the spacing between wind turbines along the east-west wind direction is between 500-850m, and the spacing between wind turbines along the north-south wind direction is between 3035-4149m. The row spacing of the turbines for the Project is at least 2km. As compared to the Nysted windfarm, the Project has a larger distance between the WTGs (ie at least 500m) and row spacing (ie at least 2km). Considering that the Project has a much bigger distance/spacing between the wind turbines, the Project is likely to be able to achieve a higher bird avoidance rate.

[42] 雲林離岸風力發電廠興建計畫環境影響說明書 (定稿本), 2018

[43] 大彰化西南離岸風力發電計畫第二次環境影響差異分析報告 (定稿本), April 2022

- It should be noted that monitoring (ie during construction and operations) of offshore/sea birds will be conducted as based on the EIA requirement, This monitoring is key in providing further updated Project survey results to potentially determine if there is sufficient need (eg such as observation of BFS or Saunders's Gull) to undertake an updated CRM run.
- An interval of 500m should be kept between turbines. The space between turbines should be reserved to a sufficient degree to allow birds to fly through. The Project in actual follow above rule to set up the layout. However, it should be noted that the distances proposed by EPA have not been promulgated to date. For the nine offshore windfarm developments in Changhua (Figure 5.2), a distance of 2km between WTG arrays will be retained by the offshore windfarm developers to minimise the risk of migratory bird collisions with WTGs.

Based on the Project's EIA, Changhua's offshore wind developers[44] will jointly set up a bird monitoring system in each windfarm to observe bird activity, including thermal imaging, sonic microphones, and high-performance radars. Changhua's offshore wind developers[45] will also share the monitoring results with each other, to analyse the bird activities in different directions[46].

As per the discussions above, the overall cumulative impact to this VEC, including on the critical habitat trigger species (ie BFS and Saunders's gulls), during operation phase is considered as not significant.

The cumulative impact on migratory birds during construction phase and operation phase are summarized in Table 5.9.

[44] #1, #4, #5, #6, #7, #8, #9, #10, #11, #12, #14, #15, #16, #17, #18, #21, #22 and #23 in Figure 1.2

[45] #1, #4, #5, #6, #7, #8, #9, #10, #11, #12, #14, #15, #16, #17, #18, #21, #22 and #23 in Figure 1.2

[46] Hai Long No.3 Environmental Impact Comparative Analysis Report, 2021

Figure 5.2: Bird flying corridor setup at Changhua offshore area

Source: Hailong No.3 Environmental Impact Comparative Analysis Report, 2021

Note: Yellow and orange paths are the bird flying corridors.

Table 5.9: Summary of cumulative impact on migratory birds (including seabirds at sea)

Phase of Project	Indicator of cumulative impact	Potential impact identified	Mitigation measures	Residual impact magnitude –from the Project	Residual impact magnitude – from other developments	Impact duration	Significance of cumulative impact after mitigation measures implemented
Operation Phase	Change in population	Collision with wind turbine blades and barrier effect	• For this Project, the spacing between wind turbines along the east-west wind direction is between 519~704m, and the spacing between wind turbines along the north-south wind direction is between 3719~4182m • As proposed by the EPA (ie have not been promulgated), the distance between wind turbines in Taiwan that it is to be greater than 700m, and the distance between blades of adjacent turbines are to be greater than 400m.	Minor	Minor	Long term	Not significant

Source: Greater Changhua Southwest Offshore Wind Farm Project EIA Report, 2018; Mott MacDonald, 2024

6 Step 6: Management strategies

This section presents the management strategies designed to address the Project's incremental contribution to cumulative impacts on the selected assessed VECs (Step 6). For each selected VEC, an appropriate management action was identified following the mitigation hierarchy concept – avoid, minimise and compensate. Effective indicators and threshold triggers are also proposed. The set of strategies are based on the Project's level of impact on a referred VEC and the overall cumulative impact to the VEC. Required measures and tangible and reasonable best efforts to mitigate impacts were also taken into consideration.

In order to identify adequate strategies, plans and procedures to manage the Project's contribution to cumulative impacts, the mitigation and monitoring plan identified in the EIA, EIS and Coastal Management reports were reviewed.

6.1 Marine habitat

For the Taiwanese Humpback Dolphin MWH, alignments of submarine cables of various windfarm developments are designed to array within the Changhua Northern Common Corridor and take the shortest feasible route to the cable landing point to minimise extent of impact associated with construction works on fragmentating the Taiwanese Humpback Dolphin MWH. Sequential laying of submarine cables will be conducted in sections to avoid blocking the passage of dolphins between north and south of the Taiwanese Humpback Dolphin MWH. A Project Health Safety and Environmental Plan has been formulated to provide pertinent information regarding the construction of the Project offshore windfarm and surrounding area to the Project's contractors. According to the Project's EIA, the following management actions specify the mitigation measures to be implemented for cumulative impact on the Taiwanese Humpback Dolphin MWH throughout construction phase:

- Vessels within 1,500m radius of the Taiwanese Humpback Dolphin MWH and its borders, are to maintain a speed of 6 knots or lower;
- Construction vessels are to avoid travelling across areas known with high density of dolphin activities during peak season and other sensitive areas;
- Navigation route of vessels will be designed to avoid sensitive areas.

Furthermore, although the Project's EIA does not define specific sailing routes, but each vessel is expected to formulate its own sailing plan or navigational safety plan to avoid nearby fishing vessels and ensure safety of ships when entering and leaving the construction port. With reduced traffic collisions or safety issues also means reduced disturbance to the marine habitat and waters.

Protected Reef Areas, Artificial Reef Areas and Fisheries Resources Conservation Areas have been avoided during the design of windfarm sites and alignments of submarine transmission cables. Nevertheless, as a precautionary strategy, developer will notify and seek advice from responsible administrative authorities to minimise any potential impact if the Project footprint overlaps any of these sensitive areas. Furthermore, protective seabed work stones will be put in place to protect wind turbine foundations, and this will serve as artificial reefs and providing marine habitat.

As per the EIA 2nd amendment report, the Project will apply an ROV during the foundation installation. One turbine in each row (east-west direction) will be selected to assess seabed disturbance and impact to water quality in the surrounding marine area.

6.2 Marine flora and fauna

It should also be noted that the construction of Phase 2b and Greater Changhua 4 is overseen by the same construction management team. It is also understood that the construction of both developments will be coordinated and delivered as a 'single development'. It is expected that there is only one construction vessel fleet to be working across both developments. Hence, the occurrence of concurrent offshore foundation work by these two developments are not expected.

The Project will participate coordination platform by the management level of nearby windfarm projects (ie consisting of nine (9) projects[47]). The platform will facilitate better communication on implementing relevant measures and sharing resources.

Nevertheless, the concerned marine fauna species, constituted in this VEC, have wide range of use and movement in the Taiwan strait. To minimise cumulative impact of collision risk between working vessels and marine fauna (discussed in section 5.2.1), the Project is recommended to request each vessel to formulate their own sailing plan or navigational safety plan. The plans should cover avoidance of vessel collisions, port entry and exit safety, and reference or align to the vessel navigation-related mitigation measures for the Taiwanese Humpback Dolphin MWH as discussed in Section 6.1.

Table 6.1: Mitigation and monitoring for marine fauna to be implemented at project level

Phase	Mitigation measure / monitoring at project level
Pre-construction	Conduct underwater acoustic survey at two stations located at the boundary of windfarm site for one whole month (consecutive 30 days) during each of the four seasons of a year to fully grasp the long-term underwater noise (including cetacean acoustics)
	Review the pre-construction monitoring results for any unpredicted findings or differences with the findings of the EIA stage, and review the adequacy of management actions for minimising negative impact on this VEC.
	An interval of 500m to be kept between turbines to allow for sufficient space for birds to fly through
	Adopt jacket type foundation for WTGs which generates low-noise level during pile driving, as far as practicable
	The submarine cable route from WTG to landfall shall take the shortest distance feasible.
	The submarine cable will be buried 1 to 2m (2m within the nearshore area) to reduce electromagnetic field (EMF) effects.
Construction	Conduct cetacean monitoring 20 times per year
	Offshore foundation installation of WTG foundation: ● Remind workers not to use any Acoustic Deterrent Device or other sound-emitting device at any time ● Adopt the best applicable underwater noise reduction method, such as bubble curtains or balloon curtain ● Set up four underwater acoustic monitoring stations that are evenly distributed at 750 m from each installation location. Sound exposure level should not exceed 160 dB as monitored by the four underwater acoustic monitoring stations. ● Deploy at least three qualified TCOs on construction vessel to watch the warning zone (750 m from installation location) and monitoring zone (1500 m from installation location). TCO will inform installation workers if marine mammal is observed or detected within the warning zone, and the installation workers should suspend installation under safe condition until marine mammal has left and not been observed/detected within the warning zone for 30 minutes. For any marine mammal entering the monitoring zone, TCO will watch its movement to confirm if it approaches the warning zone.

[47] The offshore windfarm projects Greater Changhua 2b, 4, Hai Long 02, 03 and Hai Ding 01, 02 and 03.

Phase	Mitigation measure / monitoring at project level
	● Offshore construction activities will be coordinated between the windfarms of the Project Company to mitigate cumulative impacts of underwater noise from pile driving. Installation activities are to be coordinated to ensure installation activity of only one WTG at a time.
	Vessel speed and navigation: ● Vessels within 1,500m radius of the Taiwanese Humpback Dolphin Major Wildlife Habitat (MWH) and its borders, are to maintain a speed of 6 knots or lower. ● Construction vessels are to avoid entering the hot spots during the dolphin's peak activity periods as far as practicable. ● Navigation route of vessels will be designed to avoid sensitive areas. ● Construction vessels will be sourced and based from the nearest port and to minimise transit routes
	Construction vessels are to avoid entering areas known to have high density of dolphin activities.
	Construction of the submarine cable will be conducted in sections. Each section will be reinstated following completion of cable installation. This will be completed before commencing on the construction activities of the next section.
	Conduct intertidal ecological survey at 50m range from both sides of the submarine cable landing point, at a frequency of once per season
Operation	Continuous cetacean acoustic monitoring and dolphin monitoring programme to continue monitoring the effect of operation to cetacean, with the frequency of 20 times per year
	Warning lights are to be installed on the blades of the WTG, in accordance with the Aviation obstacle sign and obstacle light setting standard (航空障礙物標誌與障礙燈設置標準) to reduce the likelihood of bird collision at night. Its implementing methods should follow horizontal direction intervals not exceeding 900m and be implemented on the corners or most outer row.

Note: Procedures for the suspension of monitoring works are to comply with Clause 37 of Enforcement Regulations for Environmental assessment.

6.3 Community livelihood: fisheries resources and zones

The marine navigation route management plan recommended in Section 6.1 should also consider fishing boats and adopt similar measures in particular for mitigating cumulative impact on areas known with high density of fisheries activities. Speed limit and setting of predefined marine navigation routes for construction vessels mentioned in Section 6.1 would also serve as measures for minimising risk of collision with fishing boats and impact on shifts in fisheries livelihoods. Navigation channels were segregated for fishing boats, construction vessels and other ships to facilitate the development of OWF[48]. Nevertheless, it is recommended that relevant developers of adjacent windfarm developments and coastal developments that would affect the same fishing ground in Changhua County could coordinate/liaise with the Fishermen's Association on the management actions (designed at project level and summarised in Table 6.2) to achieve effective mitigation of cumulative impact on fisheries livelihoods over the construction phase of windfarm developments.

Table 6.2: Mitigation and monitoring for fisheries to be implemented at project level

Phase	Mitigation measure / monitoring at project level
Construction	● From fisheries resources (number of fishing boats, fisheries type, species, catch, etc.) published by the Fisheries Agency, identify reference species for monitoring to compare the impact before and after operation. ● Point count survey of plankton, fish fry, fish egg and benthos as well as line survey of fish species and abundance once every season ● Observation by underwater photography at two WTG foundations for the colonization effect of fish ● Adopt the best applicable underwater noise reduction method

[48] 離岸風電推動現況與展望, presentation by Ministry of Economic Affairs for Executive Yuan meeting: https://www.ey.gov.tw/File/11A5C30CA17A5735?A=C (Accessed: 14 April 2020)

Phase	Mitigation measure / monitoring at project level
	● Communicate with Changhua District fishermen's association to get mutual agreement on compensation as listed under the Fishery Compensation Benchmark for Offshore Wind Power (離岸式風力發電廠漁業補償基準)[49]
	● A navigation safety plan will be formulated.
Operation	● Point count survey of plankton, fish fry, fish egg and benthos as well as line survey of fish species and abundance once every season
	● Observation by underwater photography at two WTG foundations for the colonization effect of fish
	● Annual analysis of the Taiwan Fisheries Yearbook from Fisheries Agency to organise related fishery livelihood and economics information (fishery environment, fishery facilities, number of fisher folk, amount of catch)
	● Design and implement a program to ensure continuous stakeholder engagement

Note: Procedures for the suspension of monitoring works are to comply with Clause 37 of Enforcement Regulations for Environmental assessment.

6.4 Migratory birds (including seabirds at sea)

To minimise the significance of negative impact on migration birds due to risk of collision with WTGs, the Project has made adjustments to the WTG placements, creating bird flight corridors to favour avoidance behaviour of birds (see Section 5.3). The Project's EIA also notes that Hai Long windfarms and Formosa 3 windfarms will also adopt this measure, while Hai Ding has also adjusted their designs to leave a 2km bird corridor between its projects and the Project. Other management actions designed for implementation are consolidated in Table 6.3. The Project also has a biodiversity action plan (BAP) in place which outlines action plans to ensure conservation and enhancement of biodiversity, in particular for critical habitat species identified within the CHA. Refer to the Project's BAP for the specific actions in place.

Similar to the recommendation mentioned in Section 6.3, as the migratory waterbirds and breeding seabirds have a broad range in the Taiwan Strait, this Project will participate coordination platform by the management level of nearby windfarm projects (ie consisting of nine (9) projects[50]). The platform will facilitate better communication on implementing relevant measures and sharing resources. This Project will, as prescribed by the EIA commitments, execute an environment monitoring plan, whereby general project information will be shared to the general public through quarterly reports.

Table 6.3: Mitigation and monitoring for migratory birds (including seabirds at sea) to be implemented at project level

Phase	Mitigation measure / monitoring at project level
Pre-construction surveys	Conduct direct observation at vessel transect survey and radar survey for seabirds for two years before commencement of marine works
	Conduct satellite tracking of shorebirds for once in each season before commencement of marine works
Construction	Avoid construction work on intertidal habitat during the bird migration period (November to March)
	Follow the design of WTG placement allowing bird flight corridors between WTGs and each windfarm site to minimise bird collision with windfarms
Operation	Measures for Seabirds ● The project shall follow Article 17 of the Aviation obstacle sign and obstacle light setting standard, the electric generator structure should use Type A obstructing light. Its implementing method should follow horizontal direction intervals not exceeding 900m and be implemented on

[49] Fishery Compensation Benchmark for Offshore Wind Power (離岸式風力發電廠漁業補償基準): https://www.fa.gov.tw/cht/LawsRuleFisheries/content.aspx?id=540&chk=5207eda4-0453-4482-a789-08406f114339&param (Accessed: 7 February 2020)

[50] The offshore windfarm projects Greater Changhua 2b, 4, Hai Long 02, 03 and Hai Ding 01, 02 and 03.

Phase	Mitigation measure / monitoring at project level
	the corners or most outer row. Hence the number of warning lights installed on the turbines will be based on the windfarm layout configuration. ● At time of environment monitoring, if large flocks of protected species or large-sized birds are passing through windfarm, the operator shall be committed to conduct a feasible speed reduction mechanism (風機降轉機制). ● Maintain the distance of at least 500 m separation between each WTG ● Maintain the north-south and east-west flight corridor with at least 2 km between each of the windfarm sites ● Maintain at least 8 km distance from the coastline for the north-south flight corridor
	Bird monitoring programme ● Surveillance devices (ie thermal imaging, acoustic microphone, radar) on turbines shall be installed within the windfarm to allow continuous monitoring of bird activities. ● Supplemental and seasonal birds/ ecological surveys should be undertaken around the WTGs during the operation period. ● Adaptive measures including seeking feasible mitigation measures in the future should be considered.

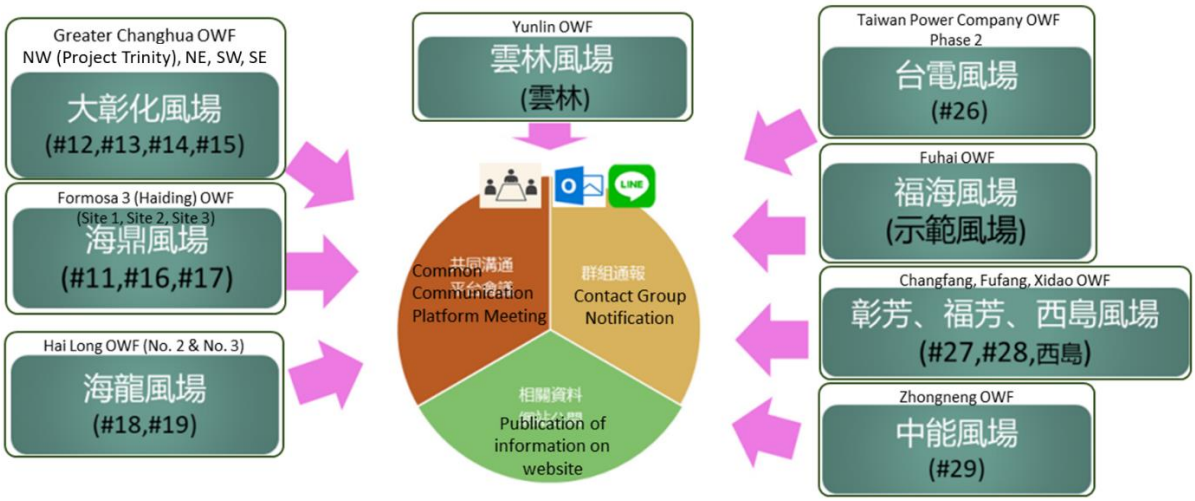
Note: Procedures for the suspension of monitoring works are to comply with Clause 37 of Enforcement Regulations for Environmental assessment.

6.5 Collaboration with adjacent developments

Besides the mitigation and monitoring plan identified in the EIA reports, it is important for the Project and adjacent windfarm developments to coordinate their management plans and share information with each other for a more robust and comprehensive management of the identified impacts. The environmental management plans should ideally be standardised, and monitoring programmes should be integrated between the WTG developments in the area. This would allow for a wide-reaching dataset, providing the developers an opportunity to identify additional mitigation measures. Proposed actions, including sharing of information with other windfarm developers in the area and potential offsets and additional conservation actions with various stakeholders, will be developed and implemented as part of the BAP.

The Project and the adjacent 14 windfarm developments in Changhua and Yunlin have initially suggested common communication platform to conduct regular meetings for discussion and coordination on matters regarding migratory birds and ecology, and suggested setup of contact groups for facilitating mutual notification (refer to the EIS Report). The communication platform suggested is indicated in Figure 6.1 below.

Figure 6.1: Suggested communication platform amongst Changhua and Yunlin windfarm developments



Source: Environmental Impact Investigation Report of Offshore Wind Power Project in Yunlin and Changhua (Third revision) (Unitech, 2020), 2020

7 Glossary

Acronym	Definition
AoI	Area of influence
ASL	Above Sea Level
BAP	Biodiversity action plan
BOE	Bureau of Energy
CBD	Convention on Biological Diversity
CFA	Changhua Fisheries Association
CHA	Critical habitat assessment
CIA	Cumulative Impact Assessment
CRM	Collision risk model
DAI	Direct area of influence
E&S	Environmental and social
EA	Energy Administration
EAAA	Ecologically appropriate areas of analysis
EBL	Electricity business license
EFR	Exclusive Fishing Rights
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EMF	Electromagnetic field
EP	Equator Principles
EPA	Environmental Protection Administration
FCA	Fishery compensation agreement
FGD	Focus group discussions
FSIA	Focused Social Impact Assessment
GIIP	Good International Industry Practice
GN	Guidance Note
HRIA	Human rights impact assessment
HVAC	High voltage alternating current
IBA	Important Bird Area
IBAT	Integrated Biodiversity Assessment Tool
IFC	International Finance Corporation
IUCN	International Union for Conservation of Nature
KIIs	Key informant interviews
LNG	Liquefied natural gas
LRP	Livelihood Restoration Programme
MoEA	Ministry of Economic Affair
MW	Megawatt
MWH	Major Wildlife Habitat
NDC	National Development Council
O&M	Operation and maintenance
OnSS	Onshore substations
OSS	Offshore substation

Acronym	Definition
OWF	Offshore windfarm
PS	Performance Standard
SEP	Stakeholder Engagement Plan
SIA	Social impact assessment
TCO	Taiwan Cetacean Observers
TPC	Taiwan Power Company
TWD	New Taiwan Dollar
VECs	Valued environmental and social components

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