

Comments from District Planning Officer/Sai Kung & Islands, Planning Department

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Please note our comments below on the captioned application for supporting the application and clarification purpose.

1. Please provide a brief review on the existing ecological conditions at the proposed installation locations and advise your consideration to identify the proposed locations from ecological aspect. Please also advise the mitigation measures to minimise or avoid any impact of the proposed installations to the surrounding ecological environment.

Several site inspections of the two specific installation footprints indicates that both locations have a coastal profile with mixed rocky and sandy shores open to the ocean and prone to accumulate a large amount of litter and debris as shown in the figures below. In particular:

- *Tai O Old Pier:* The proposed spot is a secluded coastal shore. Due to tidal patterns and seasonal wave action, this shoreline naturally acts as an accumulation point for dynamic marine refuse and driftwood. The installation will completely bypass the vegetated zone; no clearance, trimming, or disturbance of the existing canopy, branches, or root systems will take place.

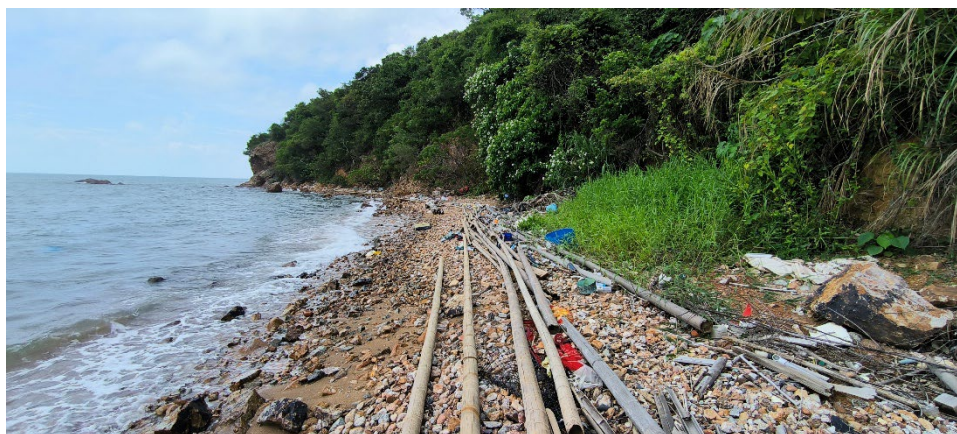




Figure 1 May 22, 2026





Figure 2 June 23, 2026

- *Tai O Wastewater Treatment Works:* The location is situated on the natural rocky coastline just beyond the facility boundary. Similar to the pier site, this rugged terrain naturally catches floating marine debris brought in by high tides.



Consideration for Site Identification (From Ecological Aspect):

The selection of these two specific locations was primarily driven by two

practical and operational necessities:

1. **Direct Marine Line-of-Sight:** The monitoring equipment requires an unobstructed, direct line-of-sight to the open sea to function and collect valid ocean data to provide useful information for flood monitoring.
2. **Remoteness and Minimal Public Disturbance:** These specific spots are physically isolated and difficult to access, meaning they experience virtually no public or tourist foot traffic. This minimizes the risk of vandalism or accidental disturbance to the equipment.

Proposed Mitigation Measures: To ensure the installations remain completely benign to the surrounding environment, the following measures will be adopted:

1. **Visual Integration:** The lightweight base blocks and equipment housings will be finished in non-reflective, nature-toned colours (such as dark grey or earth brown) to blend seamlessly with the natural rocks, rubble, and coastal backdrop.
2. **Protection of Vegetation:** No vegetation, roots, or canopy will be cleared, cut, or damaged. Buffer distances from mature coastal plants will be maintained during the installation.
3. **Efficient Installation & Minimal Duration:** All components are modular and prefabricated off-site. The on-site assembly is exceptionally efficient and is expected to be completed within a couple of working days per site. This drastically compresses the deployment window, rendering any temporary disturbance negligible.
4. **No Heavy Machinery:** All components are lightweight and will be hand-carried to the sites. Minimal hand-made excavation is planned and no heavy vehicles or machinery will be used, preventing habitat disruption.
5. **Site Housekeeping:** During the installation phase, the team will ensure the immediate working footprint is kept tidy. Any pre-existing marine litter within the immediate surroundings will also be cleared and disposed responsibly alongside any site waste. All disposals will be conducted in strict accordance with local regulations and statutory requirements.
6. **The Commitment:** The Department of Civil and Environmental Engineering of the Hong Kong Polytechnic University pledges to organize and execute

periodic beach clean-up initiatives at both proposed sites (Tai O Wastewater Treatment Station and Tai O Pier Station) throughout the operational lifespan of the project.

2. Please advise the technical justification for the number of 14 antennas to be installed at each site, say, the reasons behind for requiring exactly 14 antennas at each site. Please also specify the monitoring coverage (in area) of all the antennas and explain how the 28 antennas installation could facilitate the necessary coverage for the research.

The allocation of 14 antennas per operational site is dictated by the proprietary hardware architecture, signal processing requirements, and spatial resolution constraints of the dual-frequency WERA system. The system operates via a continuous-wave directional regime where transmission and reception functionalities are physically segregated into distinct antenna arrays:

- Broadband Receive (Rx) Antenna Array (12 Antennas): To dynamically mitigate electromagnetic radio-frequency interference (RFI) and adapt to fluctuating sea states, the system uses an asynchronous dual-frequency time-sharing operation. To execute the necessary digital beamforming and spatial processing under dual-frequency constraints, the architecture requires a linear array composed of a minimum of 12 broadband active receiver antennas. The physical spacing between these 12 units is mathematically optimized based on the shorter wavelength of the higher frequency band to maintain a pristine directional beam pattern and prevent grating lobes.

$$d \approx \frac{\lambda_{min}}{2} \approx \frac{c}{2 \cdot f_{max}} \approx \frac{3 \times 10^8 \text{ m/s}}{2 \cdot 30.0 \times 10^6 \text{ Hz}} \approx 5.0 \text{ meters}$$

- Transmit (Tx) Antenna Array (2 Antennas): Radio wave transmission is handled independently by a 2-pole directional transmit array consisting of exactly 2 antennas. This standalone configuration ensures the required high antenna efficiency, optimal forward radiation pattern, and appropriate physical isolation from the adjacent 12-antenna receiving array.

Consequently, the integration of 12 receiver antennas and 2 transmitter antennas establish a baseline of 14 antennas per site, which represents the minimum configuration required to ensure technical viability, azimuthal accuracy, and

dual-frequency operational compliance.

The deployment of a dual-station network comprising 28 antennas in total (two interconnected sites utilizing 14 antennas each) is a fundamental prerequisite to achieving the research objectives and fulfilling the empirical demands of the oceanographic survey:

- **Spatial Monitoring Coverage (Single Array):** A single 12-antenna receive array yields an effective angular field of view of 120 degrees (60° clockwise and 60° counterclockwise relative to the array's boresight perpendicular, see Figure 1). Within this sector, a single radar station can exclusively measure the *radial* component of the sea surface current (i.e., velocity vector components moving directly toward or away from the station).

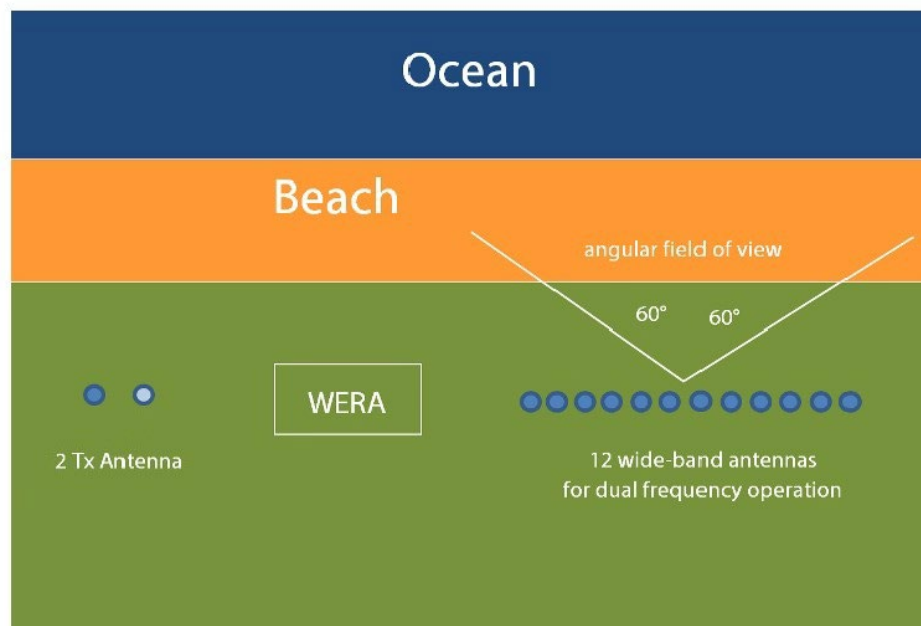


Figure 3 Scheme of antennas configuration

A single vector component is mathematically insufficient to determine true hydrodynamic movement. To derive two-dimensional sea surface current vectors (providing both absolute velocity and actual geographic direction), it is mandatory to cross-examine and synthesize radial data from two geographically distinct vantage points looking at the same body of water (see Figure 2).

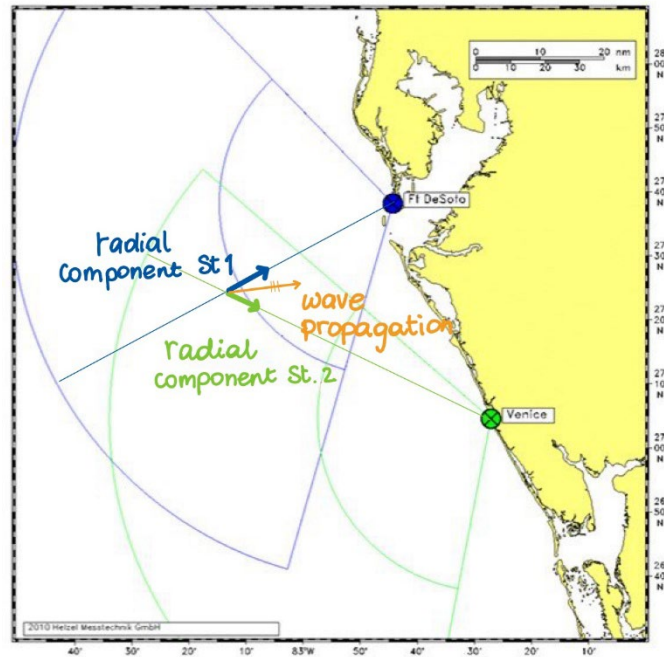


Figure 4 Example of coupled stations in USA (currently working stations)

The 28-antenna infrastructure creates an overlapping observing area. The synchronized data stream from both 14-antenna sites is processed through a centralized server to deliver high-resolution, artifact-eliminated, real-time spatial maps of ocean currents and wave heights, updated at 15-to-30-minute intervals. Furthermore, this specific 28-antenna deployment provides the dense spatial-temporal resolution required to feed empirical hydrodynamic models, thereby directly empowering the study's environmental risk assessment, drift prediction, and hazard mitigation capabilities

3. Please supplement with rendering(s) or picture(s) showing (1) the appearance of an antenna; and (2) the photomontage of the installation at the two locations for a better understanding of their scale.

Appearance of an array antenna in several worldwide installations are shown in the following figures, demonstrating the low landscape impact.



Figure 5 Antenna Array integrated along a boardwalk in Georgia, USA



Figure 6 Antenna Array surrounded by nature in Capo Granitola, Sicily, Italy



Figure 7 Antenna Array along a public beach in Liverpool Bay, UK



Figure 8 Antenna Array along a public beach in South Florida, USA

Photomontage of the installation at the two locations: Because the 12 receiving antennas are spaced 5.0 meters apart along a linear alignment, they do not form a solid visual barrier. Instead, they present as highly spaced, ultra-thin vertical rods (only 3 cm thick) that do not obstruct panoramic coastal views.

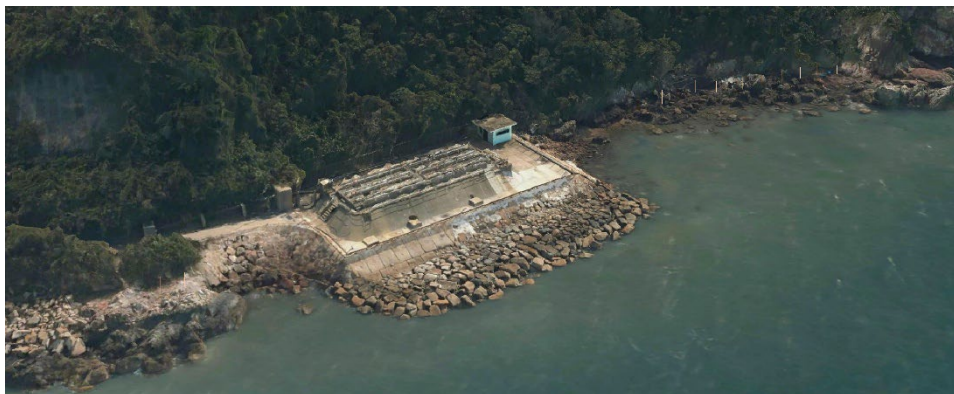




Figure 9 Rendering showing the antennas on Tai O Wastewater Treatment



Figure 10 Rendering showing the antennas on Tai O Pier

1. Verification of Temporary, Low-Impact Engineering

This rendering visually confirms that the physical components of the array meet the strictest non-permanent criteria:

Zero Ground Excavation: The temporary concrete footings, shown adapted to the micro-topography of the rocks, represent the total physical footprint. No permanent concrete pouring, trenching, or cutting of the soil is required.

Aesthetic Material Integration: The use of natural wooden support poles has been prioritized to ensure the structure visually recedes into the rocky and wooded backdrop. This creates a far lower visual contrast than utility poles or standard metal masts.

2. Contextualizing Long-Range Visibility (Visual Disappearance)

Coastal Segment: The proposed station is located on a section of rugged, rocky coast that is not easily accessible by public. There is no easy land-based public access, and

it is not a destination for local recreational users.

Invisible at Service Distance: A slender 3 cm diameter antenna is physically smaller than the angular resolution threshold of the human eye at standard "long-range" viewing distances. From the Tai O public ferry or any main tourist footpath, the entire installation will be completely imperceptible, blending seamlessly into the texture of the rocks and trees.

3. Visual Impact Relativity: Project Benefits vs. Environmental issue

Finally, when assessing the temporary visual presence of this non-profit scientific equipment, we must consider relativity and net benefit:

Minimal Intrusion Compared to Environmental Issue: The annual typhoons cause significant environmental disruption to this specific segment of the coast, and the village and the villagers behind it, resulting in large accumulations of marine refuse (visible in Figures attached to this document). In contrast, this proposed installation consists of 14 thin vertical rods, whose temporary visual impact is small compared to the chaotic impact of natural weather events.

Scientific Life-Saving Benefit: This temporary installation (28 antennas total across 2 sites) directly powers the first real-time oceanographic warning network for Tai O. The data it provides feeds directly into models for flood prediction and marine environmental hazard mitigation. We submit that the minimal temporary visual impact of these scientific instruments is heavily outweighed by the life-saving and environmental resilience benefits they directly provide to the local Tai O community.

4. Please provide justifications to illustrate that the proposed installation is able to be temporary in nature. If the installation is to remain in place for more than 3 years, please clarify whether the applicant will apply for planning permission from the Town Planning Board again as appropriate.

The proposed oceanographic monitoring installation has been specifically designed from the ground up to be entirely temporary, modular, and fully reversible. It requires no heavy civil engineering works, permanent structures, or invasive construction. The temporary nature is guaranteed by the following

technical specifications:

- **Off-Site Prefabrication & Gravity-Based Anchoring:** The concrete footings are precast off-site. They are placed directly on top of the existing natural rocky surface. To ensure structural stability against wave action, only a layer of non-invasive levelling mortar is applied to the rock contact point. No excavation, drilling, or deep foundation pouring into the natural soil/bedrock will take place.
- **Surface-Laid Reversible Cabling:** All connection cables are laid directly on the ground surface, protected by thin conduits, and secured using simple, non-invasive mortar on rocks or removable U-shaped anchors in the soil. No underground trenching or permanent cable ducting is required besides the small excavation in Tai O wastewater under the paved slab.
- **Rapid and Complete Decommissioning:** Because the entire system consists of modular, dry-assembled components (wooden poles, stainless steel supports, and precast bases), the entire installation at both sites can be completely dismantled, loaded, and cleared from the site within short time.
- **Full Site Restoration:** Upon decommissioning, all components will be removed, leaving no permanent footprint or ecological scar. The shoreline will be restored entirely to its original state.

2. Clarification on Operational Lifespan and Future Planning Applications

As a scientific research and environmental safety project, the value of the collected oceanographic data (such as wave modelling and tidal monitoring for local safety) naturally increases with the continuity and length of the observation period. However, the applicant fully acknowledges and respects the statutory planning controls under the Town Planning Ordinance:

- **Commitment to Compliance:** The initial planning permission is sought for a temporary period of 3 years.
- **Procedure for Extension:** If the benefit generated by the radar network in terms of improving the coastal resilience for the local community is considered valuable, the applicant formally commits to submitting a new section 16 planning application (or a renewal/extension of temporary permission) to the Town Planning Board well in advance of the expiry date, in full compliance with prevailing guidelines. The expectation of the applicant is to produce a net

improvement to the safety of Hong Kong and to the Tai O community in particular.