T-VER Component Project Activities Design Document

VARUNA (THAILAND) COMPANY LIMITED

myclimate (Switzerland)

Programme of Activities Details	
Title of PoA	Alternate Wetting and Drying (AWD) in Thailand
Project participant	myclimate (Switzerland)
Co-project participant	Varuna (Thailand) Company Limited Wave BCG Company Limited
Project type	☐ Renewable energy of fossil fuel replacement ☐ Improvement of the efficiency of electricity and heat generation ☐ Use of public transportation system ☐ Use of electric vehicle ☐ Improvement of the efficiency of engine ☐ Improvement of the efficiency of energy consumption in building and factory and in household ☐ Use of natural refrigerant ☐ Use of clinker substitute ☐ Solid waste management ☐ Domestic wastewater management ☐ Methane recovery and utilization ☐ Industrial wastewater management ☑ Reduction, absorption and removal of greenhouse gases from the forestry and agriculture sectors ☐ Capture, storage, and/or utilization of greenhouse gas ☐ Other ....
Programme of Activities	Water management in rice fields by alternating drying and irrigation to reduce methane emissions while maintaining rice yields comparable to traditional cultivation methods.
Crediting Period of PoA	☑ 5 years <15/06/2026 - 14/06/2031>
T-VER Methodology	T-VER-P-METH-13-08
	Enhanced Good Practices in Paddy Rice Field
	1
T-VER Tools ***(if any)***	-

T-VER Component Project Activity (CPA) Detail	
CPA No.	CPA 1
Title of CPA	Alternate Wetting and Drying (AWD) in Thailand (Bang Nam Priao District, Chachoengsao Province)
Project participant	myclimate (Switzerland)
Co-project participant	Varuna (Thailand) Company Limited Wave BCG Company Limited
Project owner	Farmer
Project location	Bang Nam Priao District, Chachoengsao Province
Coordinates of project location	13.919299, 100.999809 (UTM 47P 716075.14E 1539708.58N)
Project activity	Alternate Wetting and Drying (AWD) rice cultivation, which involves improving water management in paddy fields in Bang Nam Priao District, Chachoengsao Province.
Project investment cost	N/A
Estimated Greenhouse Gas Emission Reductions/Removals	231 tCO_2eq/y
Crediting period of CPA	☑ 5 years (15/06/2026 - 14/06/2031) ☐ 15 years ☐ others .... years

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Part 1: Component Project Activity Information

1.1 Project Information

1.1.1 Objectives of the project activities

This project promotes the adoption of Alternate Wetting and Drying (AWD) rice cultivation across irrigated areas in Bang Nam Priao District, Chachoengsao Province, as a replacement for traditional continuously flooded practices. The AWD technique involves allowing paddy fields to dry periodically before re-flooding, thereby reducing anaerobic conditions responsible for methane generation. This approach results in substantial greenhouse gas (GHG) emission reductions, improved water-use efficiency, and lower pumping costs, while maintaining rice yield performance.

CPA 1 engages a group of exemplary rice farmers in Bang Nam Priao District, Chachoengsao Province, who exhibit strong environmental awareness and responsibility. These farmers have expressed interest in adopting AWD rice cultivation with the intention of serving as role models and local leaders in advancing knowledge on GHG reduction within their communities. The subproject also aims to improve community well-being by generating additional income through carbon credit sales for participating farmers. Furthermore, the participants will contribute to disseminating water management technologies and low-carbon rice cultivation practices that are tailored to the water conditions and agricultural context of the project area.

1.1.2 Description of the organization’s activities related to the project

Varuna is responsible for supporting and implementing key activities under the Alternate Wetting and Drying (AWD) project to ensure compliance with the T-VER methodology and to promote sustainable rice cultivation practices for this CPA. Core responsibilities include coordinating with local agricultural agencies and farmer groups, conducting field assessments to evaluate baseline water management conditions, and providing technical guidance on transitioning from Continuous Flooding (CF) to the AWD technique. The company also oversees capacity-building activities, including training sessions for farmers on AWD principles, water-level monitoring, and the use of field measurement tools.

1.1.3 Operation prior to the implementation of the T-VER project.

Bang Nam Priao District, Chachoengsao Province, is characterized by low-lying floodplains with minimal elevation above sea level. The area contains numerous rivers and canals, making it highly suitable for rice cultivation, particularly in terms of water management. Several subdistricts possess strong agricultural potential and accommodate large farming communities. However, certain areas require careful consideration due to risks of flooding or waterlogging, as well as soil and water conditions that may exhibit acidity in specific zones.

The district hosts several large-scale rice farming groups and clusters, including the Don Ko Ka Large Plot comprising 193 farmers with a total cultivated area of 4,861 rai; the Sala Daeng 1 Large Plot consisting of 33 farmers over 911 rai; and the Pho Rong Akat Large Plot with 66 farmers managing 1,403 rai. These groups reflect the strength and organization of the local agricultural networks. (Bang Nam Priao District Agricultural Office)

Rice cultivation in Bang Nam Priao follows two main seasons. The wet season (main crop) typically begins with planting from May to July, followed by harvesting from September to November, relying primarily on rainfall and aligning well with the district's lowland characteristics. The dry-season crop starts from November to February, with harvesting occurring between February and May. This cycle utilizes water from irrigation systems and the extensive canal network, enabling farmers in Bang Nam Priao to cultivate more than one crop per year.

Prior to the implementation of the T-VER project, the project developers conducted surveys and interviews with local farmers regarding their water management practices. Most farmers reported maintaining continuous flooding throughout the growing season and draining water 1–2 weeks before harvesting, following traditional rice cultivation methods. To align with T-VER standards, the project proposes shifting water management practices from Continuous

Flooding (CF) to Alternate Wetting and Drying (AWD). This technique helps reduce methane emissions and is well-suited to Bang Nam Priao, where irrigation infrastructure supports systematic water control, making the adoption of AWD feasible and effective for local rice fields.

1.1.4 Greenhouse gas reduction activities, sources and quantities of raw materials, and number of the operation days of the project.

Project Activities on reducing, absorbing, and sequestering greenhouse gas (GHG) emissions in rice cultivation areas of participating farmers in Bang Nam Priao District, Chachoengsao Province. Two farmers participated in the project, covering a total area of approximately 98 rai, as documented in land title records (details in Appendix 2). The project emphasizes reducing GHG emissions through good agricultural practices, particularly water management in rice fields, by applying the Alternate Wetting and Drying (AWD) technique to minimize methane (CH_4) emissions in irrigated areas.

The project developer organized a training session on AWD rice cultivation and collected farmers' feedback on February 26, 2025, at the Agricultural Product Efficiency Learning Center (APELC), Village No. 4, Don Ko Ka Subdistrict, Bang Nam Priao District, Chachoengsao Province.

For project monitoring and reporting, participating farmers record information and take photographs of water-level measurement tubes in the fields using the Smart Watcher mobile system according to the prescribed schedule.

Project Activity Procedures:

1) Application Process for Participation in the AWD Project

<u>Step 1: Awareness and Application for Participation</u>

Farmers are informed about the project through public relations activities and briefing sessions. They then voluntarily express their interest in participating and submit basic information along with land tenure documents for preliminary eligibility consideration.

Step 2: Selection and Registration of Rice Plots

The project developer verifies the qualifications of farmers and their cultivation areas by assessing their suitability in accordance with the criteria set by the Thailand Greenhouse Gas Management Organization (Public Organization) and the T-VER-P-METH-13-08 methodology. Once approved, the farmers and their rice plots are officially registered in the project system.

Step 3: Application Registration and Preparation

Farmers attend training sessions on the use of the application and the implementation of Alternate Wetting and Drying (AWD) practices. They then register and use the Smart Watcher application in conjunction with the system of Varuna (Thailand) Co., Ltd. to record relevant data, including:

(1) Plot information, such as geographic coordinates and plot boundaries

(2) Water management data

(3) Cultivation activity records

Step 4: Field Preparation and Installation of Water Level Monitoring Tubes

Prior to cultivation, farmers are required to prepare their rice fields and install water level monitoring tubes to track subsurface water levels. The guidelines are as follows:

(1) Use a PVC pipe approximately 20–30 cm in length, perforated around the pipe to allow water flow

(2) Install the pipe into the soil at a depth of approximately 15–20 cm, ensuring that the top of the pipe is slightly above the ground surface

(3) Place the pipe in a representative location of the field, avoiding areas that are excessively low-lying or elevated

This installation is intended to monitor water levels and support irrigation management in accordance with AWD principles. For example, water is allowed to recede to approximately -10 to -15 cm below the soil surface before re-irrigation. This is a critical step to ensure proper water management in compliance with project requirements.

Step 5: Implementation, Data Recording, and Benefit Sharing

Farmers carry out rice cultivation following AWD practices while consistently recording data through the application for monitoring and evaluation of greenhouse gas emission reductions. Once the project is certified, the results are used to calculate carbon credits, and the benefits are allocated to participating farmers in proportion to their level of participation.

2) AWD Practice Procedure

Step 1: Land Preparation

Prior to cultivation, rice fields are prepared to ensure optimal conditions for planting. The process begins with primary tillage, which involves plowing the soil to a depth of approximately 15–30 centimeters. This operation turns over the topsoil, allowing the lower soil layers to be exposed to air. It facilitates the decomposition of organic matter, reduces the accumulation of weeds and soil-borne pests, and improve soil structure, making it looser and more friable. Additionally, leaving the soil to dry for approximately 7–14 days after primary tillage helps to partially balance soil pH and enhances the activity of beneficial microorganisms.

This is followed by secondary tillage, which is conducted after primary tillage. The objective is to break down large soil clods into smaller particles and to evenly incorporate plant residues or organic matter into the soil. Secondary tillage improves soil texture, making it more suitable for rice cultivation, and enhances the soil's water-holding capacity, which is a critical factor for water management under the Alternate Wetting and Drying (AWD) system.

Subsequently, harrowing is carried out to level and smooth the soil surface using appropriate tools or leveling equipment. This process minimizes surface unevenness and slope, thereby reducing variations in water depth across the field. As a result, water levels can be controlled more accurately and efficiently throughout the entire plot. This is essential for implementing AWD practices and helps prevent issues such as waterlogging or excessive drying in certain areas of the field.

In addition, the field must be further leveled to ensure uniformity, enabling effective water level control. A small amount of water is then introduced into the field to prepare for cultivation. Finally, appropriate rice varieties suitable for AWD practices are selected to ensure efficient cultivation and alignment with project principles. The rice varieties applicable to the project area are as follows:

Table 1.1: Rice Varieties and Harvesting Age

Rice Variety	Harvesting Age (Days)	Average Yield (tons/rai)	Variety Certification	Suitability for AWD
RD 41	105	0.7–0.9	Certified by the Rice Department in 2009	Moderate – requires proper water management
RD 61	87–96	0.8–1.0	Certified by the Rice Department in 2015	Good – short maturity, suitable for water scheduling
RD 85	115–120	0.9–1.1	Certified by the Rice Department in 2020	Moderate to good – high yield, requires consistent water management
Pathum Thani Fragrant Rice	104–126	0.8–1.0	Certified by the Department of Agriculture in 1987	Good – well adapted to irrigated areas
Hom Mali 105 (Jasmine Rice 105)	105–120	0.6–0.8	Certified by the Rice Department (official national standard variety)	Moderate – caution required during dry periods
RD 43	90–100	0.8–1.0	Certified by the Rice Department in 2017	Very good – suitable for AWD and dry-season rice cultivation
RD 31 (Pathum Thani 1)	100–110	0.9–1.1	Certified by the Rice Department in 1998	Good – strong root system, responds well to AWD
RD 57	105–110	0.9–1.1	Certified by the Rice Department in 2011	Good – disease resistant, suitable for water management
RD 79	95–105	0.8–1.0	Certified by the Rice Department in 2018	Good – well adapted to AWD systems
RD 107 (Phitsanulok 72)	105–110	0.7-1.00	Certified by the Rice Department	Good – strong root system, responds well to AWD
RD 111 (Chao Phraya 72)	100–116	0.7–0.95	Certified by the Rice Department	Good – strong root system, responds well to AWD

Step 2: Rice Planting and Seedling Stage

Rice is established either by direct seeding or transplanting, depending on site conditions and management practices. During the seedling stage (approximately the first 15–20 days), water levels should be carefully controlled and not allowed to become excessively high. If the water level in the soil drops below the specified threshold (e.g., about 10 cm below the soil surface), water should be added to the field.

The seedling stage is critical, as rice plants are establishing and developing their root systems. Water management must therefore be handled with care, maintaining conditions that are "moist but not excessively waterlogged" to support healthy root growth. Excessive standing water may weaken seedlings, increase the risk of lodging, and limit oxygen availability to roots. Conversely, excessive drying may adversely affect germination and early establishment.

At this stage, full implementation of Alternate Wetting and Drying (AWD) is generally not applied. Instead, emphasis is placed on maintaining appropriate water levels to ensure strong crop establishment. Once the crop progresses beyond the seedling stage into the tillering stage, systematic AWD practices can be initiated. Proper water management during this phase reduces the risk of yield loss and provides a strong foundation for subsequent AWD implementation.

Step 3: Water Management Using Alternate Wetting and Drying (AWD)

Alternate Wetting and Drying (AWD) is a key practice for improving water-use efficiency and reducing greenhouse gas emissions. The procedure is as follows:

- Allow the water level in the field to decline naturally until it reaches approximately 10–15 cm below the soil surface.
- Re-irrigate the field to a water depth of approximately 5–10 cm.
- Repeat this cycle (alternating wet and dry conditions) during the vegetative growth and tillering stages.

Farmers use an AWD tube as a monitoring tool to observe subsurface water levels and determine whether to continue drying or to irrigate. This improves the accuracy of water management and reduces reliance on estimation.

Allowing periodic drying enhances soil aeration, preventing continuous saturated conditions. This differs from conventional continuous flooding, where soils remain anaerobic. AWD not only reduces water consumption but also promotes stronger root development and significantly reduces methane (CH_4) emissions, which are typically generated under prolonged anaerobic conditions.

Farmers should also monitor crop conditions closely. If signs of water stress are observed, irrigation should be applied before the threshold is reached to prevent adverse impacts on yield.

Step 4: Water Level Control During Panicle Initiation to Heading Stage

The period from panicle initiation to heading is critical for determining both yield and grain quality. Water levels must be carefully managed during this stage, which can be divided into sub-stages as follows:

(1) Tillering Stage

This stage involves the production of additional tillers, which directly affects the number of panicles. AWD can be applied by allowing water to recede to approximately -10 to -15 cm below the soil surface before re-irrigation. This promotes root growth, strengthens plant structure, reduces water use, and lowers methane emissions.

(2) Panicle Initiation Stage

During this stage, panicles begin forming inside the stem. A stable water depth of approximately 5–10 cm should be maintained, and the field should not be allowed to dry. Adequate water availability supports nutrient accumulation and increases the number of grains per panicle.

(3) Heading Stage

At this stage, panicles emerge from the flag leaf sheath. Water levels should be maintained consistently at approximately 5–10 cm. Water stress should be avoided, as it may negatively affect flowering. Adequate water supports successful pollination and grain setting.

(4) Flowering to Early Grain Formation Stage

Following pollination, grains begin to develop. Consistent water levels must be maintained. Water deficiency during this stage may result in unfilled grains or reduced grain numbers. Proper water management ensures full grain development and improved quality.

Step 5: Drainage Before Harvest

When the crop reaches the ripening stage (approximately 20–30 days before harvest), water should be drained from the field to allow the soil to dry. This promotes uniform grain maturation and facilitates harvesting operations.

During this stage, rice grains develop from the milky stage to the dough stage and eventually reach full maturity. Draining water reduces soil moisture, creating suitable field conditions for uniform ripening. It also encourages the plant to shift from vegetative growth to assimilate accumulation in the grains, resulting in better grain weight and quality.

Additionally, drainage helps firm up the field surface, reducing muddiness and allowing easier access for both manual and mechanized harvesting, while minimizing yield losses due to lodging.

In practice, when the crop enters the ripening stage (approximately 20 days after flowering), farmers should:

- Continuously drain water from the field until the soil is dry
- Remove the AWD tube to prevent damage or loss
- Monitor grain maturity closely to determine the optimal harvest time

This step represents the final stage of the AWD system, ensuring high-quality yield while aligning with greenhouse gas mitigation practices in agriculture.

3) Post-Harvest Agricultural Land Management

After rice harvesting, proper management of agricultural land is essential to prepare for the next cultivation cycle, as well as to minimize environmental impacts and greenhouse gas emissions. The recommended practices are as follows:

3.1) Management of Agricultural Residues (Rice Straw)

Following harvest, residual materials such as rice straw and stubble remain in the field and should be managed appropriately. Straw may be incorporated into the soil to increase organic matter content and improve soil structure. Alternatively, it can be collected and utilized for other purposes, such as compost production or as mulching material. Open-field burning should be avoided, as it contributes to greenhouse gas emissions and air pollution.

3.2) Soil Preparation for the Next Cropping Cycle

After draining the field and completing harvest operations, the soil should be left to dry for a period of time. This helps reduce the accumulation of pests and pathogens in the soil and improves soil aeration. Subsequently, land preparation processes—such as primary tillage, secondary tillage, and harrowing—should be carried out to prepare the field for the next cultivation cycle.

3.3) Post-Harvest Water Management

Field infrastructure related to water management, including bunds, canals, and irrigation systems, should be inspected and repaired as necessary to ensure proper functionality. Water management planning for the next cropping cycle should be undertaken, with consideration given to the implementation of the Alternate Wetting and Drying (AWD) system. Unnecessary water retention in the field should be avoided to minimize methane emissions.

3.4) Weed and Pest Control

Remaining weeds in the field should be removed, and measures should be taken to disrupt the life cycles of pests and plant diseases that may persist after harvest. Integrated approaches—such as soil incorporation, field drying, and biological control methods—should be applied to reduce reliance on chemical inputs and promote environmentally sustainable practices.

3.5) Data Recording and Evaluation

Relevant data should be systematically recorded, including yield, straw volume, and post-harvest activities. Performance from the previous cycle—such as water use, yield outcomes, and the effectiveness of AWD practices—should be evaluated. These data can then be used to improve planning and management for subsequent cropping cycles.

Water Management

Water management in rice fields under the project is a critical component that affects both production efficiency and the reduction of greenhouse gas emissions, particularly methane (CH_4), which is generated under continuously flooded (anaerobic) soil conditions. The project therefore adopts water management based on the Alternate Wetting and Drying (AWD) approach, with the following details:

1) Principles of AWD Water Management

AWD involves controlling water levels in rice fields by avoiding continuous flooding and instead alternating between wet (flooded) and dry periods in a controlled manner. This approach reduces anaerobic soil conditions, which are the primary cause of methane emissions, while also improving water-use efficiency in agriculture.

2) Field Implementation Procedures

Participating farmers are required to implement the following practices:

- Install an AWD tube in the rice field to monitor subsurface water levels
- Allow the water level to naturally decline until it reaches approximately 10–15 cm below the soil surface
- Re-irrigate the field to maintain a water depth of approximately 5–10 cm above the soil surface

- Repeat the wet–dry cycle, particularly during the tillering stage

Water management practices are adjusted according to the crop growth stage. During the panicle initiation to heading stages, water levels are maintained at a constant level, and AWD is temporarily suspended to avoid negative impacts on yield.

3) Water Level Control and Monitoring

Water levels are systematically controlled and monitored through:

- Regular measurement of water levels using the AWD tube
- Recording water levels and irrigation timing
- Capturing photographic records during both dry periods and irrigation events

These data serve as Activity Data for the project's Monitoring and Verification processes.

4) Water Management Across Growth Stages

Water management is adapted to suit each stage of rice growth, as follows:

- Seedling stage: Maintain shallow water levels to support crop establishment
- Tillering stage: Apply AWD (alternate wetting and drying)
- Panicle initiation to heading stage: Maintain a stable water level and avoid water stress
- Maturity stage: Drain water from the field prior to harvesting

The implementation of this water management approach plays a key role in enhancing production efficiency while reducing environmental impacts and supporting greenhouse gas mitigation in the agricultural sector.

1.1.5 Expected amount of greenhouse gas emissions/removal

The implementation of this project involves shifting from the traditional rice cultivation practice of maintaining continuous flooding in paddy fields to the Alternate Wetting and Drying (AWD) water management technique. This approach reduces methane emissions by shortening the duration of waterlogged conditions in the fields. The project is implemented in Bang Nam Priao District, Chachoengsao Province, covering an operational area of approximately 98 rai over a period of five years. It is expected to achieve a reduction of approximately 231 tCO_2e, or an average of 47 tCO_2e per year. The project is classified as a very small-scale project, with annual greenhouse gas emission reductions not exceeding 1,000 tCO_2e.

Figure 1: The boundaries of the area according to title deed and the location of the project site map

1.2 Project Boundary

The geographic boundary encompasses the rice fields where the cultivation method and water regime are changed. The spatial extent of the programme boundary includes all fields that change the cultivation method in the context of the programme activity. The system boundary of the programme can be visualised as follows:

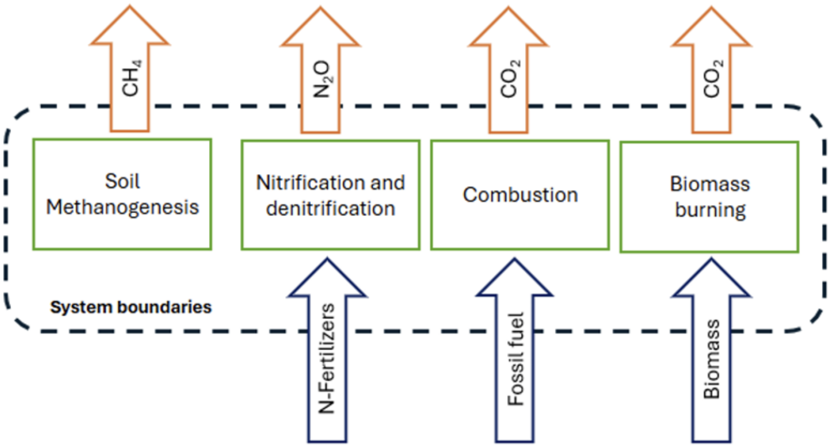


Figure 2: Schematic representation of system boundaries for baseline scenario above, and project scenarios below. In the project scenario it is estimated that there is no application of urea and liming.

Soil methanogenesis, urea decomposition, soil carbonate dissolution and neutralization, nitrification and denitrification and fossil fuel combustions and biomass burning are included. The following emissions are directly influenced by the programme:

- Methane emissions result from the anaerobic decomposition of organic matter by soil methanogen
- microbial transformation of Nitrogen in fertilizers in the soil through nitrification and denitrification processes
- combustion of fossil fuels (e.g.: from increased machineries use)
- biomass burning (i.e.: straw burning)

The following emissions are indirectly influenced by the programme:

- nitrogen losses through volatilization of ammonia and nitrogen oxides, as well as leaching and surface runoff, which subsequently lead to nitrous oxide emissions

The selection of project areas requires leveraging the national farmer database provided by Rice Department (RD) to preliminarily assess agricultural land size. As AWD farming activities necessitate precise water control for paddy fields, it is essential to integrate irrigation canal data from the Royal Irrigation Department (RID) to identify areas with suitable water inflow and outflow systems. This ensures the identification of optimal locations for implementing AWD farming.

To address the issue of double-counting carbon credits, the project conducted a cross-check of provincial areas against existing carbon credit initiatives related to rice cultivation. The assessment identified 8 provinces eligible for the implementation of this programme. This assessment, together with the final confirmation from the relevant Thai authorities, ensure the avoidance of overlapping activities and unique credit allocations.

The mitigation activity at the programme level is planned to start with this CPA, to then scale up to the entirety of Chachoengsao and Khon Kaen, Maha Sarakham and Nongbualamphu (in June 2026), where each province will constitute a separate CPA. It will then include Sukhothai in 2027, followed by Kanchanaburi, Nakhon Pathom and Uttaradit in the following years to reach a total of 196,742 ha (1,229,663 rai) by 2029. Provinces' participation to the programme is subject to approval by the Thai authorities.

A local stakeholder consultation (LSC) meeting took place in Chachoengsao in February 2025 to introduce the farmers to the programme, and the farmers of Chachoengsao will be visited again by 2026 to sign the contracts. The stakeholder consultation meeting in Khon Kaen, Maha Sarakham and Nongbualamphu are planned for Q2-Q3 2026. LSC for the additional provinces are planned for year 2026 onwards.

Awareness raising and technical trainings will be key activities in the programme implementation as a way of promoting the adoption of climate smart agriculture and ensuring the proper application of AWD practices. The successful adoption of the new farming practice and technology will depend on the involvement of the farming communities. Therefore, AWD communities will be built and scaled up. There will be dedicated field staff working with community leaders or a community leader will be hired part-time to build trust with farmers and enroll farmers into AWD communities.

General approach to stakeholder engagement:

1. **Local Stakeholder Consultation (LSC):** Before the implementation of the programme, a Stakeholder consultation will take place in person in each province in order to present this programme and the opportunities for farmers to join such an initiative. Community leaders and other relevant stakeholders according to the TGO guideline will be invited to participate and will be able to ask questions regarding the project.
2. **Signing of contract and trainings:** After the stakeholder consultation, a follow up meeting will be organized for the signing of the contract between the farmers and Varuna. The contract between Varuna and the farmers has the purpose to bind the farmers' participation to the programme with Varuna's support, as well as to waive the carbon rights to the programme owner. At the end of the training session, the farmers will be provided with the contract and the AWD tubes. The trainings will include the explanation on how the farmers should use the mobile platform. The invitation to the first training session will clarify that the farmer needs to provide proof of the land right or lease of land for the signing of the contract.
3. **Start of implementation:** The signed contract and the proof of land right or land lease will be collected by Varuna before the start of the AWD activity. This will be considered as the start of the implementation activity.

Table 1.2: Participants: State and non-state actors involved in the implementation of the Activity

	Name	**Roles (can be multiple for one entity)**
Buyer of the ITMOs	KliK Foundation	The KliK Foundation will be the buyer of the Mitigation Outcomes generated by the Activity.
Project Owner	Myclimate	myclimate will be KliK Foundation's contractual partner
Project Developer	VARUNA (THAILAND) COMPANY LIMITED	Implementing-lead responsible for project execution, data collection, data analysis to ensure delivery of emission reductions, marketing and communication, and preparing project documents for validation according to Premium T-VER standard which allows the trading of mitigation outcomes under Article 6.2 of the Paris Agreement) and Swiss Government's requirements.

	Name	Roles (can be multiple for one entity)
MRV	myclimate CarbonFarm	myclimate is responsible for the monitoring, reporting and verification (MRV) of the project to ensure the delivery of ITMOs to KliK Foundation. CarbonFarm, a French AWD monitoring provider, will provide support to myclimate for the development, calibration and application of the mathematical model.
Technology Provider	VARUNA (THAILAND) COMPANY LIMITED	Provide technology for the farmers to enhance quality of AWD farming monitoring and managing which is cross checked with satellite and ground data.
Farmers	Farmers, both landowners and renters	Participate to the programme and implement AWD practices. Both farmers owning the fields and farmers renting the fields will be able to participate to the programme.
Main government agency	Rice Department (RD)	Supporting and providing ground data of the potential areas which are suitable for AWD activity, give suggestion to engaging with the farmers for expanding AWD activity across Thailand. The RD shall also confirm that no other AWD programme, neither nationally nor internationally financed, is taking place in the provinces targeted by this programme.
	Royal Irrigation Department (RID)	Providing data on farmer's water usage and areas with water management systems essential for supporting AWD activities and effective water control. The RID shall also confirm that no other AWD programme, neither nationally nor internationally financed, is taking place in the provinces targeted by this programme.
	Department of Agriculture Extension (DoAE)	Supporting local stakeholder initiatives, fostering collaboration, and encouraging farmers to adopt improved rice cultivation practices for enhanced productivity and sustainability.
	Thailand Greenhouse Gas Management Organization (TGO)	Registers projects under TVER Premium, provides guidelines for project development, and develops methodologies.
Government entities responsible for authorization	Department for Climate Change and Environment (DCCE)	Thai authority granting authorization to the programme
	Federal Office for the Environment (FOEN)	Swiss authority granting authorization to the programme

The institutional set up of the AWD Activity involves several key agencies that ensure its effective implementation and sustainability. The RD, as the main government agency, oversees and supports the programme by providing critical ground data and guidelines for engaging with farmers. The RID supplies data on farmers' water usage and identifies areas with necessary water management systems. The AWD schedule will be developed in close collaboration with them, to ensure an optimal implementation of AWD practices. In addition, the DoAE fosters local initiatives and collaboration.

The implementation of the programme is managed by Varuna, which coordinates the farmer engagement activities and training sessions in collaboration with the DoAE. Varuna also oversees data collection, ensuring that accurate and comprehensive information is gathered from all participants.

To ensure smooth and effective communication throughout the programme, a coordination group or committee will be established. This group/committee will include representatives from Varuna, the DoAE, and selected farmer leaders from participating communities. The committee will meet regularly to review progress, address any challenges, and facilitate timely information exchange between all stakeholders.

myclimate is responsible for MRV tasks, including summarising data, preparing monitoring reports, and organising verification processes (as well as organizing the programme's validation before its start). This involves meticulous analysis and reporting to ensure that the programme adheres to established standards and achieves its objectives. myclimate's role is crucial in validating the outcomes and maintaining transparency throughout the implementation phase, thereby enhancing trust among stakeholders.

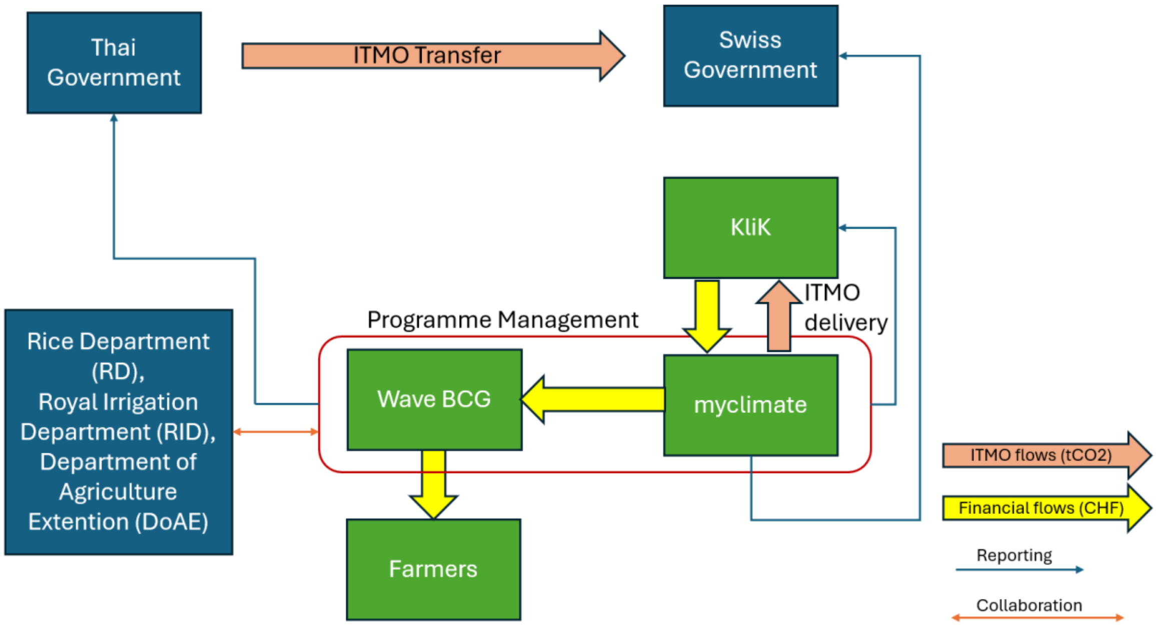


Figure 3: Illustration of the relationships in the programme activity focusing on ITMO revenue flows and reporting/controlling responsibilities. Please note that for this first CPA, Varuna is responsible instead of Wave BCG

Technology and Tool

In Thailand it is common practice that fields are continuously flooded (5–10 cm of standing water) throughout the growing season from the vegetation period, productive period and ripening period. The water is draining out of the field at the end of the growing season (90 days after sowing).

The application of the Alternate Wetting and Drying (AWD) system requires efficient water level management in rice fields. The principle involves alternating between flooded and non-flooded conditions in order to stimulate root development and strengthen rice stems. This practice is implemented during the vegetative period and the ripening period.

Water management begins with maintaining a water level of approximately 5 centimeters above the soil surface. Thereafter, the water is allowed to gradually recede until it falls approximately 10–15 centimeters below the soil surface, or until soil cracking becomes visible.

The field is then re-irrigated. This wetting and drying cycle can be repeated several times according to the growth stages of rice, as follows:

First cycle: During the vegetative period at approximately 20–25 days after planting, water is allowed to drop 10–15 centimeters below the soil surface before re-irrigation.

Second cycle: During the vegetative period at approximately 35–40 days after planting, the same water management practice is applied.

Third cycle: During the transition from vegetative to productive stage at approximately 50–55 days after planting, water is again allowed to recede before reflooding.

Fourth cycle: During the productive period at approximately 70–75 days after planting, water is managed in the same manner.

Fifth cycle: During the ripening period at approximately 90–95 days after planting, the field is allowed to dry to the specified level before re-irrigation.

However, the number and timing of drying cycles may be adjusted depending on climatic conditions, site-specific characteristics, and field management suitability in order to achieve optimal rice growth and productivity.

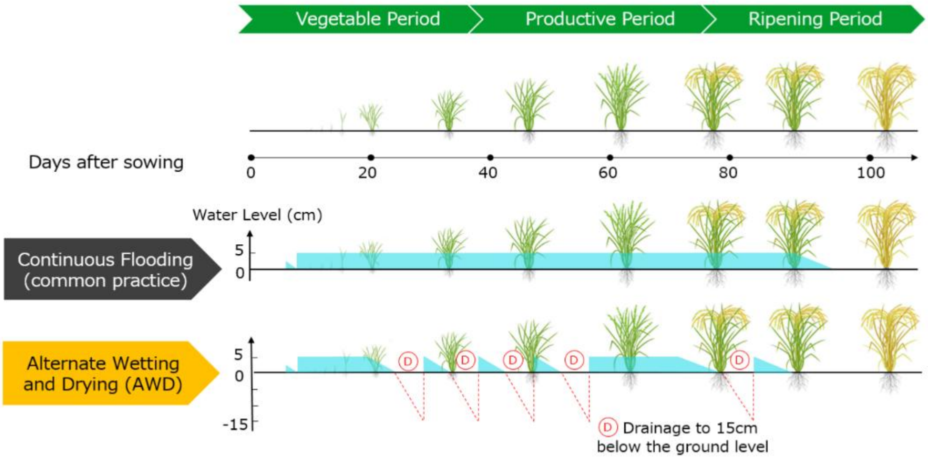


Figure 4: Illustration of AWD practice

The AWD tube to monitor water level below the soil surface is a typical AWD tube with standard size of 7-15 cm diameter and 30-40 cm length and is installed 25 cm below ground level, with 5 cm remaining above the surface. It has 10–15 perforations for water level monitoring, spaced every 2–3 cm along the submerged portion (25 cm below ground). The holes have a diameter of 5–10 mm, preventing clogging while ensuring proper water flow. The programme will distribute 1 tube per field and the number of tubes will increase if the elevation within the field changes.

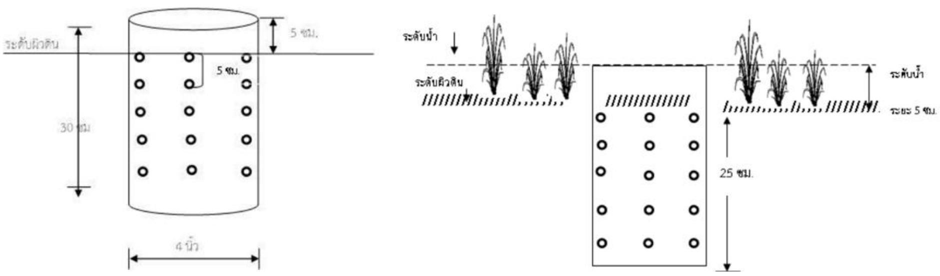


Figure 5: Illustration of the tube's positioning in the soil

Knowledge and expertise of AWD water management practice will be transferred through trainings by experts from Thailand's Rice Department and Varuna Team. Each farmer will receive at least one level measuring tubes, depending on the size and slope of the field, as the location should be representative of the average water depth in the field.

Flat soil is crucial for the successful implementation of AWD as it ensures uniform water distribution across the field, preventing areas from either drying out completely or remaining overly saturated. The provinces targeted in the AWD programme have been assessed for their topography. It has been determined that Laser Land Levelling (LLL), which is an advanced and costly technique to achieve perfectly flat fields, will likely not be necessary in these areas due to their naturally suitable land conditions. This natural advantage simplifies the implementation process and reduces costs, making it easier for farmers to adopt AWD practices.

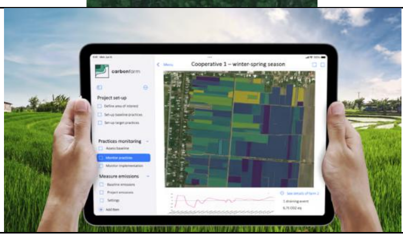
The Smart Watcher application is designed to collect and monitor data necessary to calculate ex-post mitigation outcomes. The application is accessed by a QR code that the farmers can easily scan from their phone. The primary focus of the application is tracking key agricultural and environmental parameters that are crucial for verifying the effectiveness of mitigation practices.

Implementation Equipment

The tools used for implementing Alternate Wetting and Drying (AWD) rice cultivation, including plot coordinate recording and field data collection for documenting rice farming activities, are detailed in the accompanying table.

Table 2.3: Implementation Equipment

No.	Equipment image	Equipment	Utilization
1		Tube	Used to measure the water level in the rice field

No.	Equipment image	Equipment	Utilization
2		Water pump	Used to pump water into or out of rice fields or irrigation canals constructed for rice cultivation activities.
3		Land leveler tractor	Used to remove small mounds and fill low-lying areas in order to smooth and level uneven soil surfaces, thereby improving field uniformity and enhancing water distribution efficiency across the field.
4		Smart Watche or a similar tool	A web application used to capture images of the water level in rice fields, along with location coordinates and the date of image capture.
5		Carbon Farm platform or similar tool	Platform for collecting and analyzing satellite images

Project Boundary

The greenhouse gas emission reduction project, implemented through T-VER-P-METH-13-08 Good Practices in Paddy Rice Version 01, is carried out in Don Ko Ka Subdistrict, Bang Nam Priao District, Chachoengsao Province. A total of two farmers participate in the project, covering an area of 98 rai according to the title deed, with an operational area of 98 rai. Details of the participating farmers by plot are presented in Table 2.2

For the project areas, continuous monitoring will be conducted using a long-term land management plan to support verification and confirmation that the project areas remain under implementation throughout the project's lifespan.

Table 2.2: Farmer Plot Information in Don Ko Ka Subdistrict, Bang Nam Priao District, Chachoengsao Province

Name: Mr. Suphab Noreewong						
Plot Location: 1A: 47P 716180E 1540072N 2A: 47P 716112E 1540680N Don Ko Ka Subdistrict, Bang Nam Priao District, Chachoengsao Province						
CODE	Title Deed Number	Area According to Land Title (rai)	Project Implementation Area (rai)	Parameter	Type[a]	Category/Value
1A,2A	2577/26/77	49.48	48.44	Water management style (on-season)	Dynamic	Continuously flooded
				Water management model (pre-season)	Dynamic	Flooded pre-season >30 days
				Organic Amendment	Dynamic	No organic amendment
				Soil pH	Static	There is no measurement of soil pH.
				Application of chemical fertilizer	Static	Chemical fertilizer applied - Formula 46-0-0 (urea) fertilizer at a rate of 10 kg/rai - Formula 16-20-8 fertilizer at a rate of 30 kg/rai
				Liming	Static	Lime material applied
				Soil Organic carbon (SOC)	Static	<1%
				Climate	Static	The area in Chachoengsao Province is classified as moderately to highly suitable for rice cultivation.
				Rice variety	Dynamic	RD111 or 107

Name: Mr. Supot Noreewong

Plot Location: 1B: 47P 716113E 1540056N
2B: 47P 716046E 1540646N
Don Ko Ka Subdistrict, Bang Nam Priao District, Chachoengsao Province

CODE	Title Deed Number	Area According to Land Title (rai)	Project Implementation Area (rai)	Parameter	Type[a]	Category/Value
1B, 2B	2577/26/77	48.37	45.09	Water management style (on-season)	Dynamic	Continuously flooded
				Water management model (pre-season)	Dynamic	Flooded pre-season >30 days
				Organic Amendment	Dynamic	No organic amendment
				Soil pH	Static	There is no measurement of soil pH.
				Application of chemical fertilizer	Static	Chemical fertilizer applied - Formula 46-0-0 (urea) fertilizer at a rate of 10 kg/rai - Formula 16-20-8 fertilizer at a rate of 30 kg/rai
				Liming	Static	Lime material applied
				Soil Organic carbon (SOC)	Static	<1%
				Climate	Static	The area in Chachoengsao Province is classified as moderately to highly suitable for rice cultivation.
				Rice variety	Dynamic	RD111 or 107

Remark:

[a] Dynamic conditions are those that are linked to the activity in the plot, thus causing changes over time and need to follow up Static conditions are parameters specific to the area in determining soil characteristics. and does not change over time therefore measure or report the value only once

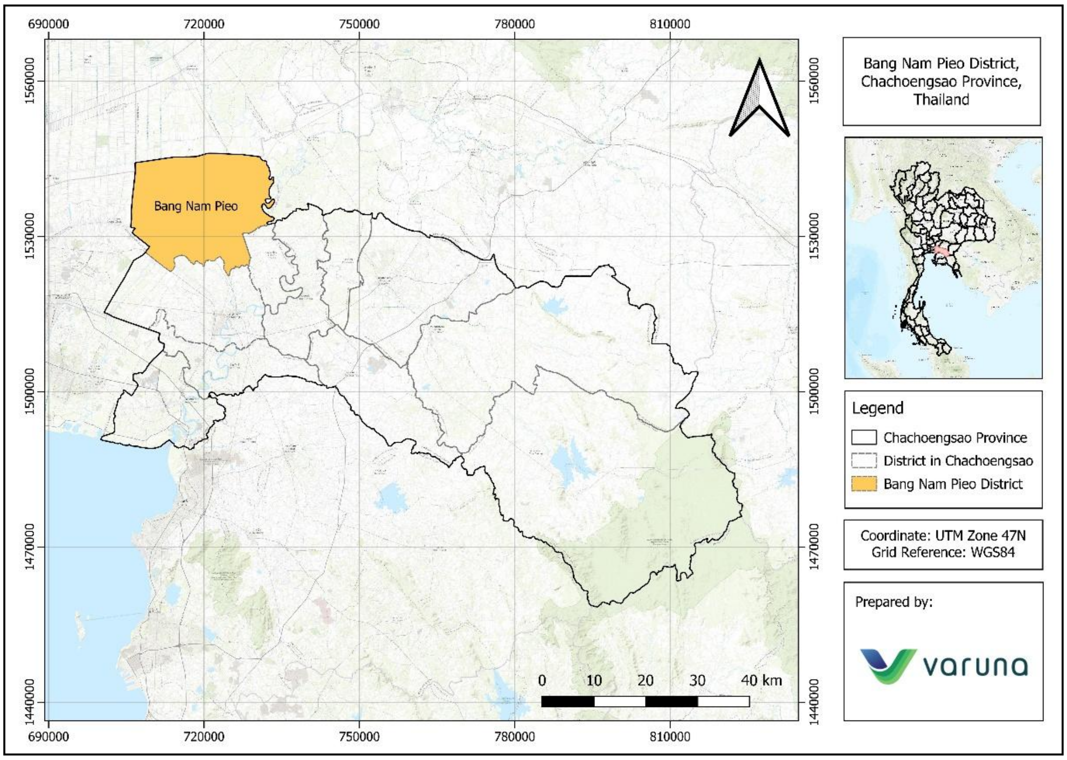


Figure 6: Map showing Bang Nam Priao District, Chachoengsao Province

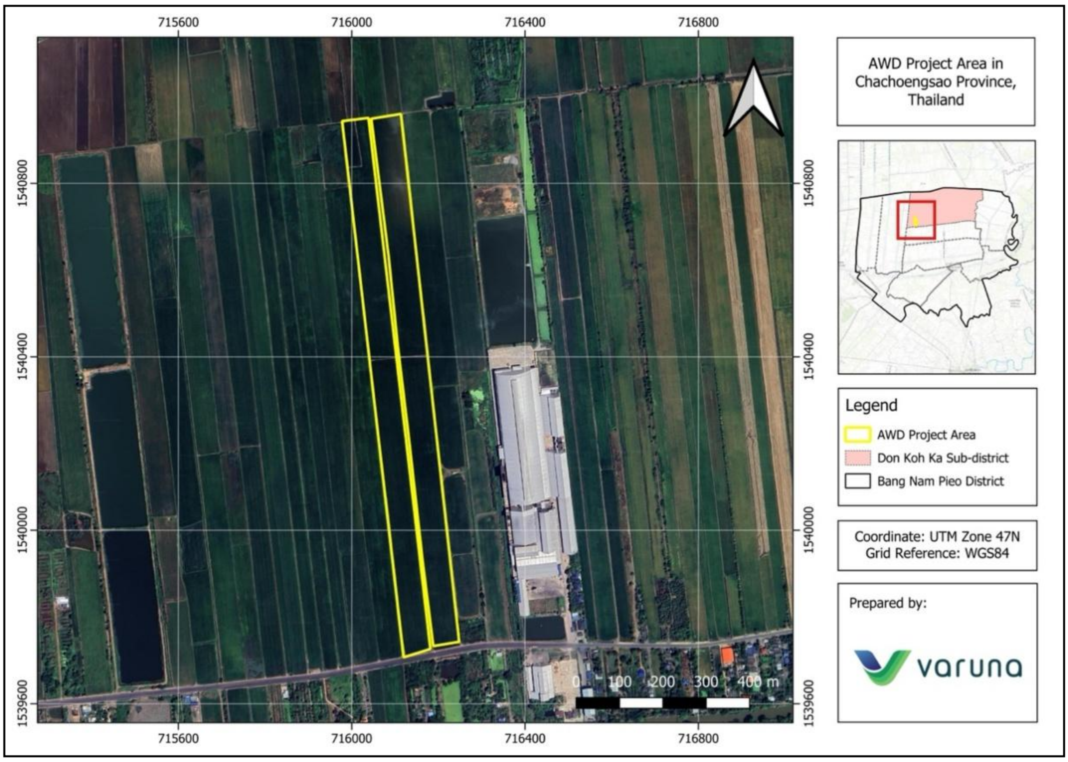


Figure 7: The boundaries of the area according to title deed and the location of the project site map

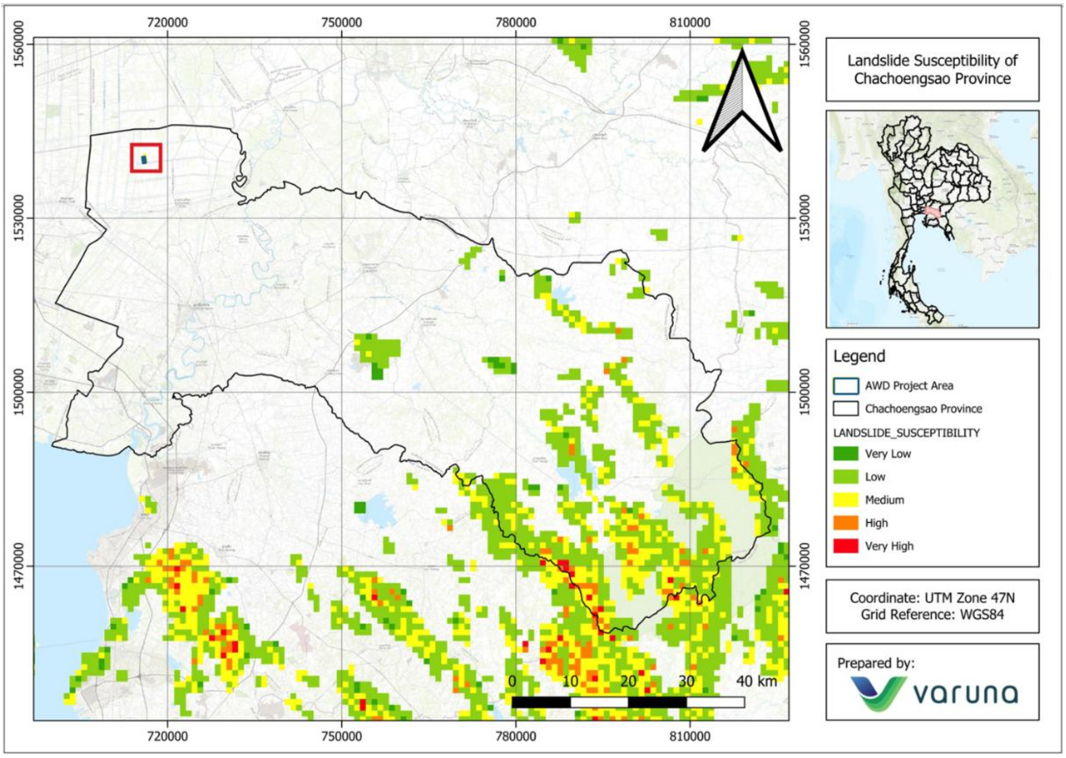


Figure 8: Map showing Landslide Susceptibility of Chachoengsao Province

(Source: Department of Mineral Resources)

The area of Bang Nam Priao District, Chachoengsao Province, where the AWD rice cultivation project is located, does not fall within landslide-risk zones. This reflects the suitability of the area for agricultural use, particularly rice farming, as the terrain is relatively flat and lacks steep slopes that could lead to landslides.

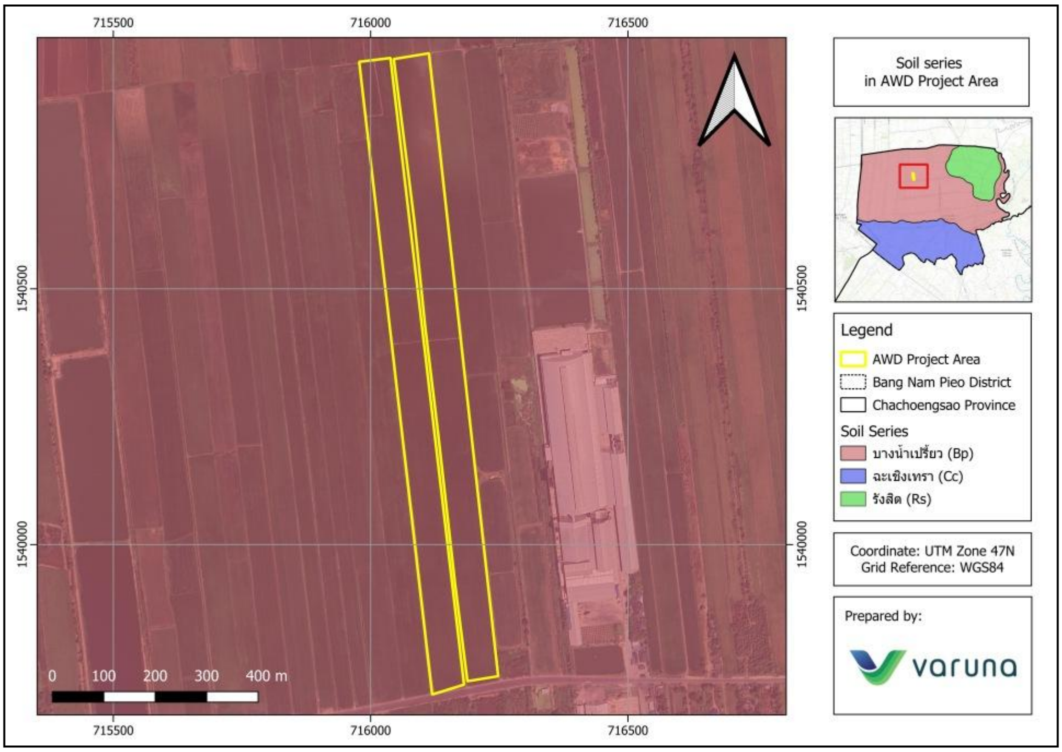


Figure 9: Map showing Soil Series in the AWD Project Area, Bang Nam Priao District, Chachoengsao Province (Source: Department of Land Development)

The project area is underlain by Bang Nam Priao soil series (Bp) and is characterized by flat to nearly level terrain with slopes of 0–1 percent. The soils are very deep and exhibit strongly to extremely acidic conditions. The surface soil is clayey in texture, with dark gray to very dark gray coloration, and shows very strongly acidic to moderately acidic soil reaction (pH 4.5–6.0). The upper subsoil is composed of grayish brown clay with red and yellow mottles, with soil reaction ranging from extremely acidic to moderately acidic (pH 4.0–6.0). In areas where straw-yellow mottles (jarosite) are present, the soil reaction is strongly to extremely acidic (pH < 5.5), indicating the presence of potential acid sulfate soil conditions. The lower subsoil is grayish brown with yellowish brown, reddish brown, and red-yellow mottles, and may include greenish gray sulfidic materials with high sulfur content at depths below 150 cm. At these depths, soil reaction ranges from neutral to moderately alkaline (pH 7.0–8.0). The surface layer commonly exhibits cracking and deep fissures. For paddy rice cultivation, soil acidity management is recommended through the application of appropriate liming materials, together with the integrated use of chemical and organic fertilizers, in order to improve soil fertility and overall soil productivity.

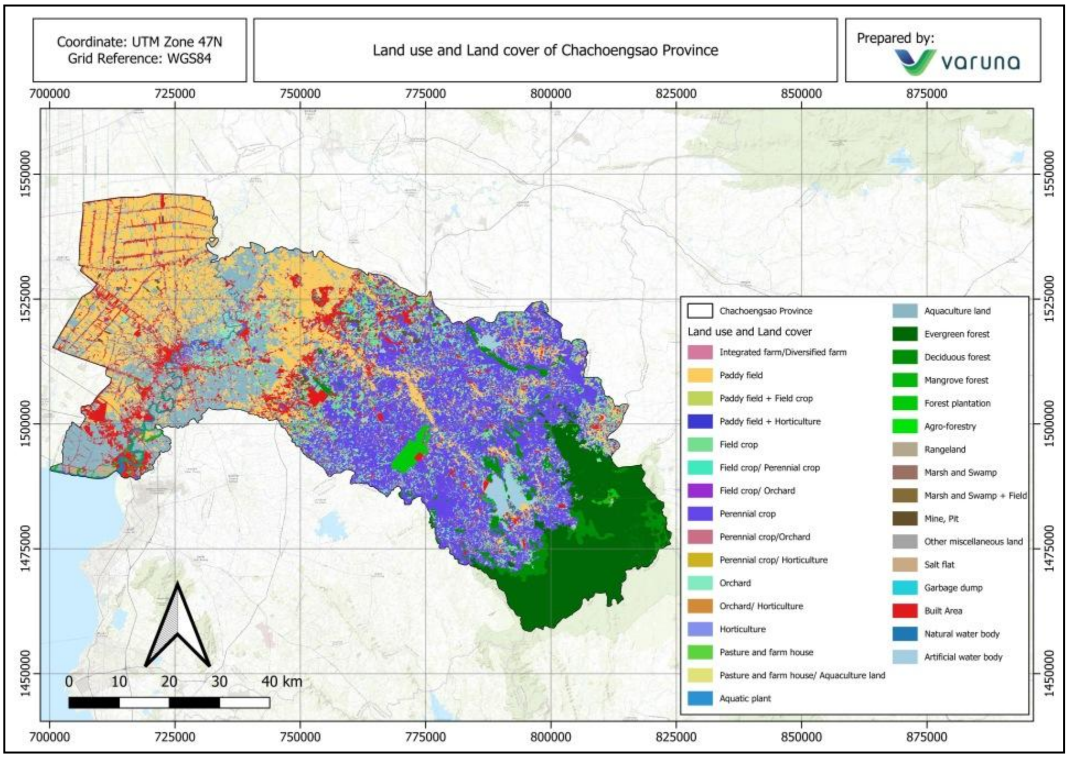


Figure 10: Map showing Land use and Land cover of Bang Nam Priao District, Chachoengsao Province (Source: Department of Land Development)

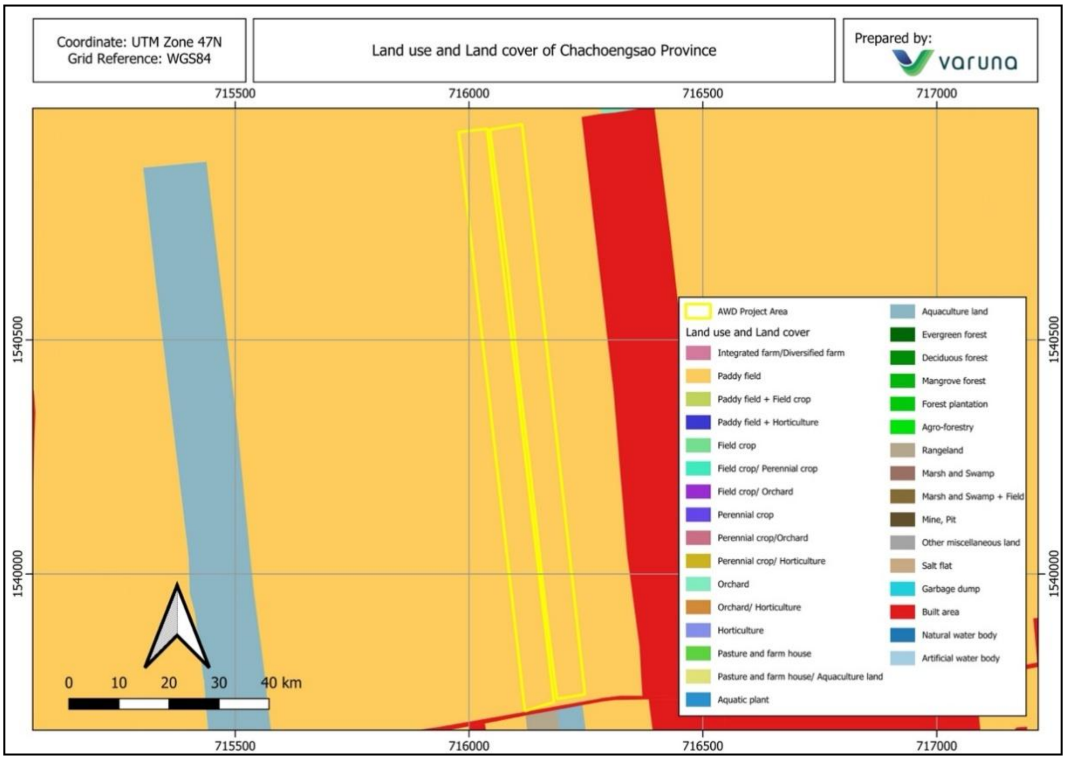


Figure 11: Map showing Land use and Land cover of the location of the project site map

(Source: Department of Land Development)

The project area in Bang Nam Priao District, Chachoengsao Province is located in a region with soil conditions suitable for rice cultivation using the Alternate Wetting and Drying (AWD) method, an efficient water management technique. The soil in the area consists of loam or sandy clay loam, which provides good drainage and allows water to be retained during irrigation cycles in accordance with AWD principles. This helps reduce water usage, decrease greenhouse gas emissions, and maintain productivity effectively. The map therefore serves as spatial evidence confirming the suitability of the project area in terms of soil characteristics and its potential for sustainable agricultural development.

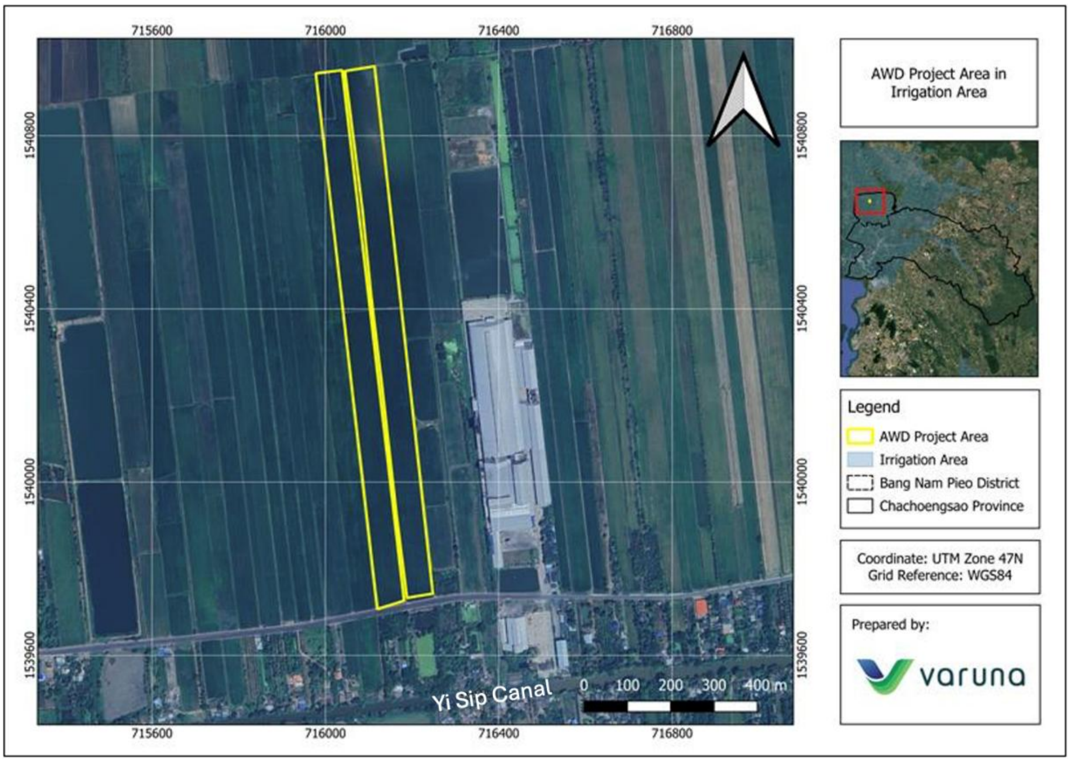


Figure 12: Map showing the project boundaries within the irrigated area of Bang Nam Priao District, Chachoengsao Province (Source: Department of Water Resources)

The map illustrates the project boundary within the irrigated areas of Bang Nam Priao District, Chachoengsao Province , including the presence of Yi Sip Canel, which serves as a key irrigation canal supporting water distribution in the project area. The areas shown on this map can be used to analyze the potential for applying the Alternate Wetting and Drying (AWD) technique, which is a water management practice in rice fields that allows the field to dry intermittently instead of maintaining continuous flooding. This technique plays a significant role in reducing methane (CH_4) emissions, one of the major greenhouse gases generated from the agricultural sector.

1.3 Double counting

The project activity in this project used to registered or in the process of registering other carbon other international climate mitigation mechanisms such as Development Mechanism (CDM), Voluntary Carbon Standard (VCS), Gold Standard etc. or Renewable Energy Certificates (REC)

☑ No

☐ Yes

Project Title..

Scheme...

Crediting period that is issued...

1.4 Additionality

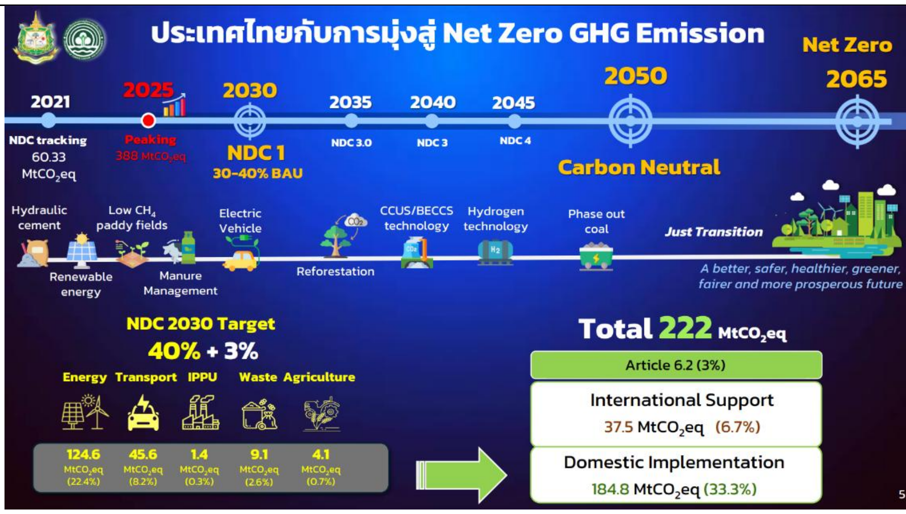
In accordance to T-VER-P-METH-13-08, additionality of the implemented activities shall be demonstrated following a three step approach:

Step 1: Prove that the project is activity is additional to what is required by the law

Thailand has made significant commitments under its NDC to reduce greenhouse gas emissions and enhance sustainable agricultural practices. As part of its NDC, Thailand aims to improve water management systems and promote the adoption of advanced farming techniques, including AWD. This commitment is reflected in various initiatives and policies aimed at minimizing methane emissions from rice cultivation, a major contributor to the country's greenhouse gas profile.

The proposed AWD project offers an <u>additional layer of mitigation that complements Thailand's existing commitments</u>. By focusing on areas not currently covered by neither the national AWD initiatives nor by climate finance activities (GCF), this programme ensures that its activities do not overlap with or duplicate the efforts already underway. Instead, it provides a supplementary mechanism to go beyond the NDC targets, both conditional and unconditional, thus contributing to Thailand's overall climate goals in a more ambitious manner.

Table 1.5: Related Policy and Regulation

Related Policy and Regulation	**Description**
Description	Thailand's 2nd Updated Nationally Determined Contributions (NDC) and its Action Plan 2021-2030
Type	Policy
Impact	 The NDC Action Plan on Mitigation 2021-2030 has been developed as a strategic framework for the main responsible agencies and related organizations to reduce greenhouse gas emissions in Thailand. The plan aims to achieve the country's Nationally Determined Contribution (NDC) targets, which includes a 30–40% reduction from the Business-As-Usual (BAU) scenario by 2030. This Action Plan outlines strategies that collectively represent a potential reduction of 222 million tonnes of CO_2 equivalent ($MtCO_2eq$) by 2030. The emissions reductions can be categorized as follows: 184.8 $MtCO_2eq$ (33.3%) from domestic actions (unconditional target). 37.5 $MtCO_2eq$ (6.7%) from international support (conditional target). Furthermore, 3% (ca. 16.6 M tCO_2eq) will come from Article 6 of the Paris Agreement mechanism, leading to a total of 43%. This will be additional to the country's conditional and unconditional targets. This AWD program falls within this category.

Related Policy and Regulation	**Description**
Description	Guidelines for the Use of Carbon Credits for International Objectives
Type	Guidelines
Impact	The Guidelines for the Use of Carbon Credits for International Objectives have been adopted by the Cabinet on the 26th of August 2025. These provide a list of eligible sectors under Article 6, which includes “methane reduction of rice cultivation”. These guidelines replace the Carbon Credit Management Guideline and Mechanism, which was approved by the National Committee on Climate Change in 2022.

Step 2: prove that activities are not common practices

As shown per Table 3.1, the farmers participating in this CPA have not been conducting AWD and continuous flooding is considered common practice.

Step 3: identify the barrier that may hinder the transition from existing agricultural practices to improved methods.

The main barrier hindering the transition to AWD is the lack of knowledge on improved methods by the farmers. This hindrance is overcome thanks to farmers trainings made possible by the programme.

1.5 Crediting period

Project start date: 15/06/2026

The crediting period, in accordance with the requirements of the voluntary greenhouse gas reduction programme under Thailand’s Premium T-VER standard, stipulates that forestry and agriculture projects (Category 13) involving activities that reduce methane or nitrous oxide emissions from agriculture, and implemented as single projects, shall have a project duration of 5 years.

☑ 5 years

☐ 15 years

☐ others ....years

1.6 Compliance with Premium T-VER PoA project development criteria

Criteria	Explanation
CPA applies the same T-VER methodology as the proposed Programme of Activities.	The CPA (Component Project Activity) group applies the voluntary greenhouse gas reduction methodology for improved rice field management (T-VER-P-METH-13-08 Version 1), which is the same methodology used in the T-VER Programme of Activities (PoA) project proposal.
CPA is the same project type as the proposed Programme of Activities.	The Component Project Activity (CPA) is a project type involving the reduction, absorption and removal of greenhouse gases from the forestry nad agriculture sectors, similar to those proposed under the Programme of Activities (PoA) framework.
The total amount of expected GHG emission reductions/removals of all CPA shall not be 60,000 tCO2eq/year.	The total amount of ER for this CPA is well below the 60'000 tCO2eq/year mark
The size of each CPA shall be a micro-scale project.	This CPA is < 1000 tCO2eq/yr and therefore qualifies as a micro-scale project
The addition of CPA have to occur within the timeframe of the registered PoA.	The addition of all Component Project Activities (CPAs), including new farmer groups or areas joining the programme, must be finalized within the registered crediting period of the

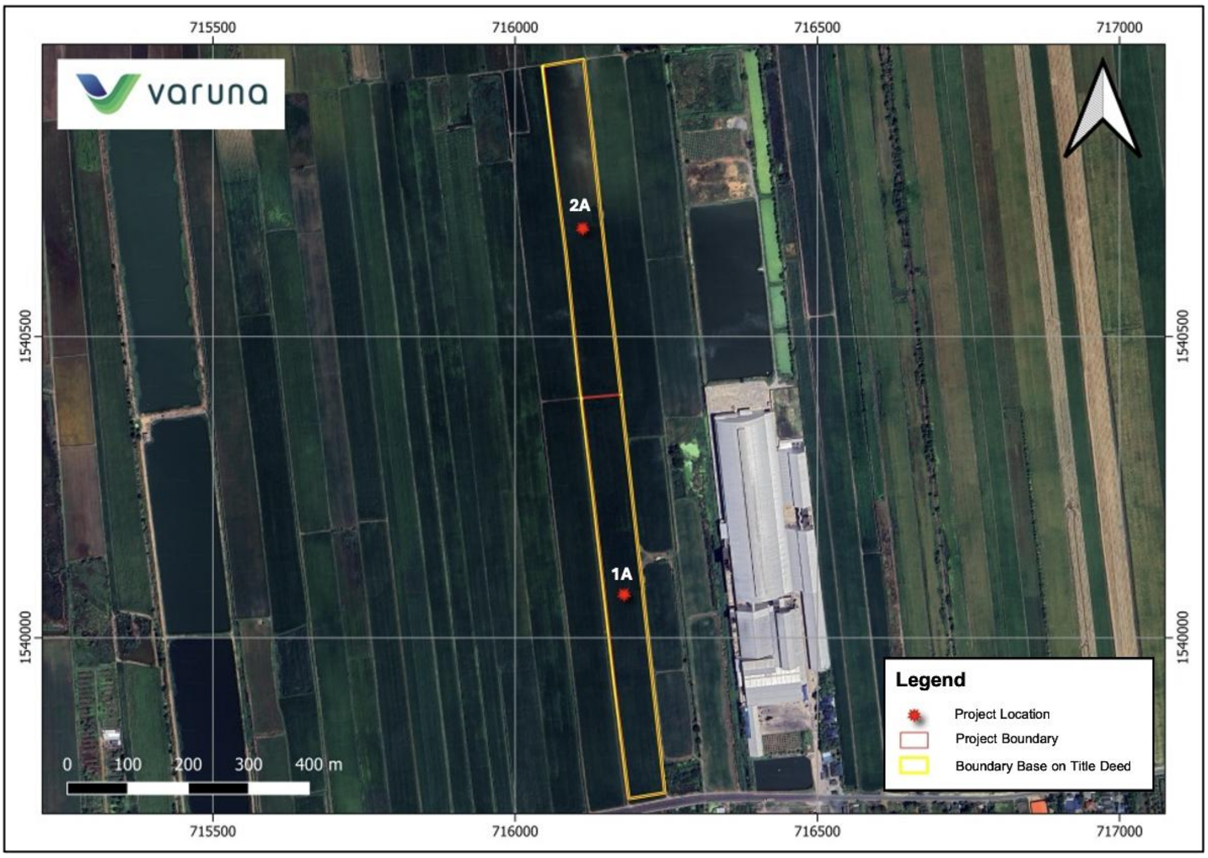
Criteria	Explanation
	Programme of Activities (PoA), which extends from 15/06/2026, to 14/06/2046.

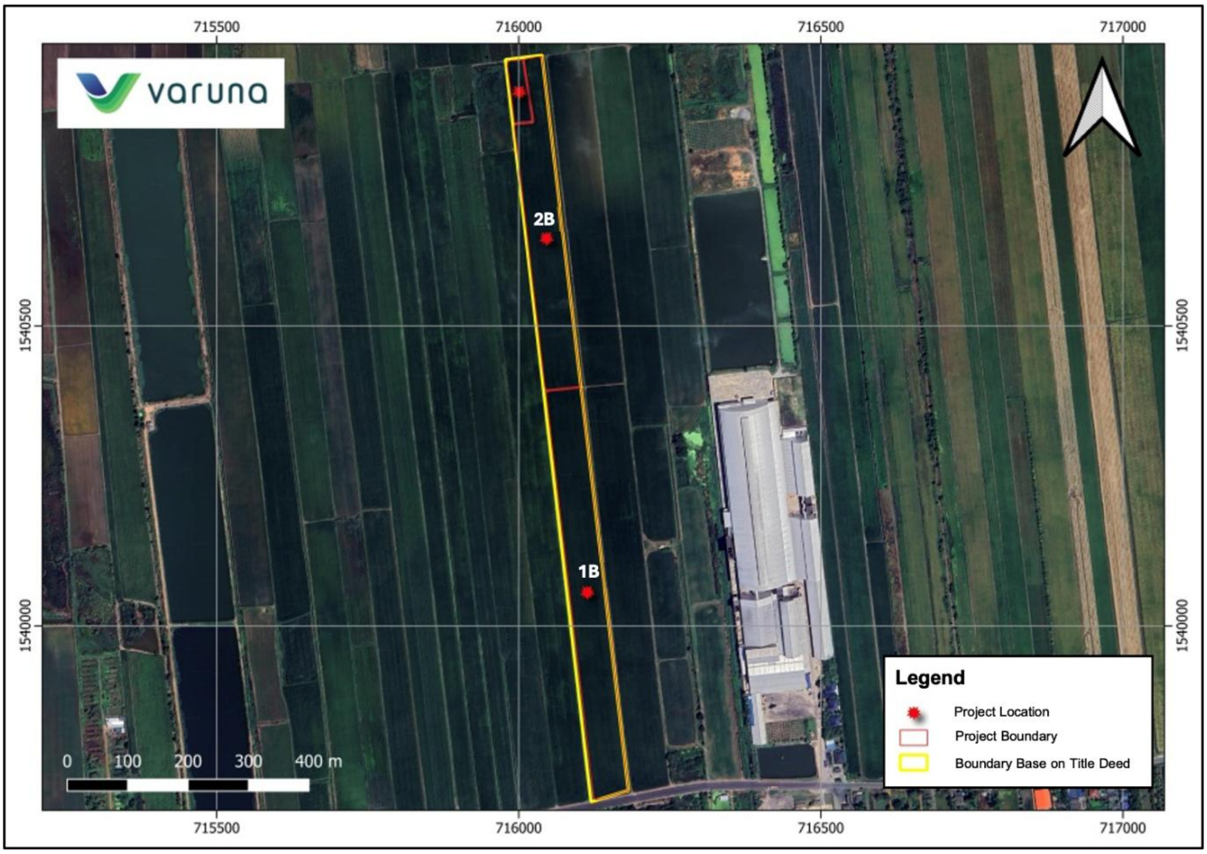
1.7 Document or certificate of land use rights (For Reduction, absorption and removal of greenhouse gases from the forestry and agriculture sectors)

The project area is managed by two participating farmers, covering a total of 98 rai. The carbon credits certified under the project will be allocated between the farmers, as the project owners, and Varuna (Thailand) Co., Ltd. The documents submitted for participation in the project are as follows:

1) Application Form for Participation in the AWD Rice Carbon Credit Project
2) Copy of National Identification Card
3) Copy of House Registration
4) Land Title Deed or documents demonstrating land ownership or land-use rights
5) Map or documents indicating the rice cultivation area
6) Information related to rice farming activities
7) Documents issued by relevant government agencies, if applicable (e.g., certificate from the District or Provincial Agricultural Office, if support has been provided)

These are accompanied by images of the participating farmers' documents, as shown in Figure 13


715500
716000
716500
717000
1540500
1540000
varuna
2A
1A
0
100
200
300
400 m
Legend
Project Location
Project Boundary
Boundary Base on Title Deed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varuna
2B
1B
0
100
200
300
400 m
Legend
Project Location
Project Boundary
Boundary Base on Title Deed

Figure 14: Project Area Boundaries by Individual Plots

1.8 Project investment cost

The implementation of this project will be more than half of the cost being payments to farmers for the successful implementation of AWD. Payments to farmers are defined as variable costs, because they depend on the amount of land successfully converted to AWD. However, since only two farmers are participating in this CPA, the value is constant throughout the years. Other cost components are associated mostly to Varuna's field visits and surveys, digital MRV and Varuna's software expenses. Costs associated to drone spraying and PVC tubes are only minor (see figure 15).

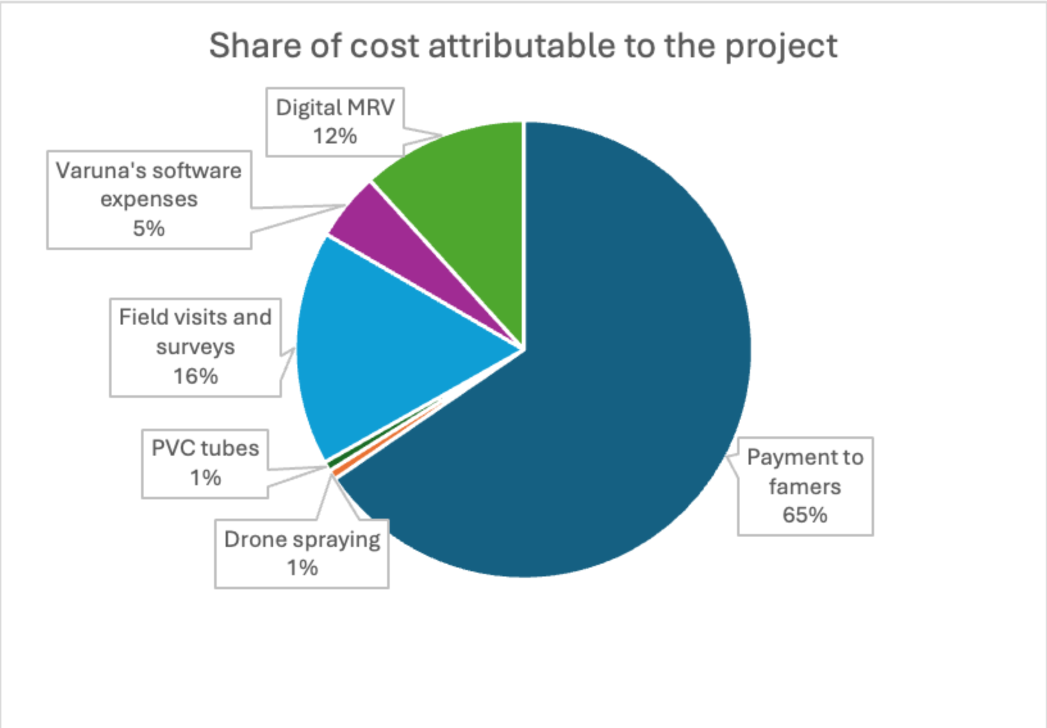

Figure 15: Total costs attributable to the project divided by cost type

While the costs outlined above are directly linked to the implementation of this particular project, costs that occur at the broader programme level are not included above. Such programme-level costs include Varuna's staff-related expenses, business promotion activities such as educating farmers, additional MRV costs related to the use of closed chambers and deployment of smart platforms, as well as verification and registration fees.

Program-level costs are essential for supporting individual projects, but they don’t increase in direct proportion as the program scales up. For example, staff expenses include coordination, technical support, and oversight needed for project implementation. Business promotion and farmer education are important for participant engagement, sharing best practices, and encouraging sustained use of sustainable methods, but these costs also don’t rise directly with the number of farmers, since training and meetings occur at the community level. Similarly, other expenses—like using a closed chamber to monitor an entire province—remain fixed regardless of participation numbers, making the cost per farmer higher when fewer join in. Additional program-wide costs include verification and registration fees.

A project-level financial plan cannot fully represent project viability because many costs occur at the programme level and are not attributable to individual projects. Therefore, a project-level financial plan is not provided.

Part 2 T-VER Methodology

2.1 T-VER Methodology and Tools

No.	Methodology Code	Version	Title of methodology/tool
1	T-VER-P-METH-13-08	1.0	Enhanced Good Practices in Paddy Rice Field

2.2 Project Conditions

Code: T-VER-P-METH-13-08	
Version: Version 1.0	
Methodology/tool: Enhanced Good Practices in Paddy Rice Field	
Project Conditions	**Justification/Explanation**
Project area may consist of multiple areas grouped together.	The project participation area of each sub-project group consists of multiple individual plots combined into a single area.
The area is suitable with its designated land use zoning.	The sub-project group areas are located within existing rice cultivation zones and fall under irrigated areas. The site conditions are suitable for implementing the Alternate Wetting and Drying (AWD) rice cultivation practices, as illustrated in Figures 9 and 10.
Not at risk of land slide.	The project implementation areas are situated in lowland plains and do not include sloping or mountainous areas; therefore, there is no risk of landslides, as shown in Figure 8.
In the case of adjusted water management practice in rice cultivation, the project area must be located within irrigated zones or areas with self-supplied water resources. Farmers must also provide equipment or tools that allow for effective control of irrigation and drainage.	The rice cultivation activities are carried out in accordance with the Enhanced Good Practices in Paddy Rice Field. The project areas are located within an irrigated zone, with Canal 20 located near the project sites. Farmers are equipped with tools and equipment that enable them to control water intake and drainage from the canal.

2.3 Relevant information for calculating greenhouse gas emissions

Relevant greenhouse gas sources for calculation

Emission Source	Type of Greenhouse Gas	Detail of activity
Baseline Emission		
Calculation methane reduction from modelling reference by TGO guideline	CO_2	The CO_2 emissions in the baseline are related to the agricultural practices which burn fossil fuel as well as from the application of limestone, dolomite and urea. The last three have been estimated ex-ante and are excluded because baseline emissions represent < 1% of methane sources (0.33%). The ex-post fossil fuel consumption will be considered for baseline source, despite baseline emissions represents 2.54% of methane sources and according to the methodology, emissions amounting to < 5% of methane sources could be omitted from the estimations.
	CH_4	The activity of methanogenic microorganisms in soil, calculated using modelling parameters (ex-post and ex-ante).
	N_2O	The N_2O emissions in the baseline are related to the use of nitrogen-based fertilizers. Direct and indirect baseline emissions have been estimated ex-ante (based on IPCC guidelines) and, despite they represent less than 1% of methane sources (0.14% for direct nitrous oxide emissions and 0.17% for indirect nitrous oxide emissions) and therefore could be neglected, the ex-post emissions will be

Emission Source	Type of Greenhouse Gas	Detail of activity
		considered as part of the results of mathematical model developed.
Project Emission		
Improving Water Management of rice cultivation activity for methane reduction	CO_2	See above. The project will measure these emissions (ex-post) due to the activity.
	CH_4	The activity of methanogenic microorganisms in soil, calculated using modelling parameters (ex-post and ex-ante).
	N_2O	See above. The N_20 emissions for project activity will be part of the results of mathematical model (ex-post).
Leakage Emission		
-	-	-

Part 3 Calculation of emission reductions

3.1 Calculation of baseline sequestration/emission

3.1.1 Determination of Parameters for Calculating Baseline Greenhouse Gas Emissions

Determination of Parameters for Calculating Baseline Greenhouse Gas Emissions Using Mathematical model

Table 3.1: Details on agricultural practices for baseline and project emissions

Name: Mr. Suphab Noreewong				
Plot Location: 1A: 47P 716180E 1540072N 2A: 47P 716112E 1540680N Don Ko Ka Subdistrict, Bang Nam Priao District, Chachoengsao Province				
CODE	Parameter	Type[a]	Baseline Scenario	Project Scenario
1A,2A	Water management style (on-season)	Dynamic	Continuously flooded	Intermittent flooded (multiple drainage and AWD
	Water management model (pre-season)	Dynamic	Flooded pre-season >30 days	Short flooding <30 days
	Organic Amendment	Dynamic	No organic amendment	No organic amendment
	Soil pH	Static	There is no measurement of soil pH.	There is no measurement of soil pH.
	Application of chemical fertilizer	Static	Chemical fertilizer applied - Formula 46-0-0 (urea) fertilizer at a rate of 10 kg/rai - Formula 16-20-8 fertilizer at a rate of 30 kg/rai	Chemical fertilizer applied - Formula 46-0-0 (urea) fertilizer at a rate of 8 kg/rai
	Liming	Static	Lime material applied	Lime material applied
	Soil Organic carbon (SOC)	Static	<1%	1.7-2.0%
	Climate	Static	The area in Chachoengsao Province is classified as moderately to highly suitable for rice cultivation.	The area in Chachoengsao Province is classified as moderately to highly suitable for rice cultivation.
	Rice variety	Dynamic	RD111 or 107	RD111 or 107

Name: Mr. Supot Noreewong				
Plot Location: 1B: 47P 716113E 1540056N 2B: 47P 716046E 1540646N Don Ko Ka Subdistrict, Bang Nam Priao District, Chachoengsao Province				
CODE	Parameter	Type[a]	Baseline Scenario	Project Scenario
1B, 2B	Water management style (on-season)	Dynamic	Continuously flooded	Intermittent flooded (multiple drainage and AWD
	Water management model (pre-season)	Dynamic	Flooded pre-season >30 days	Short flooding <30 days
	Organic Amendment	Dynamic	No organic amendment	No organic amendment
	Soil pH	Static	There is no measurement of soil pH.	There is no measurement of soil pH.

Name: Mr. Supot Noreewong				
Plot Location: 1B: 47P 716113E 1540056N 2B: 47P 716046E 1540646N Don Ko Ka Subdistrict, Bang Nam Priao District, Chachoengsao Province				
CODE	Parameter	Type[a]	Baseline Scenario	Project Scenario
	Application of chemical fertilizer	Static	Chemical fertilizer applied - Formula 46-0-0 (urea) fertilizer at a rate of 10 kg/rai - Formula 16-20-8 fertilizer at a rate of 30 kg/rai	Chemical fertilizer applied - Formula 46-0-0 (urea) fertilizer at a rate of 8 kg/rai
	Liming	Static	Lime material applied	Lime material applied
	Soil Organic carbon (SOC)	Static	<1%	1.7-2.0%
	Climate	Static	The area in Chachoengsao Province is classified as moderately to highly suitable for rice cultivation.	The area in Chachoengsao Province is classified as moderately to highly suitable for rice cultivation.
	Rice variety	Dynamic	RD111 or 107	RD111 or 107

3.1.2 Calculation of Baseline Greenhouse Gas Emissions (Baseline Sequestration/Emission)

Code: T-VER-P-METH-13-08
Version: 1.0
Methodology/tools: Enhanced Good Practices in Paddy Rice Field T-VER-P-TOOL-01-13
Equation: $BE_y = \sum_{s=1}^{m} BE_s$ $BE_s = \sum_{i=0}^{n}\left((CH_{4\,SOIL,BL,s,i} \times CF) + CO_{2\,LIME,BL,s,i} + CO_{2\,UREA,BL,s,i} + N_2O_{SOIL,BL,s,i}\right)$

Where:

BE_y	=	Total baseline greenhouse gas emissions in year y (tonnes of carbon dioxide equivalent)
BE_s	=	Baseline greenhouse gas emissions in growing season s (tonnes of carbon dioxide equivalent)
$CH_{4\,SOIL,BL,s,i}$	=	Methane emissions from soil carbon in the baseline scenario during growing season s for sample unit i (tonnes of carbon dioxide equivalent)
CF	=	Conservativeness factor or below business-as-usual adjustment factor
$CO_{2\,LIME,BL,s,i}$	=	Carbon dioxide emissions from lime application in the baseline scenario during growing season s for sample unit i (tonnes of carbon dioxide equivalent)
$CO_{2\,UREA,BL,s,i}$	=	Carbon dioxide emissions from urea fertilizer application in the baseline scenario during growing season s for sample unit i (tonnes of carbon dioxide equivalent)

$N_2O_{SOIL,BL,s,i}$	=	Nitrous oxide emissions from nitrogen fertilizer application in the baseline scenario during growing season s for sample unit i (tonnes of carbon dioxide equivalent)
I	=	Sample unit i as listed in Table 1 (n = total number of sample units)
S	=	Growing season (s = number of growing seasons in the project year)

Ex-ante Baseline emissions for $CH_{4SOIL,BL,s,i}$

The baseline and project emissions source of CH_4 – soil methanogenesis are assessed by a process-based model. As per the "Guideline for Premium Thailand Voluntary Emission Reduction Program (Premium T-VER) version 5.0"[1], if more than 16,000 tCO_2eq/year, it is considered to be a large project. The project chooses the DNDC based modelling method.

Assessment Method: Modelling

$$CH_{4_{SOIL,BL,s,i}} = GWP_{CH4} \times fCH_{4_{SOIL,BL,s,i}}$$

Where:

$CH_{4_{SOIL,BL,i,t}}$	=	Methane emissions from soil methanogenesis in the baseline scenario during growing season s for sample unit i (tonnes of carbon dioxide equivalent)
$fCH_{4_{SOIL,BSL,i,t}}$	=	Methane emissions from soil methanogenesis in the baseline scenario as simulated by the model during growing season s for sample unit i (tonnes of methane)
GWP_{CH4}	=	Global warming potential of methane (tonnes of carbon dioxide equivalent per tonne of methane)

The model predicts greenhouse gas emissions from agricultural areas, such as CH_4 and N_2O emissions from soil. The ex-ante calculations are based on: (1) emission data from experimental or research plots, and (2) data from high-quality academic literature, such as peer-reviewed journal publications.

A Monte Carlo analysis was conducted by repeatedly running the DNDC model while sampling plausible ranges for uncertain inputs (e.g., timing and implementation parameters). This approach generates a distribution of outcomes rather than a single point estimate, allowing for the

[1] Guideline for Premium Thailand Voluntary Emission Reduction Program (Premium T-VER) V.4, provided separately to the validator.

quantification of uncertainty and sensitivity. It also supports the selection of a conservative average ex-ante value that is not overly influenced by any single assumption. In practice, this method helped produce a more representative sample, particularly after filtering out a significant number of fields due to soil representativeness issues, including clay content.

The scientific basis for applying models to estimate greenhouse gas emissions from agricultural areas is described in Appendix 3 of T-VER-P-METH-13-08 Version 01. In addition, the document "Ex-ante Methodology Overview & Results," prepared by Carbon Farm, has been shared as a confidential reference.

Ex-post Baseline emissions for $CH_{4SOIL, BL,s,i}$

The baseline and project emissions source of CH_4 – soil methanogenesis will be assessed by a process-based model. As per the "Guideline for Premium Thailand Voluntary Emission Reduction Program (Premium T-VER) version 5.0"[2], if more than 16,000 tCO_2eq/year, it is considered to be a large project. The project chooses the modelling method including direct measurement for plausibility checks.

Assessment Method: Modelling

$$CH_{4_{SOIL,BL,s,i}} = GWP_{CH4} \times fCH_{4_{SOIL,BL,s,i}}$$

Where:

$CH_{4_{SOIL,BL,i,t}}$	=	Methane emissions from soil methanogenesis in the baseline scenario during growing season s for sample unit i (tonnes of carbon dioxide equivalent)
$fCH_{4_{SOIL,BSL,i,t}}$	=	Methane emissions from soil methanogenesis in the baseline scenario as simulated by the model during growing season s for sample unit i (tonnes of methane)
GWP_{CH4}	=	Global warming potential of methane (tonnes of carbon dioxide equivalent per tonne of methane)

The model predicts greenhouse gas emissions from agricultural areas, such as CH_4 and N_2O emissions from soil. The model is calibrated and validated using gas measurements from the

[2] Guideline for Premium Thailand Voluntary Emission Reduction Program (Premium T-VER) V.4, provided separately to the validator.

following sources: (1) collecting actual emission data from the project area in representative areas, (2) emission data from experimental plots or research plots, or (3) data from high-quality academic literature, such as those reviewed by experts or published in academic journals. A plausibility check will be performed against measurements carried out with closed chambers. This approach is additional to TGO requirements and ensures that the model is conservative and in line with actual field conditions. Specifically for ex-ante, the current version of the model has been calibrated and validated using 125 paired datasets of emission reductions from practice changes across Thailand, Vietnam, and Cambodia, derived from peer-reviewed literature. This version was applied by Carbon Farm to generate the ex-ante estimates. Prior to the first verification, the calibration and validation report will be updated to incorporate any newly available datasets and to ensure that model parameterisation is fully representative of Thai production systems.

The scientific principles for using models to assess greenhouse gas emissions from agricultural areas are detailed in Appendix 3 of T-VER-P-METH-13-08 Version 01

Ex-ante Baseline emissions for $CO_{2LIME, BL,s,i}$

For the assessment of carbon dioxide emissions from liming (using calcite, calcium carbonate, or calcium magnesium carbonate), the calculation is done based on default values as set in T-VER-P-METH-13-08.

Some liming materials are both locally produced and imported. Only the amount produced locally is considered for baseline emissions:

$$CO_{2\,LIME,BL,s,i} = \sum\left[\left(\left(M_{Limestone,BL,s,i} \times A_{s,i}\right) \times EF_{Limestone}\right) + \left(\left(M_{Dolomite,BL,s,i} \times A_{s,i}\right) \times EF_{Dolomite}\right)\right] \times \frac{44}{12}$$

Where:

$CO_{2\,LIME,BL,s,i}$	=	Quantity of carbon dioxide emitted from lime application in the baseline scenario in growing season s of sample unit i (tonnes of carbon dioxide)
$M_{Limestone,BL,s,i}$	=	Quantity of lime used in the baseline scenario in growing season s of sample unit i (tonnes of lime per rai)
$EF_{Limestone}$	=	Greenhouse gas emission factor from lime use (tonnes of carbon per tonne of lime)

$M_{Dolomite,BL,s,i}$	=	Quantity of dolomite applied in the baseline scenario in growing season s of sample unit i (tonnes of dolomite per rai)
$EF_{Dolomite}$	=	Greenhouse gas emission factor from dolomite application (tonnes of carbon per tonne of dolomite)
$A_{s,i}$	=	Harvested area in growing season s of sample unit i (rai)
$\frac{44}{12}$	=	Molecular weight ratio of carbon dioxide to carbon

The ex-ante ER calculation has shown that CO_2 emissions from liming are below 5%.

Ex-post Baseline emissions for $CO_{2LIME,\ BL,s,i}$

These are assessed as zero, because negligible in ex-ante estimation.

Ex-ante Baseline emissions for $CO_{2UREA,\ BL,s,i}$

Urea is broken down by an enzyme called urease, resulting in the release of carbon dioxide gas. Additionally, the ammonia in urea can be transformed, leading to the release of nitrous oxide gas, which will be calculated in a subsequent section.

Some urea fertilizers are both locally produced and imported. Only the amount produced locally is considered for baseline emissions.

For the assessment of carbon dioxide emissions from urea application, a third assessment approach is necessary: calculation using default values with the following equation:

$$CO_{2\,UREA,BL,s,i} = \Sigma\left((M_{Urea,BL,s,i} \times A_{s,i}) \times EF_{Urea}\right) \times \frac{44}{12}$$

Where:

$CO_{2\,UREA,BL,s,i}$	=	Carbon dioxide emissions from urea application in the baseline scenario in growing season s of sample unit i (tonnes of CO2)
$M_{Urea,BL,s,i}$	=	Quantity of urea used in the baseline scenario in growing season s of sample unit i (tonnes of urea per rai)
EF_{Urea}	=	Greenhouse gas emission factor for urea (tonnes of carbon per tonne of urea)

$A_{s,i}$	=	Harvested area in growing season s of sample unit i (rai)
$\frac{44}{12}$	=	Molecular weight ratio of carbon dioxide to carbon

The ex-ante ER calculation has shown that CO_2 emissions from urea are below 5%.

Ex-post Baseline emissions for $CO_{2UREA, BL,s,i}$

These are assessed as zero, because negligible in ex-ante estimation.

Ex-ante Baseline emissions for $N_2O_{SOIL, BL,s,i}$

Nitrogenous fertilizers applied to cultivated land, whether in the form of chemical fertilizers, organic fertilizers, manure, or agricultural residues, undergo transformations by soil microorganisms through nitrification and denitrification processes. During these processes, direct nitrous oxide emissions occur. Additionally, indirect nitrous oxide emissions arise from losses due to ammonia and nitrogen oxide volatilization, as well as leaching or surface runoff, where lost nitrogen is transformed and released as nitrous oxide.

The assessment of nitrous oxide emissions from nitrogen fertilizer application is based on DNDC based modelling method following the scientific principles for using models to assess greenhouse gas emissions from agricultural areas are detailed in Appendix 3 of T-VER-P-METH-13-08 Version 01. In addition, the document "Ex-ante Methodology Overview & Results," prepared by Carbon Farm, has been shared as a confidential reference.

$$N_2O_{SOIL,BL,s,i} = GWP_{N2O} \times fN_2O_{SOIL,BL,s,i}$$ *Equation 1*

Where:

$N_2O_{SOIL,BL,s,i}$	=	Nitrous oxide emissions from nitrogen fertilizer application in the baseline scenario in growing season s of sample unit i (tonnes of carbon dioxide equivalent)
$fN_2O_{SOIL,BL,s,i}$	=	Nitrous oxide emissions from nitrogen fertilizer application in the baseline scenario obtained from the model in growing season s of sample unit i (tonnes of nitrous oxide)
GWP_{N2O}	=	Global warming potential of nitrous oxide (tonnes of carbon dioxide equivalent per tonne of nitrous oxide)

$$N_2O_{SOIL,BL,s,i} = N_2O_{Direct,BL,s,i} + N_2O_{Indirect,BL,s,i}N_2O_{Indirect,BL,s,i}$$
$$= N_2O_{ATD,BL,s,i}$$
$$+ N_2O_{L,BL,s,i}N_2O_{SOIL,BL,s,i}N_2O_{Direct,BL,s,i}\ N_2O_{Indirect,BL,s,i}N_2O_{ATD,BL,s,i}N_2O_{L,BL,s,i}F_{SN,BL,s,i}F_{ON,BL,s,i}EF_{N2ODirect}EF_{ATD}EF_{LEACH}Frac_{GASF}Frac$$

Ex-post Baseline emissions for $N_20_{SOIL, BL,s,i}$

Nitrogenous fertilizers applied to cultivated land, whether in the form of chemical fertilizers, organic fertilizers, manure, or agricultural residues, undergo transformations by soil microorganisms through nitrification and denitrification processes. During these processes, direct nitrous oxide emissions occur. Additionally, indirect nitrous oxide emissions arise from losses due to ammonia and nitrogen oxide volatilization, as well as leaching or surface runoff, where lost nitrogen is transformed and released as nitrous oxide.

If the project requires an assessment of nitrous oxide emissions from nitrogen fertilizer application, the **modelling method** is used.

The assessment of nitrous oxide emissions from nitrogen fertilizer application is based on mathematical model following the scientific principles for using models to assess greenhouse gas emissions from agricultural areas are detailed in Appendix 3 of T-VER-P-METH-13-08 Version 01.

$$N_2O_{SOIL,BL,s,i} = GWP_{N2O} \times fN_2O_{SOIL,BL,s,i}$$

Where:

$N_2O_{SOIL,BL,s,i}$	=	Nitrous oxide emissions from nitrogen fertilizer application in the baseline scenario in growing season s of sample unit i (tonnes of carbon dioxide equivalent)
$fN_2O_{SOIL,BL,s,i}$	=	Nitrous oxide emissions from nitrogen fertilizer application in the baseline scenario obtained from the model in growing season s of sample unit i (tonnes of nitrous oxide)
GWP_{N2O}	=	Global warming potential of nitrous oxide (tonnes of carbon dioxide equivalent per tonne of nitrous oxide)

3.2 Calculation of project sequestration/emission

Code: T-VER-P-METH-13-08
Version: 1.0
Methodology/tool: Enhanced Good Practices in Paddy Rice Field T-VER-P-TOOL-01-13
Equation: $PE_y = \sum_{s=1}^{m} PE_s$ $PE_s = \sum_{i=0}^{n} \left(CH_{4_{SOIL,PJ,s,i}} + CO_{2_{LIME,PJ,s,i}} + CO_{2_{UREA,PJ,s,i}} + N_2O_{SOIL,PJ,s,i} + CO_{2_{FUEL,PJ,s,i}} + Non - CO_{2_{BURNing,PJ,s,i}} \right)$

Where:

PE_y	=	Total greenhouse gas emissions from project activities in year y (tonnes of carbon dioxide equivalent)
PE_s	=	Total greenhouse gas emissions from project activities in growing season s (tonnes of carbon dioxide equivalent)
$CH_{4_{SOIL,PJ,s,i}}$	=	Methane emissions from soil methanogenesis from project activities in growing season s of sample unit i (tonnes of carbon dioxide equivalent)
$CO_{2_{LIME,PJ,s,i}}$	=	Carbon dioxide emissions from lime application from project activities in growing season s of sample unit i (tonnes of carbon dioxide equivalent)
$CO_{2_{UREA,PJ,s,i}}$	=	Carbon dioxide emissions from urea fertilizer application from project activities in growing season s of sample unit i (tonnes of carbon dioxide equivalent)
$N_2O_{SOIL,PJ,s,i}$	=	Nitrous oxide emissions from nitrogen fertilizer application from project activities in growing season s of sample unit i (tonnes of carbon dioxide equivalent)
$CO_{2_{FUEL,PJ,s,i}}$	=	Carbon dioxide emissions from fossil fuel combustion from project activities in growing season s of sample unit i (tonnes of carbon dioxide equivalent)
$Non - CO_{2_{BURNing,PJ,s,i}}$	=	Greenhouse gas emissions from biomass burning from project activities in growing season s of sample unit i (tonnes of carbon dioxide equivalent)
I	=	Sample unit I as referred in table 1 (n = The total number of sample units)
S	=	Growing season (s = The total number of growing seasons in the project)

Ex-ante Project emissions for $CH_{4SOIL,\ PJ,s,i}$

As described for the baseline, CH_4 emissions from soil methanogenesis under the project scenario are assessed using a modeling approach. The DNDC model was run repeatedly to generate a range of plausible outcomes, capturing variability and uncertainty in the estimates.

$$CH_{4_{SOIL,PJ,s,i}} = GWP_{CH4} \times fCH_{4_{SOIL,PJ,s,i}} \qquad \text{Equation 2}$$

Where:

$CH_{4_{SOIL,PJ,i,t}}$	=	Methane emissions from soil carbon in the project activities during growing season s for sample unit i (tonnes of carbon dioxide equivalent)
$fCH_{4_{SOIL,PJ,i,t}}$	=	Methane emissions from soil carbon in the project activities as simulated by the model during growing season s for sample unit i (tonnes of methane)
GWP_{CH4}	=	Global warming potential of methane (tonnes of carbon dioxide equivalent per tonne of methane)

The model predicts greenhouse gas emissions from agricultural areas, such as CH_4 and N_2O emissions from soil. The sources of the validated mathematical model included: (1) emission data from experimental plots or research plots, or (2) data from high-quality academic literature, such as those reviewed by experts or published in academic journals. As indicated in the baseline emissions chapter, this approach is additional to TGO's requirements.

The scientific principles for using models to assess greenhouse gas emissions from agricultural areas are detailed in Appendix 3 of T-VER-P-METH-13-08 Version 01. In addition, the document "Ex-ante Methodology Overview & Results," prepared by Carbon Farm, has been shared as a confidential reference.

Ex-post Project emissions for $CH_{4SOIL,PJ,s,i}$

As explained for the baseline, the project emissions source of CH_4 – soil methanogenesis is assessed under modelling method including direct measurement as a plausibility check.

$$CH_{4_{SOIL,PJ,s,i}} = GWP_{CH4} \times fCH_{4_{SOIL,PJ,s,i}}$$

Where:

$CH_{4_{SOIL,PJ,i,t}}$	=	Methane emissions from soil carbon in the project activities during growing season s for sample unit i (tonnes of carbon dioxide equivalent)
$fCH_{4_{SOIL,PJ,i,t}}$	=	Methane emissions from soil carbon in the project activities as simulated by the model during growing season s for sample unit i (tonnes of methane)
GWP_{CH4}	=	Global warming potential of methane (tonnes of carbon dioxide equivalent per tonne of methane)

The model predicts greenhouse gas emissions from agricultural areas, such as CH_4 and N_2O emissions from soil. The sources of the validated mathematical model included: (1) collecting actual emission data from the project area, (2) emission data from experimental plots or research plots, or (3) data from high-quality academic literature, such as those reviewed by experts or published in academic journals. As indicated in the baseline emissions chapter, this approach is additional to TGO's requirements.

The scientific principles for using models to assess greenhouse gas emissions from agricultural areas are detailed in Appendix 3 of T-VER-P-METH-13-08 Version 01.

Ex-ante Project emissions for $CO_{2LIME, PJ,s,i}$

For the assessment of carbon dioxide emissions from liming (using calcite, calcium carbonate, or calcium magnesium carbonate), the calculation is done based on default values as set in the Premium T-VER methodology:

Some liming materials are both locally produced and imported. Only the amount produced locally is considered for project emissions.

$$CO_{2\,LIME,PJ,s,i} = \sum\left[\left(\left(M_{Limestone,PJ,s,i} \times A_{s,i}\right) \times EF_{Limestone}\right) + \left(\left(M_{Dolomite,PJ,s,i} \times A_{s,i}\right) \times EF_{Dolomite}\right)\right] \times \frac{44}{12}$$

Where:

$CO_{2\,LIME,PJ,s,i}$	=	Quantity of carbon dioxide emitted from lime application in the project scenario in growing season s of sample unit i (tonnes of carbon dioxide)
$M_{Limestone,PJ,s,i}$	=	Quantity of lime used in the project scenario in growing season s of sample unit i (tonnes of lime per rai)
$EF_{Limestone}$	=	Greenhouse gas emission factor from lime use (tonnes of carbon per tonne of lime)
$M_{Dolomite,PJ,s,i}$	=	Quantity of dolomite applied in the project scenario in growing season s of sample unit i (tonnes of dolomite per rai)
$EF_{Dolomite}$	=	Greenhouse gas emission factor from dolomite application (tonnes of carbon per tonne of dolomite)
$A_{s,i}$	=	Harvested area in growing season s of sample unit i (rai)
$\frac{44}{12}$	=	Molecular weight ratio of carbon dioxide to carbon

The ex-ante ER calculation has shown that CO_2 emissions from liming are below 5%.

Ex-post Project emissions for $CO_{2LIME,\ PJ,s,i}$

These are assessed as zero, because negligible in ex-ante estimation.

Ex-ante Project emissions for $CO_{2UREA,\ PJ,s,i}$

Urea is broken down by an enzyme called urease, resulting in the release of carbon dioxide gas. Additionally, the ammonia in urea can be transformed, leading to the release of nitrous oxide gas, which will be calculated in a subsequent section.

Some urea fertilizers are both locally produced and imported. Only the amount produced locally is considered for project emissions.

For the assessment of carbon dioxide emissions from urea application, a third assessment approach is necessary: calculation using default values with the following equation.

$$CO_{2\,UREA,PJ,s,i} = \sum\left((M_{Urea,PJ,s,i} \times A_{s,i}) \times EF_{Urea}\right) \times \frac{44}{12}$$

Where:

$CO_{2\,UREA,PJ,s,i}$	=	Carbon dioxide emissions from urea application in the project scenario in growing season s of sample unit i (tonnes of CO2)
$M_{Urea,PJ,s,i}$	=	Quantity of urea used in the project scenario in growing season s of sample unit i (tonnes of urea per rai)
EF_{Urea}	=	Greenhouse gas emission factor for urea (tonnes of carbon per tonne of urea)
$A_{s,i}$	=	Harvested area in growing season s of sample unit i (rai)
$\frac{44}{12}$	=	Molecular weight ratio of carbon dioxide to carbon

The ex-ante ER calculation has shown that CO_2 emissions from urea are below 5%.

Ex-post Project emissions for $CO_{2UREA,\ PJ,s,i}$

These are assessed as zero, because negligible in ex-ante estimation.

Ex-ante Project emissions for $N_20_{SOIL,\ PJ,s,i}$

Nitrogenous fertilizers applied to cultivated land, whether in the form of chemical fertilizers, organic fertilizers, manure, or agricultural residues, undergo transformations by soil microorganisms through nitrification and denitrification processes. During these processes, direct nitrous oxide emissions occur. Additionally, indirect nitrous oxide emissions arise from losses due to ammonia and nitrogen oxide volatilization, as well as leaching or surface runoff, where lost nitrogen is transformed and released as nitrous oxide.

If the project requires an assessment of nitrous oxide emissions from nitrogen fertilizer application, the DNDC based modelling following the scientific principles for using models to assess greenhouse gas emissions from agricultural areas are detailed in Appendix 3 of T-VER-P-METH-13-08 Version 01. In addition, the document “Ex-ante Methodology Overview & Results,” prepared by Carbon Farm, has been shared as a confidential reference.

$$N_2O_{SOIL,PJ,s,i} = GWP_{N2O} \times fN_2O_{SOIL,PJ,s,i}$$ *Equation 3*

Where:

$N_2O_{SOIL,PJ,s,i}$	=	Nitrous oxide emissions from nitrogen fertilizer application in the project scenario in growing season s of sample unit i (tonnes of carbon dioxide equivalent)
$fN_2O_{SOIL,PJ,s,i}$	=	Nitrous oxide emissions from nitrogen fertilizer application in the project scenario obtained from the model in growing season s of sample unit i (tonnes of nitrous oxide)
GWP_{N2O}	=	Global warming potential of nitrous oxide (tonnes of carbon dioxide equivalent per tonne of nitrous oxide)

$$N_2O_{SOIL,PJ,s,i} = N_2O_{Direct,PJ,s,i} + N_2O_{Indirect,PJ,s,i} N_2O_{Indirect,PJ,s,i}$$
$$= N_2O_{ATD,PJ,s,i}$$
$$+ N_2O_{L,PJ,s,i} N_2O_{SOIL,PJ,s,i} N_2O_{Direct,PJ,s,i} \; N_2O_{Indirect,PJ,s,i} N_2O_{ATD,PJ,s,i} N_2O_{L,PJ,s,i} F_{SN,PJ,s,i} F_{ON,PJ,s,i} EF_{N2ODirect} EF_{ATD} EF_{LEACH} Frac_{GASF} Frac_{G}$$

Ex-post Project emissions for $N_20_{SOIL, PJ,s,i}$

Nitrogenous fertilizers applied to cultivated land, whether in the form of chemical fertilizers, organic fertilizers, manure, or agricultural residues, undergo transformations by soil microorganisms through nitrification and denitrification processes. During these processes, direct nitrous oxide emissions occur. Additionally, indirect nitrous oxide emissions arise from losses due to ammonia and nitrogen oxide volatilization, as well as leaching or surface runoff, where lost nitrogen is transformed and released as nitrous oxide. If the project requires an assessment of nitrous oxide emissions from nitrogen fertilizer application, the **modelling method** is used.

The assessment of nitrous oxide emissions from nitrogen fertilizer application is based on mathematical model following the scientific principles for using models to assess greenhouse gas emissions from agricultural areas are detailed in Appendix 3 of T-VER-P-METH-13-08 Version 01.

$$N_2O_{SOIL,PJ,s,i} = GWP_{N2O} \times fN_2O_{SOIL,PJ,s,i}$$

Where:

$N_2O_{SOIL,PJ,s,i}$	=	Nitrous oxide emissions from nitrogen fertilizer application in the project scenario in growing season s of sample unit i (tonnes of carbon dioxide equivalent)
$fN_2O_{SOIL,PJ,s,i}$	=	Nitrous oxide emissions from nitrogen fertilizer application in the project scenario obtained from the model in growing season s of sample unit i (tonnes of nitrous oxide)
GWP_{N2O}	=	Global warming potential of nitrous oxide (tonnes of carbon dioxide equivalent per tonne of nitrous oxide)

Potentially neglected emissions

The following emissions sources will be monitored and reported in the ex-post monitoring only if they should account to more than 5% of the total greenhouse gas emissions, as defined in the premium T-Ver methodology. These emissions have been excluded from the ex-ante estimation as they represent less than 5% of estimated total greenhouse gas emissions.

Carbon dioxide emissions from fossil fuel combustion

In cases where the project involves the use of machinery or equipment in addition to the existing management practices, such as laser land levelling (LLL) for land preparation or using pumps to pump water into or out of the field, it is necessary to assess the amount of carbon dioxide emissions from the combustion of fossil fuels, either from the use of fossil fuels or the use of electricity (such as electric tractors). It is not expected that neither LLL nor additional pumping will be needed for the implementation of this programme and it is therefore included in the neglected emissions. If the total greenhouse gas emissions exceed 5% of the amount of greenhouse gas reduction, the assessment of carbon dioxide emissions according to Method 3

(Section 5.2.6 from T-VER-P-METH-13-08), which is calculated using default values, would be calculated using the following equation:

$$CO_{2\,FUEL,PJ,s,i} = \sum\left(\left(FC_{PJ,s,i,a} \times NCV_a \times 10^{-6} \times EF_{CO2,a}\right) \times A_{s,i}\right) \times 10^{-3} + \sum\left(EC_{PJ,s,i} \times EF_{Elec,s} \times (1 + TDL_s) \times A_{s,i}\right)$$

Where:

$CO_{2\,FUEL,PJ,s,i}$	=	Amount of carbon dioxide emissions from the combustion of fossil fuels in the project during growing season s of sample unit i (tonnes of carbon dioxide equivalent)
$FC_{PJ,s,i,a}$	=	Quantity of fuel type a used in growing season s of sample unit i (units per rai)
$A_{s,i}$	=	Harvested area in growing season s of sample unit i (rai)
NCV_a	=	*Net calorific value of fuel type a (megajoules per unit)*
$EF_{CO2,a}$	=	Greenhouse gas emission factor from the combustion of fossil fuel type a (kilograms of carbon dioxide/terajoule)
a	=	Type of fossil fuel
$EC_{PJ,s,i}$	=	Electricity consumption in growing season s of sample unit i (MWh/rai)
$EF_{Elec,s}$	=	Greenhouse gas emission factor for electricity generation/consumption in growing season s (tCO_2/MWh)
TDL_s	=	Proportion of electricity loss in the power grid for electricity supply to the point of use in growing season s

Non-CO_2 emissions from biomass burning

The implementation of AWD practices is not expected to change the practices of burning rice stubble and straw within the project area. Nevertheless, if this activity was to occur and if the total greenhouse gas emissions from this activity would exceeds 5% of the total greenhouse gas reduction target, a more detailed assessment of greenhouse gas emissions from biomass burning would be required. This assessment should use Method 3 (Section 5.2.6 from T-VER-P-METH-13-08), which involves calculations using default values based on the following equation:

$$Non - CO_{2\,BURNing,PJ,s,i} = \frac{\sum MB_{PJ,s,i} \times C_f \times A_{burn,s,i} \times \left[\left(EF_{CH_4} \times GWP_{CH_4}\right) + \left(EF_{N_2O} \times GWP_{N_2O}\right)\right]}{10^6}$$

Where:

$Non - CO_{2\,BURNing,PJ,s,i}$	=	Greenhouse gas emissions from biomass burning in growing season s of sample unit i (tonnes of carbon dioxide equivalent)

$MB_{PJ,s,i}$ = Mass of rice stubble and straw burned in the baseline scenario in growing season s of sample unit i (kilograms per rai)

C_f = Burning factor of rice stubble and straw (proportion of biomass as fuel before burning)

$A_{burn,s,i}$ = Area burned in growing season s of sample unit i (rai)

EF_{CH4} = Methane emission factor from burning agricultural residues (grams of methane per kilogram of dry biomass burned)

EF_{N2O} = Nitrous oxide emission factor from burning agricultural residues (grams of nitrous oxide per kilogram of dry biomass burned)

GWP_{CH4} = Global warming potential of methane (tonnes of carbon dioxide equivalent per tonne of methane)

GWP_{N2O} = Global warming potential of nitrous oxide (tonnes of carbon dioxide equivalent per tonne of nitrous oxide)

10^6 = Unit conversion (grams per tonne)

3.3 Calculation of Leakage Emission

Code: T-VER-P-METH-13-08
Version: 1.0
Methodology/Tool : Enhanced Good Practices in Paddy Rice Field T-VER-P-TOOL-01-13

The Methodology T-VER-P-METH-13-08, as well as guidelines from FOEN, define leakage as any GHG emission impact outside the ITMO project boundary. The Methodology T-VER-P-METH-13-08 considers leakage for AWD to be negligible and therefore does not require any assessment. Most trade-offs are already integrated in the ER calculation (i.e.: estimates of nitrogen emissions, increased fuel consumption, etc). Other potential leakages (e.g.: changes in soil organic carbon) fall outside the scope determined by FOEN for implementing projects abroad under the Framework of the Article 6.2 of the Paris Agreement. Consequently, in line with the T-VER-P-METH-13-08 methodology, the programme is not considered to generate any leakage.

3.4 Summary of greenhouse gas emissions

Code: T-VER-P-METH-13-08
Methodology : Enhanced Good Practices in Paddy Rice Field **T-VER-P-TOOL-01-13**

$$ER_{total} = BE_y - PE_y - Leakage$$

Where:

ER_{total}	=	Total expected emission reductions over the project in year y (tonnes of carbon dioxide equivalent)
BE_y	=	Total baseline greenhouse gas emissions in year y (tonnes of carbon dioxide equivalent)
PE_y	=	Total greenhouse gas emissions from project activities in year y (tonnes of carbon dioxide equivalent)

Plausibility check and uncertainty assessment

Quantification models must undergo calibration and validation before being used. The validation serves two purposes. Firstly, it quantifies the uncertainty of the emissions reduction for the combination of the local agro-ecological climate and the change in practices (i.e. adopting AWD) targeted by the project. Secondly, it removes bias. In doing so, it ensures that the outcomes are consistent with the default factors. This, however, is only sufficient if the data put into the model is reasonable. To ensure this is the case, a data QA/QC will be performed, applying simple rules that remove outliers inconsistent with what is considered reasonable practice based on the Carbon Farm experience.

A plausibility check will also be performed during the monitoring, to ensure that fundamental parameters are clearly measured at both project and baseline site and cross-checked with data from other sources. In practice, monitoring values including water level data, are sense-checked as mentioned above, throughout the monitoring period. Moreover, AI will be used to check that PVC pipes are correctly installed, using the available photo evidence. In a similar manner, soil classification will be performed using OpenLandMap Digital Soil Mapping database, but will be cross-checked with sampled observations from farmer fields via photos. The closed-chamber measurements are themselves checked for outliers (see section above).

The plausibility check takes place as the model-level, therefore applies to the farmer, the province and the programme level. The uncertainty of the model is calculated during calibration and validation as described above and the uncertainty deduction is calculated as per the Verra Standard (VMD0053) and applied to all seasons

The model uncertainty is calculated per gas (e.g. CH_4 vs N_2O) and practice category. In the context of this project, the practice category refers to the change in irrigation regime. Where there is only one change in practice—from baseline irrigation categorized as continuous flooding to project irrigation of AWD—there will only be one category per gas. The model's uncertainty will be known once the project simulations are complete. The size of the uncertainty, as a percentage of the emission reduction, depends on the magnitude of the reduction and the number of fields in the project. This means an estimate of uncertainty can be provided once the practices are clearly defined. This will be possible only once farmers have been surveyed, with all required parameters for the DNDC model included. The final uncertainty will only be available for each reporting period once the observed practice adopted is available. The model's uncertainty is calculated at 90% confidence interval, which is aligned with guidance within T-VER-P-METH-13-08 for uncertainty quantification and deduction. This confidence interval of 90% is more conservative than the standard 67% requirement under Verra's VMD0053 guidance.

Once the model uncertainty is known, the uncertainty discount factor is calculated using the following table, as per T-VER-P-METH-13-08. The uncertainty and uncertainty deduction factor are multiplied together to calculate the uncertainty deduction.

One important detail is that, under VMD0053, the model's uncertainty is calculated directly for the emission reduction. It is not calculated separately for baseline and project emissions, contrary to the example in the table below extracted from the premium T-Ver methodology. This approach streamlines the process and aligns with statistical best practices. As the primary focus is on the uncertainty in emission reduction, it is logical to quantify it directly.

Uncertainty (U)	Uncertain Deduction Factor (U_d)	Applicability
20<U≤30	50%	**Example** Mean value = 60 ± 15 tCO_2eq Calculate uncertainty (U) = 15/60 x 100 = 25% Deduction factor (U_d) = 25% x 15 = 3.75 tCO_2eq The discount calculation is based on principle of conservativeness as follows: **Baseline** = 60 - 3.75 = 56.25 tCO_2eq **Project implementation** = 60 + 3.75 = 63.75 tCO_2eq
30<U≤40	75%	
U>40	100%	

The 90% confidence level sets a relatively high bar. Given the current state of the DNDC model, it would be prudent to conservatively assume an uncertainty range of 30-40%. If we take the value of 35% uncertainty, this implies a 26.25% reduction applied to the emission reduction. This is a conservative value. If the true value is below 30%, the uncertainty reduction will be below 15%

Further information on how the model deals with uncertainty has been provided separately to the validators.

3.5 Summary of estimated greenhouse gas emission reductions

Year	d/m/y – d/m/y	Baseline Emission	Project Emission	Leakage Emission	Emission Reduction
1	15/06/2026-31/12/2026	163	117	NA	46
2	01/01/2027-31/12/2027	163	117	NA	46
3	01/01/2028-31/12/2028	163	117	NA	46
4	01/01/2029-31/12/2029	163	117	NA	46
5	01/01/2030-31/12/2030	163	117	NA	46
6	01/01/2031-31/12/2031	163	117	NA	46
7	01/01/2032-31/12/2032	163	117	NA	46
8	01/01/2033-31/12/2033	163	117	NA	46
9	01/01/2034-31/12/2034	163	117	NA	46
10	01/01/2035-31/12/2035	163	117	NA	46
11	01/01/2036-31/12/2036	163	117	NA	46
12	01/01/2037-31/12/2037	163	117	NA	46
13	01/01/2038-31/12/2038	163	117	NA	46
14	01/01/2039-31/12/2039	163	117	NA	46
15	01/01/2040-31/12/2040	163	117	NA	46
16	01/01/2041-31/12/2041	163	117	NA	46
17	01/01/2042-31/12/2042	163	117	NA	46
18	01/01/2043-31/12/2043	163	117	NA	46
19	01/01/2044-31/12/2044	163	117	NA	46
20	01/01/2045-31/12/2045	163	117	NA	46
	01/01/2046-14/06/2046	0	0	NA	0
Total (tCO_2eq)		**815**	**585**		**231**
Average (tCO_2e/y)		**126**	**79**		**47**
Total until end crediting period (tCO_2eq)		**3,262**	**2,339**		**923**

Average until end crediting period (tCO_2eq)	**163**	**117**		**46**

Part 4 Monitoring Plan of Project

4.1 Monitoring Plan

Monitoring of project implementation has been designed to comprehensively cover all key activities within the project area, ensuring data accuracy and enabling systematic assessment of greenhouse gas emission reductions. Responsibilities are clearly assigned at each level, including farmers, the project developer, and field coordinators, to ensure that implementation follows the planned framework and allows for full traceability. The monitoring structure and the relationships among relevant stakeholders are clearly defined in the project document appendix.

4.1.1 Organizational structure for monitoring and roles and responsibilities

To ensure effective project implementation, the roles and responsibilities of relevant stakeholders have been clearly defined as follows:

1) Project Owner

Participating farmers are the primary implementers of project activities in the field and the direct beneficiaries of the project, both in terms of agricultural productivity and income generation from carbon credits.

Roles and responsibilities:

- Implement cultivation practices in their fields in accordance with greenhouse gas mitigation principles, such as the AWD system
- Carry out activities in line with the project plan
- Cooperate with the project team in data collection and record-keeping, including cultivation practices, water management, and related activities through the designated system
- Facilitate site access for monitoring, inspection, and field data collection

2) Project Participant

myclimate Company is responsible for defining the overall project framework, including standards, methodologies, and carbon credit management.

Roles and responsibilities:

- Design the project in accordance with the requirements of the Thailand Greenhouse Gas Management Organization (TGO)
- Establish methodologies for calculating and monitoring greenhouse gas emission reductions
- Ensure data quality control and oversee overall project implementation
- Submit applications for carbon credit certification and manage issued credits

3) Co-Project Participant

Varuna (Thailand) Co., Ltd. is responsible for implementation at the field level of this first CPA, focusing on data collection, coordination, and farmer support. For the following CPAs, the implementation partner is Wave BCG.

Roles and responsibilities:

- Coordinate with farmers and local stakeholders
- Monitor and verify field-level activities
- Collect field data, such as water management, fertilizer application, and photographic evidence
- Prepare reports for use in calculations and verification processes

- Varuna (Thailand) Co., Ltd. Will provide support with the use of fertilization with drones and the app Smart Watcher that supports farmers in the implementation of AWD activities.

4) Field Project Coordinator

The Field Project Coordinator is responsible for managing and supervising project implementation at the field level to ensure that all activities are conducted according to the project plan and monitoring requirements.

Roles and responsibilities:

- Plan and supervise farmer activities to ensure alignment with project guidelines
- Verify the accuracy, completeness, and consistency of data recorded by farmers
- Monitor overall implementation progress and evaluate project performance
- Conduct field verification, including AWD water levels and fertilizer use
- Coordinate with the project developer to report progress and resolve issues

- Validate data prior to its use in reporting

5) Sub-Coordinator

The Sub Field Coordinator supports implementation at the group or plot level, focusing on practical assistance and local coordination to ensure continuous operations.

Roles and responsibilities:

- Communicate project guidelines to farmers and monitor daily practices
- Assist farmers with basic data recording
- Facilitate field data collection
- Compile preliminary data from farmers and submit it to the Field Project Coordinator
- Report issues, challenges, or irregularities observed in the field
- Support the use of project tools, such as the Smart Watcher application

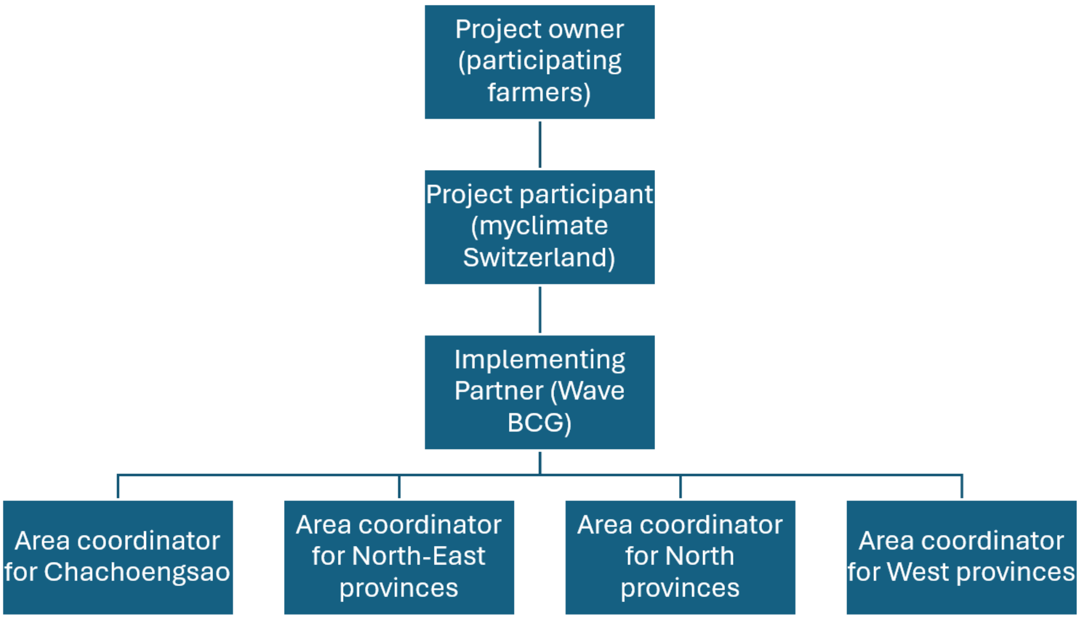

Figure 16: Organizational structure for monitoring and roles and responsibilities. Please note that for this First CPA the implementing partner is Varuna while for subsequent CPA the implementing partner will be Wave BCG.

4.1.2 Carbon Credit Certification Process

myclimate Company, as the Project Participant, and Varuna (Thailand) Co., Ltd. as the Co-Project Participant, are responsible for managing the carbon credit certification process in accordance with the standards set by the Thailand Greenhouse Gas Management Organization (TGO). The key stakeholders and their roles are as follows:

1) Participating Farmers

Farmers implement project-prescribed practices, such as Alternate Wetting and Drying (AWD), maintain records of cultivation activities, and grant access to project teams for field monitoring and data collection.

2) Varuna (Thailand) Co., Ltd. (Co-Project Participant)

Varuna (Thailand) Co., Ltd. is responsible for collecting field data from participating farmers, verifying data accuracy, and preparing greenhouse gas emission reduction reports. The company also coordinates with external entities involved in the project validation and verification processes.

3) Submission to TGO

Varuna (Thailand) Co., Ltd. prepares the Project Design Document (PDD) in accordance with TGO methodologies and submits it to TGO for preliminary review and consideration.

4) Validation and Verification Process

An independent third-party Validation/Verification Body (VVB), namely PSUVVB Center of Measurement and Standard Accreditation, Faculty of Science, Prince of Songkla University, conducts the validation and verification of project data and documentation. Varuna (Thailand) Co., Ltd. acts as the focal point for coordination and responds to all inquiries until the process is completed.

5) Carbon Credit Allocation

Upon successful certification, myclimate Company (Project Participant) holds the ownership of the carbon credits and manages their registration in the official registry system.

Varuna (Thailand) Co., Ltd. supports the allocation, transfer, or utilization of carbon credits in accordance with the agreed project framework.

4.1.3 Field Monitoring via Smart Watcher

The **Smart Watcher** application is designed to collect and monitor data necessary to calculate ex-post mitigation outcomes. The application is accessed by a QR code that the farmers can easily scan from their phone. The primary focus of the application is tracking key agricultural and environmental parameters that are crucial for verifying the effectiveness of mitigation practices.

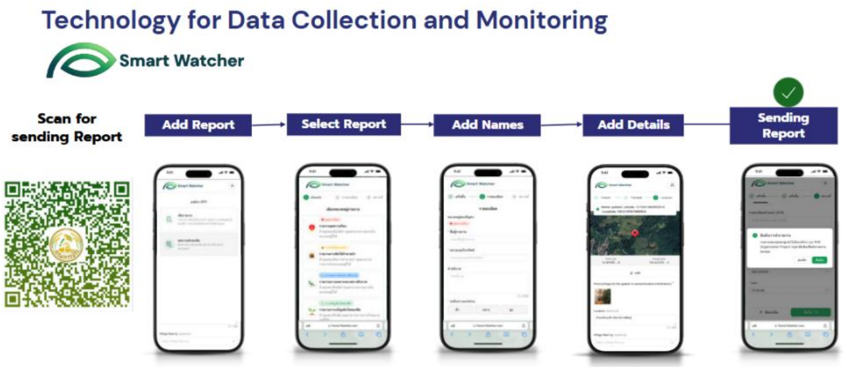

Figure 16: Smart Watcher Application: How it works

The platform conveniently supports and guides the farmers in the process of data entry. Above is an illustration of some of the data that the farmer can enter on the platform. Farmers collect field-specific data on crop growth and conditions, such as pictures of activities in the field, pictures of water level, input on field data and yield estimates. The collected data is then uploaded to a centralized digital platform called **Smart Farm platform** where it is analysed using ground data and satellite data. Multiple parameters are collected and used to monitor the AWD practices and ensure that mitigation outcomes are verifiable and reliable for carbon credit generation.

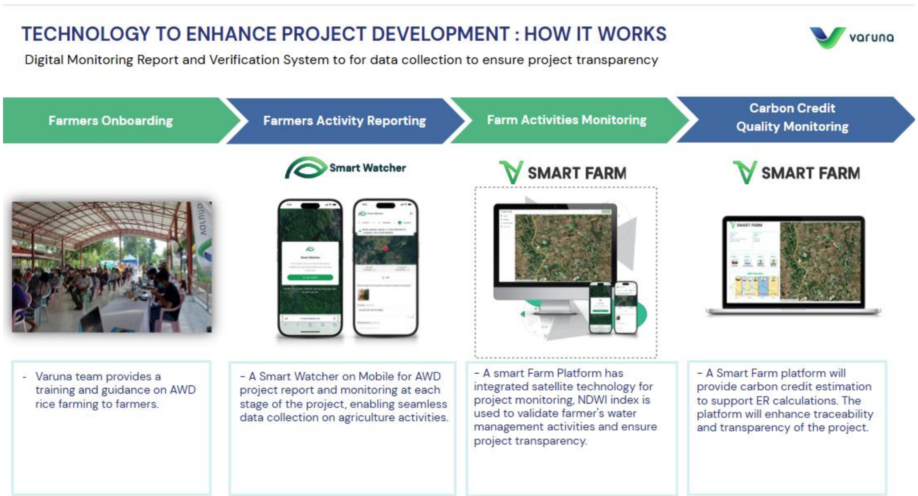

Figure 17: Smart Farm Platform : How it work

It is possible that the digital monitoring tool and system for data collection will be upgraded during the implementation. It is not expected that the collected parameters will change, but rather that, to improve accuracy and ease of data collection, a different system may be put in place: any change will be communicated in the yearly monitoring report for this CPAs.

4.1.4 Satellite-MRV

Satellite-based MRV is used to monitor rice cultivation activities at a high spatial and temporal resolution using a combination of Synthetic Aperture Radar (SAR) and optical remote sensing data. SAR data is used as the primary data source due to its ability to penetrate cloud cover and vegetation canopy, allowing for all-weather monitoring, particularly important in tropical rice-growing regions with persistent cloud cover, e.g., Thailand.

The different practices assessed by the remote-sensing approach include: (1) initial seeding/transplanting dates; (2) field drainage events, which are critical for identifying AWD practices; (3) harvest dates.

4.1.5 Process-Based Model Approach

The methane emissions reduction estimation will be calculated with a process-based model approach. A mathematical model calibrated specifically for two climatic regions in Thailand and validated under the Verra standard will be applied for the calculation of emissions reduction.

Direct measurements with closed chambers will be carried out through the entirety of the programme as a plausibility check.

The input data of the model, which corresponds to the factors affecting ER, are a combination of remote sensing data and data collected from the field via the Smart Farm Platform. Satellite imagery will be used for broader-scale monitoring, offering real-time insights into the cropping calendar, the irrigation practices and drainages employed in the field, and the burning of straw residue. Complementing this, mobile data collection tools will enable farmers to capture on-the-ground data, such as picture of tube with water depth, plant growth stages and yield data. These data sources will be integrated, analysed and used as inputs to the validated mathematical model.

4.2 Parameters not monitored

Parameter	NCVa
Unit	MJ/unit
Value	36.42
Description	Net calorific value (NCV) of fuel a
Source of data	Option 1 The net calorific value of fossil fuels indicated on the invoice from the fuel supplier. Option 2 From monitoring Option 3 Thailand Energy Statistics Report, Department of Alternative Energy Development and Efficiency, Ministry of Energy
Remark	-

Parameter	$EF_{CO_2,a}$
Unit	kgCO2/TJ
Value	74100
Description	Emission factor for combustion of fossil fuel a
Source of data	IPCC Guidelines 2006, Volume 2, Chapter 1, Table 1.4
Remark	-

Parameter	EF_{CH_4}
Unit	gCH4/kg dry matter of biomass burnt

Value	2.70
Description	Methane emission factor for biomass burning In cases where the IPCC default is applied, a value of 2.7 is assigned.
Source of data	IPCC Guidelines 2019, Volume 4, Chapter 2, Table 2.5
Remark	-

Parameter	EF_{N2O}
Unit	gN2O/kg dry matter of biomass burnt
Value	0.07
Description	Nitrous oxide emission factor for biomass burning In cases where the IPCC default is applied, a value of 0.07 is assigned.
Source of data	IPCC Guidelines 2019, Volume 4, Chapter 2, Table 2.5
Remark	-

Parameter	C_f
Unit	fraction on biomass being burnt in the field
Value	0.8
Description	Combustion factor for rice stubble and straw In cases where the IPCC default is applied, a value of 0.8 is assigned.
Source of data	IPCC Guidelines 2019, Volume 4, Chapter 2, Table 2.6
Remark	-

Parameter	$\boldsymbol{TDL_s}$
Unit	-
Value	0.03
Description	Proportion of power losses in the electrical network for electricity supply to end-use locations in season s A value of 0.03 (3%) is assigned.
Source of data	-
Remark	-

4.3 Monitored Parameters

Data / Parameter 1:	GWP_{CH4}
Data unit:	tCO_2eq/tCH_4

Description:	Global warming potential of methane
Measurement procedures (if any):	For project proposal documents: use the latest GWP_{CH4} value announced by TGO, according to IPCC Fourth Assessment (AR4) 2007. For monitoring greenhouse gas reduction: use the GWP_{N2O} value announced by TGO to assess the amount of greenhouse gases during the crediting period for greenhouse gas certification.
Monitoring frequency:	Every time TGO announces a new value
Source of data:	IPCC Fourth Assessment (AR4) 2007 The latest value announced by TGO (October 27, 2021)
QA/QC procedures	Default value

Data / Parameter 2:	GWP_{N_2O}
Data unit:	$tCO_2eq/tN2O$
Description:	Global warming potential of N2O
Measurement procedures (if any):	For project proposal documents: Use the latest GWPN2O value announced by TGO, according to IPCC Fourth Assessment (AR4) 2007. For monitoring greenhouse gas reduction: use the GWPN2O value announced by TGO to assess the amount of greenhouse gases during the crediting period for greenhouse gas certification.
Monitoring frequency:	Every time TGO announces a new value
Source of data:	IPCC Fourth Assessment (AR4) 2007 The latest value announced by TGO (October 27, 2021)[3]
QA/QC procedures	Default value

Data / Parameter 3:	$A_{s,i}$
Data unit:	Rai (1 rai = 0.16 ha)
Description:	Harvested area in growing season s of sample unit i
Measurement procedures (if any):	On-site survey: physical inspection of the area. Satellite/aerial imagery: using satellite or aerial photographs to assess the land.
Monitoring frequency:	Every growing season

[3] https://ghgreduction.tgo.or.th/en/premium-t-ver-download/download/6964/3553/32.html

Source of data:	Survey report with geographic references
QA/QC procedures	The geological survey report and satellite image data are thoroughly checked for completeness

Data / Parameter 4:	L_s
Data unit:	Day
Description:	Rice harvesting age in growing season s
Measurement procedures (if any):	On-site survey: physical inspection of farmer record
Monitoring frequency:	Every growing season
Source of data:	Digital record
QA/QC procedures	Data completeness check from farmer records

Data / Parameter 5:	**Water Management During the Growing Season**
Data unit:	-
Description:	• Continuous flooding throughout the growing season • Periodic flooding with one drainage • Periodic flooding with multiple drainages: The field is flooded and drained multiple times, including the practice of alternate wetting and drying, where the water level is lowered to 10-15 cm below the soil surface
Measurement procedures (if any):	On-site survey: physical inspection of farmer record and project area
Monitoring frequency:	Throughout the growing season
Source of data:	Digital record
QA/QC procedures	Data completeness check from farmer or project developer records

Data / Parameter 6:	**Pre-Planting Water Management**
Data unit:	**-**

Description:	• Flooding for more than 30 days before planting • Short-term flooding of less than 30 days before planting • No flooding for less than 180 days before planting • No flooding for more than 180 days before planting • No flooding for more than 365 days or crop rotation without flooding
Measurement procedures (if any):	On-site survey: physical inspection of farmer record and project area
Monitoring frequency:	Throughout the growing season
Source of data:	Digital record
QA/QC procedures	Data completeness check from farmer or project developer records

Data / Parameter 7	$MSN_{,PJ,s,i,j}$
Data unit:	Tonnes of nitrogen from chemical fertilizer per rai
Description:	Quantity of chemical fertilizer used in the project during growing season s of sample unit i, fertilizer type j
Measurement procedures (if any):	Data collected and recorded by farmers using appropriate methods (corroborated with photo provided via Smart Watcher)
Monitoring frequency:	Throughout the growing season
Source of data:	Digital record
QA/QC procedures	Data completeness check from invoices or withdrawal records or farmer or project developer records
Any comment:	The parameter is not utilized for ex-ante estimation of emission reductions, while for ex-post verification, it serves to demonstrate whether the application of nitrogen-based chemical fertilizers has been reduced by at least 5% compared to baseline levels, in accordance with the requirements outlined in T-VER-P-METH-13-08 Version 01.

Data / Parameter 9	$FC_{PJ,s,i,a}$
Data unit:	Units per rai

Description:	Quantity of fuel type a used in growing season s of sample unit i This is monitored to ensure that the emissions due to CO2 are less than 5% of the project emissions and can therefore be excluded. The ex-ante model does not include CO2 emissions from fuel; ex-post will include CO2 emissions from fuel only if they are above 5% of total project emissions.
Measurement procedures (if any):	Option 1: If fuel is purchased or withdrawn all at once without storage, the quantity used can be tracked from invoices or withdrawal records. Option 2: If fuel is stored and used from a storage container, the quantity used should be measured and recorded continuously.
Monitoring frequency:	Throughout the growing season
Source of data:	Digital record from invoices or withdrawal records provided by the farmers on the Smart Farmer application
QA/QC procedures	Data completeness check from invoices or withdrawal records or farmer or project developer records

Data / Parameter 10	$MB_{PJ,s,i}$
Data unit:	kg/rai
Description:	Mass of rice stubble and straw burned in the baseline scenario in growing season s of sample unit i This is monitored to ensure that the emissions due to CO2 are less than 5% of the baseline emissions and can therefore be excluded. The ex-ante model does not include CO2 emissions from straw burning; ex-post will include CO2 emissions from straw burning only if they are above 5% of total baseline emissions.
Measurement procedures (if any):	Use the proportion of agricultural residues to yield based on suitable reference documents for the project area corroborated with photo provided via Smart Watcher.
Monitoring frequency:	Throughout the growing season
Source of data:	Digital record
QA/QC procedures	Data completeness check from farmer or project developer records

Data / Parameter 11	$ROA_{PJ,s,i,om}$
Data unit:	Kilograms per rai, dry weight for straw and fresh weight for other materials

Description:	Quantity of organic material type OM applied in the project during growing season s of sample unit i
Measurement procedures (if any):	Data collected and recorded by the farmer or project developer using via the Smart Watcher Platform (e.g.: photos of farm record book)
Monitoring frequency:	Throughout the growing season
Source of data:	Digital records
QA/QC procedures	Data completeness check from farmer or project developer records
Any comment:	The parameter is not utilized for ex-ante estimation of emission reductions, while for ex-post verification, it serves as an input of the mathematical model.

Data / Parameter 12	$fN_2O_{SOIL,BL,s,i}$
Data unit:	Tonnes of nitrous oxide
Description:	Quantity of nitrous oxide emissions from nitrogen fertilizer application in the baseline scenario obtained from a model in growing season s of sample unit i
Measurement procedures (if any):	Details according to the selected evaluation method, including sampling and data, the use of reference values or recommended values from reliable sources, and calculations using appropriate equations. The scientific principles for using models to assess greenhouse gas emissions from agricultural areas are detailed in Appendix 3 of T-VER-P-METH-13-08 Version 01.
Monitoring frequency:	According to the round of evaluation and monitoring for certification
Source of data:	Measurement report: The values are obtained from the mathematical model that predicts greenhouse gas emissions from agricultural areas, such as CH_4 and N_2O emissions from soil. The sources of the model include: (1) collecting actual emission data from the project area, (2) emission data from experimental plots or research plots, or (3) data from high-quality academic literature, such as those reviewed by experts or published in academic journals, can be used. The selected reference data should be appropriate and applicable to the project area, especially if there is data consistent with the control factors or agricultural activities of the project.
QA/QC procedures	Appendix 3 - T-VER-P-METH-13-08 Version 01. Mathematical model will go through Independent Model Evaluation prior to verification.

Data / Parameter 13	$fN_2O_{SOIL,PS,s,i}$
Data unit:	Tonnes of nitrous oxide
Description:	Quantity of nitrous oxide emissions from nitrogen fertilizer application in the project scenario obtained from a model in growing season s of sample unit i
Measurement procedures (if any):	Details according to the selected evaluation method, including sampling and data, the use of reference values or recommended values from reliable sources, and calculations using appropriate equations. The scientific principles for using models to assess greenhouse gas emissions from agricultural areas are detailed in Appendix 3 of T-VER-P-METH-13-08 Version 01.
Monitoring frequency:	According to the round of evaluation and monitoring for certification
Source of data:	Measurement report: The values are obtained from the mathematical model that predicts greenhouse gas emissions from agricultural areas, such as CH_4 and N_2O emissions from soil. The sources of the model includes: (1) collecting actual emission data from the project area, (2) emission data from experimental plots or research plots, or (3) data from high-quality academic literature, such as those reviewed by experts or published in academic journals, can be used. The selected reference data should be appropriate and applicable to the project area, especially if there is data consistent with the control factors or agricultural activities of the project.
QA/QC procedures	Appendix 3 - T-VER-P-METH-13-08 Version 01. Mathematical model will go through Independent Model Evaluation prior to verification.

Data / Parameter 14	$fCH_{4SOIL,BSL,i,t}$
Data unit:	Tonnes of methane
Description:	Quantity of methane emissions from soil carbon sources in the baseline scenario obtained from the model, in growing season s of sample unit i

Measurement procedures (if any):	Details according to the selected evaluation method, including sampling and data, the use of reference values or recommended values from reliable sources, and calculations using appropriate equations. The scientific principles for using models to assess greenhouse gas emissions from agricultural areas are detailed in Appendix 3 of T-VER-P-METH-13-08 Version 01.
Monitoring frequency:	According to the round of evaluation and monitoring for certification
Source of data:	Measurement report: The values are obtained from mathematical model that predicts greenhouse gas emissions from agricultural areas, such as CH_4 and N_2O emissions from soil. The sources of the model includes (1) collecting actual emission data from the project area, (2) emission data from experimental plots or research plots, or (3) data from high-quality academic literature, such as those reviewed by experts or published in academic journals, can be used. The selected reference data should be appropriate and applicable to the project area, especially if there is data consistent with the control factors or agricultural activities of the project.
QA/QC procedures	Appendix 3 - T-VER-P-METH-13-08 Version 01. Mathematical model will go through Independent Model Evaluation prior to verification.

Data / Parameter 15	$fCH_{4SOIL,PJL,i,t}$
Data unit:	Tonnes of methane
Description:	Quantity of methane emissions from soil carbon sources in the project scenario obtained from the model, in growing season s of sample unit i
Measurement procedures (if any):	Details according to the selected evaluation method, including sampling and data, the use of reference values or recommended values from reliable sources, and calculations using appropriate equations. The scientific principles for using models to assess greenhouse gas emissions from agricultural areas are detailed in Appendix 3 of T-VER-P-METH-13-08 Version 01.
Monitoring frequency:	According to the round of evaluation and monitoring for certification

Source of data:	Measurement report: The values are obtained from the mathematical model that predicts greenhouse gas emissions from agricultural areas, such as CH_4 and N_2O emissions from soil. The sources of the model includes: (1) collecting actual emission data from the project area, (2) emission data from experimental plots or research plots, or (3) data from high-quality academic literature, such as those reviewed by experts or published in academic journals, can be used. The selected reference data should be appropriate and applicable to the project area, especially if there is data consistent with the control factors or agricultural activities of the project.
QA/QC procedures	Appendix 3 - T-VER-P-METH-13-08 Version 01. Mathematical model will go through Independent Model Evaluation prior to verification.

Data / Parameter 16	$EC_{PJ,s,i}$
Data unit:	MWh
Description:	Electricity consumption in growing season s of sample unit i This is monitored to ensure that the emissions due to CO2 are less than 5% of the project emissions and can therefore be excluded. The ex-ante model does not include CO2 emissions from electricity use; ex-post will include CO2 emissions from electricity use only if they are above 5% of total project emissions.
Measurement procedures (if any):	Modelling calculation based on rated power from equipment manufacturers and recorded operating hours of machinery/equipment from farmers information via the Smart Farmer application, throughout the growing season
Monitoring frequency:	Throughout the growing season
Source of data:	Measurement report
QA/QC procedures	Data completeness check from kWh Meter measure or farmer or project developer records

Data / Parameter 17	$EF_{Elec,s}$
Data unit:	Greenhouse gas emission factor for electricity production/consumption in growing season s This is monitored to ensure that the emissions due to CO2 are less than 5% of the project emissions and can therefore be excluded. The ex-ante model does not include CO2 emissions from electricity use; ex-post will include CO2 emissions from electricity use only if they are above 5% of total project emissions.
Description:	Greenhouse gas emission factor report for electricity production/consumption from projects and activities to reduce greenhouse gases, as announced by TGO.
Measurement procedures (if any):	For project proposal documents: ● Use the latest EFElec,y value announced by TGO. For monitoring greenhouse gas reduction: ● Use the EFElec,y value announced by TGO to assess the amount of greenhouse gases during the crediting period for greenhouse gas certification. However, if TGO has not yet announced an EFElec,y value for that specific year, use the most recent EFElec,y value announced by the TGO for that year instead.
Monitoring frequency:	Every time TGO announces a new value
Source of data:	For project proposal documents: based on latest value announced by TGO (October 30, 2022)[4]
QA/QC procedures	Default value

Project Parameter Monitoring Plan

Monitored Parameters	Units	Measurement / Monitoring Methods	Monitoring Frequency	Responsible Parties	Data Sources / Tools	Remarks
Project location	-	Verify plot coordinates using GPS	Once per year	Field Project Coordinator	GPS / GIS maps	Used to verify project boundary
Project area size	Rai	Land title documents combined with GPS verification	Once per year	Field Project Coordinator	Land title deed / GPS	Used for GHG emission calculations
Changes in land tenure/land use rights	-	Verification of land ownership documents	Once per year	Varuna (Thailand) Co., Ltd.	Official documents	Must be updated whenever changes occur

[4] https://ghgreduction.tgo.or.th/en/premium-t-ver-download/download/6966/3801/32.html

Monitored Parameters	Units	Measurement / Monitoring Methods	Monitoring Frequency	Responsible Parties	Data Sources / Tools	Remarks
Water level in the field (AWD)	cm	Measurement using AWD tube and photographic evidence	Weekly	Sub Field Coordinator	AWD tube / Smart Watcher	Key parameter for CH_4 calculation
Number of wetting–drying cycles	times per cropping cycle	Recording based on water level observations	Weekly	Sub Field Coordinator	Smart Watcher	Used to confirm actual AWD implementation
Duration of dry periods	days	Calculation based on water level data	Weekly	Sub Field Coordinator	Application / field records	Important for emission factor determination
Water consumption	m³/rai	Estimation based on pumping duration and flow rate	Per cropping cycle	Participating Farmers / Sub Field Coordinator	Water pump / water usage records	Used to assess water savings
Chemical fertilizer application	kg/rai	Recording of fertilizer application	Per cropping cycle	Sub Field Coordinator	Receipts / records	Used for N_2O calculation
Organic fertilizer application	kg/rai	Farmer-recorded data	Per cropping cycle	Sub Field Coordinator	Farmer records	If applicable
Lime application (for saline soils)	kg/rai	Usage records	Per cropping cycle	Sub Field Coordinator	Receipts / photographs	Important in saline soil areas
Biomass burning	kg/rai	Survey/interview methods	Per cropping cycle	Sub Field Coordinator	Photographs / reports	Must specify presence/absence
Rice varieties used	-	Farmer-recorded data	Per cropping cycle	Sub Field Coordinator	Project forms	e.g., 107 / 111
Planting date / harvesting date	date	Activity records	Per cropping cycle	Sub Field Coordinator	Smart Watcher	Used to determine growth stages
Rice yield	kg/rai	Recording of actual yield	Per cropping cycle	Sub Field Coordinator	Photographs / reports	Used to assess productivity
Fuel consumption (diesel)	L/rai	Recording of fuel usage	Per cropping cycle	Participating Farmers	Receipts	Used for CO_2 calculation
Soil conditions (e.g., saline soil)	-	Estimation based on area	Once per year	Varuna (Thailand) Co., Ltd.	Area reports	Used as a static parameter

Part 5 Local Stakeholder Consultation

5.1 Stakeholders consultation process

The stakeholder consultation process for the AWD rice farming project under T-VER Premium is designed to ensure transparency, inclusiveness, and community ownership. The process begins with early engagement, where local stakeholders—including farmers, community leaders, local government agencies, women's groups, and vulnerable populations—are informed about the project's objectives, methods, and expected impacts. Public hearings and focus group discussions are then conducted in project areas to gather feedback on potential benefits, risks, and challenges, with attention to diverse perspectives such as age, gender, education level, and farming experience. Inputs from these consultations are systematically recorded, analyzed, and incorporated into the project design to improve feasibility and responsiveness to local needs. The process also includes continuous two-way communication, where stakeholders are updated on project progress, monitoring results, and grievance mechanisms, ensuring that concerns can be raised and addressed throughout implementation.

Stakeholder	Role and Responsibilities
Farmers	- Project Implementors
Local Community (Village Head, Subdistrict Head, District Officer)	- Project Supporters
Government Agencies	- Provide policies and support for AWD - Ensure the project complies with laws and government policies
Private Sector	- Supply necessary materials, equipment, and technology - Participate in promoting marketing and product sales
Academics and Agricultural Experts	- Provide technical guidance on AWD rice cultivation - Assess project impacts and feasibility

5.2 Summary of comments from stakeholders

The stakeholder engagement meeting, held on 26 February 2025 at the Agricultural Learning Center for Increasing Production Efficiency in Village 4, Don Ko Ka Subdistrict, Bang Nam Prieo District, Chachoengsao Province, aimed to gather opinions, concerns, and attitudes from diverse stakeholders, including details such as gender, age, education level, and occupation. This meeting served as the first public hearing for the Alternate Wetting and Drying (AWD) rice farming project, which will begin in Chachoengsao and expand to Kanchanaburi, Nakhon Pathom, Uttaradit, Sukhothai, Khon Kaen, Maha Sarakham, and Nong Bua Lamphu.

The objectives were to build understanding and awareness of the project's approach, operations, and potential benefits, while also acknowledging possible impacts. It promoted participatory decision-making by enabling stakeholders to express their views, thereby ensuring inclusivity and community acceptance. The meeting also assessed potential economic, social, and environmental impacts to support effective implementation and minimize risks. Additionally, it strengthened relationships among government agencies, private sector actors, and local communities through information exchange and mutual understanding.

Summary of Participants (By Gender, Age, Farming Experiences and Roles)

Gender	No. of people	Percentage (%)
Male	11	61.11
Female	7	38.89
Total	18	100

Age	No. of people	Percentage (%)
Less than 30 years old	0	0
31-40 years old	4	22.2
41-50 years old	5	27.8
Above 51 years	9	50
Total	18	100

Farming Experiences	No. of people	Percentage (%)
1-5 years	2	11.11
6-10 years old	3	16.67

Farming Experiences	No. of people	Percentage (%)
11-20 years old	3	16.67
Above 21 years	7	38.89
	3	16.67
Total	18	100

Role	No. of people	Percentage (%)
Farmers	11	61.11
Local Leaders	2	11.11
Government	5	27.78
Others	0	0
Total	18	100

Summary of Comments

1. In the past, how has local agriculture in your area been affected?

Farmers explained that their agricultural activities have faced many challenges over the years. Unstable weather conditions and recurring droughts have reduced productivity and made rice farming increasingly uncertain. High production costs, unstable crop prices, and persistently low rice prices have placed significant financial pressure on farming households. Poor soil quality has also contributed to reduced yields, while pests and environmental problems add further difficulties. Despite these hardships, some farmers highlighted positive experiences with Alternate Wetting and Drying (AWD) cultivation, as it uses less water and can help reduce environmental impacts.

2. What concerns do you have about this project?

Several concerns were raised regarding the implementation of this project. Farmers worried about the compatibility of the rice varieties grown locally with AWD techniques and the increased risk of pests, such as rats, during dry periods. Additional challenges include saline soil areas, weed management, and potential rat infestations. Many farmers expressed uncertainty about the clarity, sustainability, and long-term commitment of the project, questioning whether companies involved would continue to provide sufficient support. Concerns were also raised about the willingness of farmers to adopt low-carbon rice cultivation, especially among elderly farmers who may prefer traditional methods and struggle with the introduction of new technology or applications. Farmers further questioned whether compensation would be attractive enough and whether the trial period would justify the effort and potential risks involved.

3. What are your additional expectations for this project?

Despite these concerns, farmers have clear expectations for positive outcomes. They hope the project will lead to higher yields, lower production costs, and increased income through AWD rice farming. Expectations also include achieving better rice prices, both domestically and internationally, and securing more stable markets for high-quality rice. Farmers want the project to deliver tangible benefits, such as improved livelihoods and reduced environmental impacts, and they emphasize the importance of the project being long-term, with continuity to ensure lasting results. Many expressed interests in field visits tailored to local conditions, as well as opportunities for study tours and practical training on AWD methods, where farmers can learn directly from experts while practicing alongside project staff. Ultimately, they expect the project to provide economic stability, environmental sustainability, and greater opportunities for accessing premium markets, ensuring that both current and future generations of farmers can benefit.

4. Improvement and mitigation measures for identified issues

Based on the stakeholder consultation meeting, key issues and improvement measures for the implementation of Alternate Wetting and Drying (AWD) rice cultivation were identified and summarized as follows:

4.1 Suitable rice varieties

The project recommends the use of certified RD rice varieties approved by the Rice Department, including RD113, RD117, and RD119, which are suitable for irrigated areas to ensure efficient productivity and alignment with local conditions.

4.2 Pests during the dry season (rodents)

Rodent management in AWD rice fields during the dry season includes:

1) Monitoring: Inspecting rice fields and bunds at least once per week to observe signs of damage such as burrows and stem feeding.

2) Environmental management: Cutting grass, removing weeds around bunds and irrigation canals, and repairing bunds to reduce rodent shelter.

3) Mechanical control: Installing traps along bunds and affected areas, and regularly adjusting trap placement to improve effectiveness.

4) Chemical control (if necessary): Using safe and recommended methods in accordance with relevant authorities, while avoiding harsh chemicals.

5) Data recording: Recording dates, control methods, and results for monitoring and project evaluation purposes.

3. Saline soil areas

Saline soil management focuses on salt leaching through repeated flooding and drainage (2–3 cycles) prior to land preparation, combined with soil improvement using organic amendments such as manure, rice husk, and gypsum to enhance soil fertility. Salt-tolerant rice varieties such as KDML105 and RD6 are recommended, using 30–35-day-old seedlings for transplanting. Post-harvest mulching is also applied to reduce salt accumulation in the soil.

4. Rodent outbreaks

Rodent control is implemented through bund vegetation management, burrow destruction, and the use of traps and rodenticides in accordance with recommendations from the Department of Agriculture. Community-wide cooperation is essential to effectively reduce rodent outbreaks.

5. Weeds

The project implements integrated weed management, including land preparation and plowing, water level control under the AWD system to suppress weed germination, mechanical or manual weeding, and the judicious use of herbicides based on technical recommendations to minimize environmental impact and maintain productivity.

6. Project clarity and sustainability

The project has clearly defined operational guidelines with a systematic Monitoring, Reporting, and Verification (MRV) system, in line with the Premium T-VER standards of the Thailand Greenhouse Gas Management Organization (TGO). The system is verifiable by third-party validation bodies (VVBs) and promotes farmer participation to ensure long-term continuity and sustainability.

7. Farmer participation

The project promotes farmer engagement through training, technical support, and financial incentives derived from carbon credits and reduced production costs. An MRV system is implemented to ensure compliance with TGO requirements and verifiability.

8. Implementation challenges

The project prepares risk management measures for potential challenges in AWD implementation by providing training, technical assistance, and continuous monitoring, while adapting practices to local conditions to enhance efficiency and reduce operational barriers.

9. Company support

The project receives support from the company in management, technical advisory, performance monitoring, and provision of necessary resources to ensure effective implementation in compliance with TGO requirements.

10. Acceptance among elderly farmers

The project recognizes that some farmers, particularly elderly ones, may adhere to traditional practices. Therefore, learning is promoted through training, demonstration plots, and close advisory support, along with evidence-based results such as cost reduction and yield improvement to build confidence in AWD adoption.

11. Technology suitability

Appropriate technologies are selected based on local context, considering ease of use, cost, and farmer readiness. Training, field demonstrations, and continuous support are provided to ensure effective adoption.

12. Project duration

The project duration is designed to be appropriate for monitoring and evaluation of outcomes, including water use efficiency, cost reduction, and greenhouse gas emission reduction, supported by an MRV system aligned with TGO standards.

13. Mobile application limitations

The project acknowledges limitations among elderly farmers in using digital applications. Therefore, simplified training, field support, and offline data recording systems are provided to ensure complete and continuous participation.

14. Adequacy of economic incentives

The project establishes appropriate incentive mechanisms based on carbon credit revenues and production cost savings. Benefits are clearly communicated, and incentive structures are adjusted to local farmer contexts to encourage sustained participation.

5.3 Corrective actions for issues identified in section 5.2

Topic Area	Problems & Concerns	Farmers' Expectations	Alternative Solution Ideas
Weather & Water Management	• Unstable weather and drought• Risk of pests (rats) during dry periods	• More stable yields• Reduced production costs	• Promote AWD and other water-saving practices• Develop climate-resilient rice varieties• Improve irrigation and water-sharing systems• Community pest control campaigns
Soil & Crop Conditions	• Poor soil quality• Saline soil areas• Rice varieties may not suit AWD	• Higher yields and better quality rice	• Use salt-tolerant and locally adapted rice varieties• Soil rehabilitation programs (organic matter, soil

Topic Area	Problems & Concerns	Farmers' Expectations	Alternative Solution Ideas
			amendments)• Seed support and trials of suitable varieties
Pests & Weeds	• Rat infestation• Weed management challenges	• Fewer crop losses, higher income	• Integrated pest management (IPM)• Community-based rat control• Training in weed control under AWD conditions
Economic Pressures	• High production costs• Unstable and low rice prices• Compensation may not be attractive	• Higher income and stable rice prices• Better access to premium/export markets	• Farmer cooperatives to lower input costs• Branding/marketing of low-carbon rice• Certification to access international markets• Incentive schemes linked to performance
Farmer Participation & Capacity	• Limited cooperation among farmers• Elderly farmers reluctant to adopt new methods• Difficulty using applications and technology	• Practical training and study visits• Desire for project continuity	• Peer-to-peer learning with farmer champions• Field visits tailored to local conditions• Simplified or offline tech support• Ongoing staff support for digital tools
Project Design & Support	• Uncertainty about project clarity, sustainability, and duration• Concerns whether company will provide ongoing support• Worry if project trial period will be worthwhile	• Long-term project with guaranteed benefits• Assurance of sustained support	• Transparent communication on project scope and timelines• Secure multi-year funding and partnerships• Phased scaling with clear milestones• Continuous support mechanisms

Appendix 1

Summary of Additionality

The programme demonstrates clear additionality at financial, farmer, provincial, and programme levels, showing that adoption of Alternate Wetting and Drying (AWD) practices in Thailand would not be possible without the support of ITMO revenues under the Article 6 framework.

Financial additionality is established through a simple cost analysis at the programme level and a qualitative barrier analysis [5] at the project/province level aligned with FOEN's 2025 requirements. In the absence of ITMO revenues, the Net Present Value (NPV) of the programme is reflecting the high fixed costs and the lack of alternative income streams from AWD implementation. In contrast, with ITMO revenues, the NPV turns positive, demonstrating that carbon revenues are the decisive factor for programme feasibility. Without ITMOs, AWD implementation would remain financially unattractive and would not be scaled up.

Additionality at the farmers' level arises from entrenched practices and financial constraints. Farmers traditionally rely on continuous flooding because it reduces risks such as weed infestation and water shortages, and because it is perceived as the most secure method for maintaining stable yields.

In the target districts, there are currently no awareness campaigns or training opportunities that could equip farmers with the knowledge needed to implement AWD correctly. Furthermore, AWD does not directly generate additional income: savings on fuel and pumping costs are modest and uncertain, and cannot be relied upon for daily financial planning. Even modest investments, such as purchasing PVC pipes for AWD tubes, present a barrier for smallholders, who are reluctant to take on extra costs. Finally, without the programme, farmers would lack access to the digital monitoring tools that reduce risks and provide guidance for correct implementation. These barriers

[5] There are realistic and credible barriers that would prevent the implementation of the proposed MA from being carried out if the MA was not developed under the Article 6 framework. These barriers are however of difficult quantification as they mostly revolve around the changing of the prevailing practices and the organization of the different activities (trainings, visits to the farmers, etc) required to make this change possible, therefore the barrier analysis has been carried out qualitatively. Attempting to quantify the barriers in purely economic terms is inappropriate, as these challenges are not directly linked to financial indicators. Any attempt at economic estimation would therefore be incomplete and potentially misleading.

apply across Thai rice farmers, the majority of whom are smallholders with limited financial capacity.

In conclusion, the programme demonstrates robust additionality at all levels. Farmers face strong cultural, financial, and organizational barriers to adopting AWD; provinces lack sufficient support to trigger large-scale practice change; and at the programme level, implementation is only financially feasible through ITMO revenues. The programme therefore clearly meets the additionality requirements and represents a contribution to achieving emission reductions under Article 6.

Appendix 2

Stakeholder Consultation Report

Project: Alternate Wetting and Drying (AWD) Rice Farming for Thai Farmers

Agricultural Learning Center for Increasing Production Efficiency

Village 4, Don Ko Ka Subdistrict, Bang Nam Prieo District, Chachoengsao Province

26 February 2025

Varuna (Thailand) Co., Ltd.

1.Background

The project to promote Alternate Wetting and Drying (AWD) rice farming in Thailand is a collaboration between Thailand and Switzerland. Its objectives are to reduce greenhouse gas emissions, enhance sustainable rice production efficiency, and conserve natural resources.

The project is planned to be implemented in 8 provinces: Chachoengsao, Kanchanaburi, Nakhon Pathom, Uttaradit, Sukhothai, Khon Kaen, Maha Sarakham, and Nong Bua Lamphu, with a project duration until 2030. Varuna Company, as the project developer, plays a key role in transferring knowledge and technology to Thai farmers to promote sustainable rice farming systems and reduce environmental impacts.

2. Introduction

2.1 Project Type: Land Use (Agriculture & Forestry) – Reduction, absorption, and sequestration of greenhouse gases from the forestry and agriculture sectors.

2.2 Project Scale: Large-scale – total reduction/sequestration of more than 16,000 tCO_2eq per year.

2.3 Project Location: Chachoengsao (first province where the project starts), Kanchanaburi, Nakhon Pathom, Uttaradit, Sukhothai, Khon Kaen, Maha Sarakham, Nong Bua Lamphu.

2.4 Expected Completion Period: 5 years (2026 – 2031).

3.Goals

The objective of conducting the stakeholder engagement meeting is to ensure that the organization is informed of the opinions, concerns, and attitudes of stakeholders, and to use this information to develop appropriate engagement plans for each stakeholder group. It also enables the organization to report key issues and concerns raised by stakeholders regarding the implementation of the Alternate Wetting and Drying (AWD) rice farming project.

4.Objectives

The objectives of the Stakeholder Consultation Meeting for the Alternate Wetting and Drying (AWD) Rice Farming Project are as follows;

4.1 Gather feedback and suggestions from stakeholders:
To provide opportunities for relevant parties—such as farmers, local communities, and related agencies—to express their opinions and offer suggestions that can be used to further improve the project's efficiency and better meet stakeholder needs.

4.2 Build understanding and awareness about the project:
The meeting aims to ensure that stakeholders understand the project's approach, operations, and potential benefits, as well as possible impacts. This will allow all parties to receive accurate information and develop a clear understanding.

4.3 Promote participatory decision-making:
By allowing stakeholders to express their opinions, the project encourages inclusive decision-making and active involvement in implementation, ensuring sustainability and community acceptance.

4.4 Assess potential project impacts:
To evaluate economic, social, and environmental impacts that may arise from project implementation, supporting effective execution and minimizing unforeseen negative consequences.

4.5 Strengthen relationships among stakeholders:
The meeting also aims to build positive relationships between government agencies, the private sector, and local communities through the exchange of information and mutual understanding.

4.6 Improve project implementation based on feedback:
Suggestions from the meeting will be considered and integrated into project implementation to align with the local context and stakeholder needs, thereby increasing the likelihood of project success.

5. Scope of Work

5.1 Stakeholder groups: Farmers, local communities, government agencies, private sector, and experts in agriculture and water management.

5.2 Key issues for stakeholder feedback:

- Knowledge and awareness of Alternate Wetting and Drying (AWD) rice farming
- Support from various organizations (TGO, government/private sector organizations)
- Resource use (water, land, fuel)
- Environmental impacts
- Economic and social impacts

5.3 Project area and conditions: Suitability of areas for AWD rice farming and potential limitations.

5.4 Impacts and evaluation: Assessment of economic, social, and environmental impacts of project implementation.

5.5 Support needs: Requirements for financial support, technical guidance, and training.

5.6 Implementation period and monitoring: Feedback on the project duration and monitoring process.

6. Stakeholders Planning

This meeting aims to provide all stakeholder groups with the opportunity to share their opinions and suggestions in order to improve the project, making it more effective and responsive to the needs of the community and farmers.

Table 1: Expectation of Stakeholders Group Attending the Meeting

Stakeholder	Expectations
Meeting Organizer (Project Developer)	- Prepare and conduct the meeting according to the plan - Share relevant information with stakeholders in advance - Coordinate with all stakeholder groups - Collect and summarize feedback from the meeting
Stakeholders (Farmers, Communities, Relevant Agencies)	- Provide opinions and suggestions about the project - Share views on potential impacts - Collaborate in improving the project to meet needs

Stakeholder	Expectations
Government Agencies (District Chief, District Agricultural Office, Land Development Department, Rice Department, Village Head, Subdistrict Head)	- Provide opinions and suggestions about the project - Share views on potential impacts - Collaborate in improving the project to meet needs

7. Stakeholder Identification

Table 2: Roles and Responsibilities of Stakeholders

Stakeholder	Role and Responsibilities
Farmers	- Project Implementors
Local Community (Village Head, Subdistrict Head, District Officer)	- Project Supporters
Government Agencies	- Provide policies and support for AWD - Ensure the project complies with laws and government policies
Private Sector	- Supply necessary materials, equipment, and technology - Participate in promoting marketing and product sales
Academics and Agricultural Experts	- Provide technical guidance on AWD rice cultivation - Assess project impacts and feasibility

Table 3: Activities for stakeholders

Activities	Stakeholders	Objectives	Communication Channel	Timeline
Public consultation meeting	Farmers, local communities	To gather feedback and suggestions on Alternate Wetting and Drying (AWD) rice farming	On-site meeting	Half-day
Opinion survey	Farmers, local communities, supporters	To collect feedback from stakeholders who are unable to attend activities	TGO website	30 days

8. Operation Plan

After the public consultation in Chachoengsao Province, additional consultations will be carried out in other provinces. At the same time, the project proposal and registration documents will be revised, and the project will undergo a review by 3rd party validators within 2025. For project implementation, farmer registration for participation and training on Alternate Wetting and Drying (AWD) rice cultivation will be conducted to enable the project to commence in by 4Q of 2025 or 1Q of 2026.

	Activity	2025				2026				2027				2028				2029				2030			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
แผนงานการเตรียมโครงการ																									
1	การทำเอกสารข้อเสนอโครงการ	■																							
2	การประชุมรับฟังความคิดเห็น	■	■																						
3	การจัดการประชาสัมพันธ์โครงการกับกลุ่มเกษตรกรที่สนใจ		■																						
4	การทำเอกสารขึ้นทะเบียนโครงการกับทาง TGO (Premium-TVER)	■	■																						
5	การตรวจสอบความใช้ได้ของโครงการจากผู้ประเมินและตรวจสอบภายนอก			■	■				■				■				■				■				■
แผนงานการดำเนินโครงการ																									
6	การเปิดลงทะเบียนเกษตรกรร่วมโครงการ				■	■			■	■			■	■			■	■			■	■			
7	การอบรมเกษตรกรในการทำนาเปียกสลับแห้ง						■	■			■	■			■	■			■	■			■	■	
8	การดำเนินโครงการเปียกสลับแห้ง							■	■			■	■			■	■			■	■			■	■

9.Stakeholder Consultation Results

From the stakeholder consultation meeting on Alternate Wetting and Drying (AWD) rice cultivation, conducted on 26 February 2025, a total of 18 respondents' responses to the questionnaire, accounting for 66.67% of the total 27 meeting participants.

9.1 General Information

Gender	No. of people	Percentage (%)
Male	11	61.11
Female	7	38.89
Total	18	100

Age	No. of people	Percentage (%)
Less than 30 years old	0	0
31-40 years old	4	22.2
41-50 years old	5	27.8
Above 51 years	9	50
Total	18	100

Farming Experiences	No. of people	Percentage (%)
1-5 years	2	11.11
6-10 years old	3	16.67
11-20 years old	3	16.67

Above 21 years	7	38.89
	3	16.67
Total	18	100

Role	No. of people	Percentage (%)
Farmers	11	61.11
Local Leaders	2	11.11
Government	5	27.78
Others	0	0
Total	18	100

9.2 Assessment Scoring Results

Assessment Criteria	Level of Understanding/ Acceptance

(5 = Very High, 4 = High, 3 = Moderate, 2 = Low, 1 = Very Low)

9.3: Additional Questions / Suggestions Regarding Participating in the Project

9.3.1 In the past, how has local agriculture in your area been affected?

- Unstable weather conditions
- Drought problems
- Reduced environmental impact
- High production costs; unstable crop prices
- High expenses
- Low rice prices
- Positive effects because Alternate Wetting and Drying (AWD) rice cultivation uses less water
- Poor soil quality

9.3.2. What concerns do you have about this project?

- Rice varieties in the area
- Pests during dry periods (rats)
- Saline soil areas

- Rat infestation
- Weeds
- Clarity and sustainability of the project
- Farmers may not cooperate in cultivating low-carbon rice
- This farming method may face some obstacles
- Whether the company will provide support or not
- Elderly farmers may hold on to traditional beliefs and practices, making it difficult to change their mindset and habits
- The technology introduced may not be suitable for local farmers
- Whether the duration of the project will be worth the trial
- Using applications may be a limitation for elderly farmers
- Compensation may not be attractive enough

9.3.3 What are your additional expectations for this project?

- Conduct field visits tailored to each different area
- Achieve higher yields
- Gain higher income from alternate wetting and drying rice farming
- Higher rice prices
- Hope that this project will help farmers earn more income
- Increase income while reducing environmental impacts
- Receive more benefits
- Desire for this project to continue
- Hope that the project will be long-term and ensure good rice prices
- The project will benefit farmers
- Rice prices meet expectations
- Want study visits on alternate wetting and drying farming so that interested farmers can gain more knowledge by practicing together with staff
- Lower production costs

- Better access to international markets for quality rice and higher rice prices compared to conventional farming

10. Appendices

10.1 Participant Lists

แบบลงทะเบียนของเกษตรกรที่เข้าร่วมประชุมรับฟังความคิดเห็นผู้ที่มีส่วนได้เสีย สำหรับโครงการ การส่งเสริมการปลูกข้าวแบบเปียกสลับแห้ง (Alternate Wetting and Drying) varuna

ลำดับ	ชื่อ-นามสกุล	อายุ	หมายเลขโทรศัพท์	ที่อยู่ (บ้านเลขที่/หมู่บ้าน/ตำบล/อำเภอ/จังหวัด)	ขนาดพื้นที่ (ไร่)	ประสบการณ์ในการทำเกษตร (ปี)	หมายเหตุ
1	น.ส.พยาฆพิชญ ผงพิลา	32	0803523009	สนง. เกษตรอำเภอบางน้ำเปรี้ยว	-	-	เจ้าหน้าที่เกษตรอำเภอ
2	น.ส.กรกมล จันทร์นอม	31	085-1779690	สนง. เกษตรอำเภอบางน้ำเปรี้ยว	-	-	
3	[illegible]	51	080690549[illegible]				[illegible] (ผู้ใหญ่บ้าน)
4	[illegible] หร่ายมาลี	59	0890287289				ปลัดอำเภอ
5	นายปรีชญ์ พยัคฆเพศ	42	0944985498	สวท. ฉะเชิงเทรา			[illegible]
6	[illegible]	62	3-1001-00089791	77 ม.14 ต.ดอนเกาะกา อ.บางน้ำเปรี้ยว	60	30	เกษตรกร
7	[illegible] พักประเสริฐ	45	089-7957758	สวช. ฉะเชิงเทรา	50	20	นักวิชาการ[illegible] (สวท.)
8	[illegible]	40	[illegible]	ต. [illegible]	63	15	เกษตรกร
9	นางสาวสายใจ สอนบุญ	44	087-9743196	สถานีพัฒนาที่ดินฉะเชิงเทรา			[illegible]
10	น.ส. [illegible]	43	089-[illegible]	"	.		[illegible]
11	[illegible] ชุ่นโลกประเสริฐ	64	082-4636191	ม.6 ต.ดอนเกาะกา อ.บางน้ำเปรี้ยว	80	11	เกษตรกร
12	[illegible]	66	082-7852960	ม.6 ต.ดอนฉิมพลี อ.บางน้ำเปรี้ยว	65	45	เกษตรกร
13	[illegible]	59	0640294695	16/2 ม.8 ดอนฉิมพลี บางน้ำเปรี้ยว	52	35	เกษตรกร
14	[illegible]	54	0659531475	26 ม.7 ต.ดอนเกาะกา	20	35	เกษตรกร
15	สังเวย [illegible]	64	063164[illegible]	ม.7 ต.ดอนเกาะกา	40	37	เกษตรกร
16	[illegible]	64	0816872678	ม.7 ต.ดอนเกาะกา	150	40	เกษตรกร
	ชื่อ - นามสกุล	อายุ	เบอร์โทร	หน่วยงาน / ที่อยู่	ขนาดพื้นที่	ประสบการณ์ทำนา	อาชีพ
17	อนุชา [illegible]	60	0805648[illegible]	4/3 ม.6 ต.ดอนฉิมพลี	30	ตั้งแต่เกิด	เกษตรกร
18	[illegible]	63	0817946519	40/1 ม.2 ต.ดอนเกาะกา	17	20 ปี	เกษตรกร
19	[illegible]	48.	0860800268	27/1 ม.11 ต.ดอนเกาะกา	49.	30. ปี	เกษตรกร.
20	[illegible]	61	089-5154291	41 ม.9 ต.ดอนเกาะกา	42	40 ปี	เกษตรกร
21	นาง [illegible]	53	086-0646812	44/1 ม.5 ต.ดอนเกาะกา	48	28 ปี	เกษตรกร
22	[illegible]	66		26 ม.6 สิงโตทอง	83	20 ปี	เกษตรกร
23	นาย [illegible]	49	0870460878	29/1 ม.8 ต.สิงโตทอง	34	35 ปี	เกษตรกร
24	[illegible]	[illegible]	0926548040	31/2 ม.4 ต.ดอนเกาะกา	45	61 ปี	เกษตรกร
25	Enrica De Luca		+41788409969	myclimate			myclimate
26	Paul Leon		+51997767071	myclimate			
27	Vicky Janssens		0636753700	KLIK FOUNDATION			
28							
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32							
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10.2 Letter of Invitation to join the stakeholder consultation

บริษัท วรุณา (ประเทศไทย) จำกัด
VARUNA (Thailand) Company Limited
304 อาคารวานิชเพลซอารีย์ (อาคารเอ) ชั้นที่ 25 ยูนิต 2501 ถนนพหลโยธิน แขวงสามเสนในเขตพญาไท กรุงเทพมหานคร 10400
304 VANIT PLACE AREE (BUILDING A), 25th FLOOR, UNIT 2501, PHAHOLYOTHIN ROAD, SAMSEN NAI, PHAYA THAI, BANGKOK 10400
Tel: +66(0) 2078 4000 Website: www.arv.co.th

ที่ VRN0010/2568

14 กุมภาพันธ์ 2568

เรื่อง ขอเชิญเข้าร่วมประชุมการรับฟังความคิดเห็นผู้มีส่วนได้ส่วนเสียโครงการการทำนาเปียกสลับแห้ง ภายใต้ความตกลงปารีสข้อ 6

เรียน นายชจรเกียรติ รักพานิชมณี ผู้ว่าราชการจังหวัดฉะเชิงเทรา

เมื่อวันที่ 24 มิ.ย. 65 นายวราวุธ ศิลปอาชา รัฐมนตรีว่าการกระทรวงทรัพยากรธรรมชาติและสิ่งแวดล้อม กับนางซีมอเน็ตตา ซอมมารูกา มนตรีแห่งสมาพันธ์ รัฐมนตรีว่าการกระทรวงสิ่งแวดล้อมคมนาคม พลังงานและสารสนเทศ สมาพันธรัฐสวิสได้ร่วมลงนามในข้อตกลงการดำเนินงานภายใต้ความตกลงปารีสระหว่างราชอาณาจักรไทยกับสมาพันธรัฐสวิส (Implementing Agreement to the Paris Agreement between the Kingdom of Thailand and the Swiss Confederation) ณ กรุงเบิร์น สมาพันธรัฐสวิส ข้อตกลงครั้งนี้ เปิดโอกาสให้ประเทศไทยกับสมาพันธรัฐสวิสดำเนินความร่วมมือภายใต้ข้อ 6 ของความตกลงปารีสโดยความสมัครใจ เพื่อขับเคลื่อนการดำเนินงานตามเป้าหมายการมีส่วนร่วมที่ประเทศกำหนด (Nationally Determined Contribution: NDC) ถ่ายโอนผลการลดก๊าซเรือนกระจกระหว่างประเทศโดยความร่วมมือนี้นับเป็นส่วนเพิ่มเติมนอกเหนือจากมาตรการภายใน NDC ของประเทศ ทั้งนี้ การดำเนินงานภายใต้ข้อตกลงฯ จะช่วยให้ประเทศไทยเรียนรู้แนวทางการดำเนินงานจากโครงการ เพื่อนำองค์ความรู้ที่ได้รับมาต่อยอดและขับเคลื่อนการดำเนินงานให้บรรลุ NDC ของไทย การมุ่งสู่เป้าหมายความเป็นกลางทางคาร์บอน (Carbon neutrality) และการปล่อยก๊าซเรือนกระจกสุทธิเป็นศูนย์ (Net zero GHG emission)

เพื่อต่อยอดความสำเร็จ ในการส่งเสริมการขับเคลื่อนการดำเนินงานให้บรรลุเป้าหมาย NDC ของประเทศไทย และสอดคล้องกับนโยบายการส่งเสริมการปลูกข้าวแบบเปียกสลับแหงแก่กลุ่มเกษตรกรนาแปลงใหญ่ และศูนย์ข้าวชุมชน ทางบริษัท วรุณา (ประเทศไทย) จำกัด ร่วมกับ Klik Foundation ในฐานะผู้รับซื้อเครดิตในนามของรัฐบาลสวิตเซอร์แลนด์กำลังพัฒนาข้อเสนอโครงการส่งเสริมการปลูกข้าวแบบเปียกสลับแห้งในพื้นที่ 7 จังหวัด ดังนี้ ฉะเชิงเทรา อุตรดิตถ์ กาญจนบุรี สุโขทัย ปราจีนบุรี นครปฐม และกรุงเทพมหานคร

ในโอกาสนี้ ทางบริษัท วรุณา (ประเทศไทย) จำกัด **ใคร่ขอเชิญท่านเข้าร่วมประชุมรับฟังความคิดเห็นผู้ที่มีส่วนได้ส่วนเสีย สำหรับการส่งเสริมการปลูกข้าวแบบเปียกสลับแห้ง (Alternate Wetting and Drying) การดำเนินโครงการภายใต้ Article 6 และ Methodology Premium T-VER ในวันพุธที่ 26 กุมภาพันธ์ 2568 เวลา 8:30 – 12:00 น. ณ ศูนย์เรียนรู้การเพิ่มประสิทธิภาพการผลิตสินค้าเกษตร (หลัก) หมู่ 4 ตำบลดอนเกาะกา อ.บางน้ำเปรี้ยว จ.ฉะเชิงเทรา** ทั้งนี้ทางบริษัทฯ ได้มอบหมายให้นางสาวสิริรัตน์ เสือมัจฉา โทร 082 978 0053 เป็นผู้ประสานงานการนัดหมายในครั้งนี้

จึงเรียนมาเพื่อโปรดพิจารณาให้ความอนุเคราะห์และขอขอบพระคุณมาในโอกาสนี้

แผนที่ศูนย์เรียนรู้การเพิ่มประสิทธิภาพ
การผลิตสินค้าเกษตร (หลัก)

ขอแสดงความนับถือ

(นางสาวพณัญญา เจริญสวัสดิ์พงศ์)
ผู้ร่วมก่อตั้งธุรกิจ
บริษัท วรุณา (ประเทศไทย) จำกัด

varuna
Smart Watcher
เทคนิคเพิ่มศักยภาพการดูแลพื้นที่การเกษตรกรรม เพื่อเกษตรกรไทย
ฟีเจอร์หลัก Smart Watcher
1
เก็บบันทึกข้อมูลรายแปลง
2
ใช้งานสะดวก
และให้ความแม่นยำสูง
3
การเข้าร่วมโครงการ
และขอรับรองคาร์บอนเครดิต
Premium T-VER
SMART FARM แพลตฟอร์ม
Smart Farm Platform
Normalized Difference Water Index (NDWI)
varuna
“ทำนาเปียกสลับแห้ง”
เทคนิคเพิ่มศักยภาพการปลูกข้าวด้วยการใช้น้ำอย่างประหยัด
เปรียบเทียบการทำนาข้าวแบบดั้งเดิม
และการทำนาข้าวเปียกสลับแห้ง
700-1,500
50%
8-13%
80%
CH_4
ลดภาวะโลกร้อนด้วย
เทคนิคการปลูกข้าวแบบเปียกสลับแห้ง
N_2O
CO_2
CH_4
เทคนิคการจัดการน้ำอย่างประหยัดแบบเปียกสลับแห้ง
ตรวจระดับน้ำในท่อดูน้ำถ้าต่ำกว่าผิวดิน 10 ซม. ให้ทดน้ำเข้าเหนือผิวดิน 5 ซม. (ท่วมปากท่อดูน้ำ)

Appendix 3

List and details of participating farmers and reference coordinates of project implementation plots

CODE	Farmer's name	Title Deed Number	District	Location
1A,2A	Mr. Suphab Noreewong	2577/26/77	Bang Nam Priao	47P 716143.03E 1540402.67N
1B, 2B	Mr. Supot Noreewong	2577/26/77	Bang Nam Priao	47P 716143.03E 1540402.67N

Appendix 4

Farmer information and project area size by plot

Contract no.	Farmer's name	Address	Code	Title Deed Number	Type	Area as per title deed	Project area
	Mr. Suphab Noreewong	Don Ko Ka Subdistrict, Bang Nam Priao District, Chachoengsao Province	1A,2A	2577/26/77	14	49	
	Mr. Supot Noreewong	Don Ko Ka Subdistrict, Bang Nam Priao District, Chachoengsao Province	1B, 2B	2577/26/77	14	49	

Appendix 5

Sustainable Development and Safeguards assessment

SDGs and Environmental and Social Risk Assessment for the implementation of AWD practices in Thailand under the framework of the Article 6 of the Paris Agreement

Introduction

Alternate Wetting and Drying (AWD) is a water management practice designed to enhance sustainability in irrigated rice cultivation by reducing methane emissions and improving resource use efficiency. Developed by Varuna and myclimate under the framework of Article 6 of the Paris Agreement and the Switzerland–Thailand bilateral agreement, this programme seeks to balance environmental and social benefits with social responsibility.

The activity does not fall under any of the category of projects that are required to carry out an Environmental (and Social) Impact Assessment[6] according to the Thai law, nevertheless the programme has carried out an Environmental and Social risk assessment in this document (Safeguards Assessment). In line with TGO requirements to ensure sustainable development and identify safeguards[7], the risk assessment has identified safeguards to mitigate risks of negative environmental and social impacts that may arise from project implementation.

The programme adheres to the Quality, Safety, Security, Health and Environment Policy of AI and Robotic Ventures[8], to which Varuna belongs to.

Sustainable Development Goals (SDGs)

Besides the obvious contribution of the programme to combating climate change (SDG13), this programme will also positively impact farmers' income (SDG 1), ensure sustainable food production and foster food-security (SDG 12, SDG 2), will create job opportunities during the trainings and monitoring (SDG 4 and SDG 8), will broaden the use of high-tech instruments (SDG 9), will optimize water usage (SDG 6), improve soil conditions (SDG 15) and will also promote gender equality by engaging with female farmers (SDG 5). This MA will monitor the three most relevant SDGs among the abovementioned ones. The following targets and indicators identified with the application of the GS impact tool[9] will be monitored to track the programme's progress and its contribution to driving sustainable development in Thailand.

SDG	Target	Relevance:	Monitoring parameter:
SDG 2: Zero hunger	2.4 By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality	The adoption of AWD practices requires less water enabling therefore more drought resistant cultivation practices. This strengthens farmers' capacity for adaptation to climate change.	Number of farmers adopted practices promoted by the project

[6] https://eiathailand.onep.go.th/imgeditor/maptaput/EIA-Eng-2021.pdf
[7] https://tver.tgo.or.th/index.php/en/en-premium/kar-phathna-khorngkar-en/pre-en-project-specification/pre-en-sustainable-development-and-safeguards-assessment
[8] https://arv.co.th/en/who-we-are/sustainability/2
[9] https://globalgoals.goldstandard.org/430-iq-sdg-impact-tool/

SDG 3: Good health and wellbeing	3.9 By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination	The programme will train farmers in avoiding the practice of open straw burning, which causes considerable air pollution.	Area under reduced/avoided open burning of biomass, crop residue
SDG 6: Clean Water and Sanitation	6.4 By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity	The adoption of AWD practices requires less water enabling the preservation of natural freshwater bodies and addressing water scarcity issues	Land area provided with (i) new, (ii) improved irrigation and drainage services

Safeguards assessment

1. Non-Discrimination, Gender equality, Inclusion and Freedom of Expression

Potential Risks:

The risk of discrimination arises primarily from entrenched social hierarchies and institutional barriers that could exclude certain groups—such as women, ethnic minorities, tenant farmers, or those lacking land documentation—from programme access and benefits. In rural Thailand, customary land tenure and informal arrangements are common, potentially preventing renters or sharecroppers from equal participation.

There is a risk that women and marginalized populations may be sidelined in benefit sharing, training, or decision-making, perpetuating existing inequalities.

Power dynamics in rural communities may discourage open feedback, with stakeholders fearing reprisal if they raise concerns about programme implementation or benefit allocation.

Risk and Safeguard assessment:

To address these risks, the programme's eligibility criteria are intentionally broad, welcoming all rice farmers, irrespective of land ownership or gender. Legal land use is verified through a range of accepted documents, including leases and certificates, reducing the administrative burden on non-owners.

Discrimination on the basis of gender or religion is not common in Thailand and is not expected, nevertheless the programme strives to ensure non-discrimination. The programme actively encourages participation of female farmers and ensures equal access to training, technology, and incentives.

To foster a safe environment, multiple reporting channels—including hotlines, anonymous emails, and physical drop-boxes—are actively promoted. Independent committees comprising community representatives, government officials, and third-party experts ensure grievances are reviewed impartially. Whistleblower protections are codified, guaranteeing confidentiality and safeguarding against retaliation.

Risk Likelihood: Negligible

2. Labour, Child Rights, and Equal Opportunity

Potential Risks:

As the AWD initiative creates opportunities in field monitoring, data entry, and community leadership, there is a potential for unintentional child labour or unfair practices, particularly where informal labour arrangements are the norm. Power imbalances could also lead to discrimination or harassment within new employment avenues.

Risk and Safeguard assessment:

The programme adheres to the Thai labour law and ILO conventions, with explicit clauses against child and forced labour. All staff and participants are educated about anti-harassment and equal opportunity policies upon enrolment. A clear, confidential grievance mechanism is accessible for reporting abuses, and all complaints are independently reviewed to guarantee fair outcomes and corrective action.

Risk Likelihood: Negligible

3. Corruption, Fraud, and Good Governance

Potential Risks:
Risks include misallocation of resources, undue influence in benefit distribution, or manipulation of emissions data, particularly given the financial incentives associated with carbon credits. The complex flow of funds across borders raises concerns about transparency and the potential for illicit activity.
Risk and Safeguard assessment:
Varuna adheres to integrity policies, sexual harassment policies, and anti-corruption policies in line with PTTEP requirements and in line with AI Robotic's Quality, Safety, Security, Health and Environment Policy (link).
Varuna conducts business with honesty and integrity. Both aggressive and passive corruption will not be permitted.
Varuna has positioned itself to comply with Anti-Money Laundering legislation and laws. By maintaining an organized and ethical business practice, the company is dedicated to preventing any involvement in acts that facilitate money laundering.
Robust financial controls are in place: all transactions are conducted via regulated bank channels, with clear documentation. Data collection leverages secure digital platforms, with traceable audit trails and government oversight, reducing manual intervention and the scope for tampering. Closed chamber measurements—subject to manipulation—are reserved for plausibility checks, while primary verification relies on satellite and remote data, further limiting opportunities for fraud.
Risk Likelihood: Minor

4. Privacy and Data Security

Potential Risks:
The use of digital platforms and remote sensing requires the collection of personal and geospatial data, raising risks of misuse, unauthorised sharing, or data breaches that could undermine trust and violate privacy rights.
Risk and Safeguard assessment:
The data collected will be strictly used only for the MRV of the programme. Any disclosure will be avoided, with the exception of the Thai and Swiss authorities and the VVB bodies.
In the event of a suspected or confirmed data breach, there will be temporary suspension of affected systems. Ther will be an incident response including notification to all related parties and root cause analysis investigation.
Risk Likelihood: Minor

5. Occupational Health and Safety

Potential Risks:
Introducing new practices or technologies may inadvertently expose farmers to unfamiliar risks, from equipment-related injuries to unfamiliar field conditions.
Risk and Safeguard assessment:
Risk assessments confirm AWD does not introduce hazards beyond those in traditional rice cultivation nor does it require the application of heavy machineries. Farmer training cover nevertheless safe operation of technology and best practices for fieldwork. Feedback loops allow prompt identification and mitigation of unforeseen risks, with adjustments to protocols as needed.
Risk Likelihood: Negligible

6. Cultural Heritage and Practices

Potential Risks:
Any shift in farming practice can affect cultural heritage, particularly if traditional methods are deeply tied to local identity or community rituals.
Risk and Safeguard assessment:
There is no significant cultural practices that is expected to be lost; AWD is an adaptation of existing rice farming rather than a fundamental change.
Risk Likelihood: Negligible

7. Economic and Livelihood Risks

Potential Risks:
Transitioning to AWD may present economic risks: initial yield reductions, increased management complexity, or upfront costs could deter adoption or impact farmer incomes.
Risk and Safeguard assessment:
Yield impacts are closely tracked, with rapid-response extension support if unexpected losses occur. Financial incentives from carbon credits cushion short-term income variability and defray costs for technology or infrastructure upgrades. Ongoing capacity building and technical support lower adoption barriers, and the use of SMARTfarmer platform encourage knowledge exchange.
Risk Likelihood: Minor; mitigated through design

8. Programme Governance, Participation, and Communication

Potential Risks:
Lapses in communication, lack of transparency, or insufficient engagement can erode trust and hinder widespread adoption.
Risk and Safeguard assessment:
Routine stakeholder engagement is built into the programme's lifecycle, from design through evaluation. Digital and face-to-face communication tools ensure all participants are informed and heard. Feedback and grievance mechanisms are reviewed for effectiveness and accessibility at least annually, with results shared openly.
Risk Likelihood: Negligible

9. Water Quality and Accessibility

Potential risk:
AWD alters irrigation schedules, which could disrupt water allocation for downstream users or impact local water quality due to changes in flooding and drainage patterns.
Risk and Safeguard assessment:
AWD is implemented only in regions with established irrigation infrastructure and in coordination with local water authorities and farmer water-user groups. Impact assessments are conducted before initiation to ensure no adverse effects on community water access. Adaptive management allows for real-time adjustments to scheduling should conflicts or issues arise.
In general, AWD practices improve water accessibility by allowing a reduced use of water resources.
Risk Likelihood: Negligible (Positive)

10. Soil Health and Quality

Potential Risks:
Potential negative impacts on soil organic carbon (SOC) due to increased aeration from intermittent drying.
Risk and Safeguard assessment:
Current science suggests SOC changes are minimal due to offsetting effects. Farmer training emphasizes sustainable residue management improving soil health which is expected to improve due to enhanced root growth and better aeration.
Risk Likelihood: Negligible to Positive

11. Air Quality

Potential Risks:
While AWD has large beneficial effects on air quality due to reducing methane emissions, there are risks associated to the potential increased machinery use and continue field residue burning.
Risk and Safeguard assessment:

Training modules discourage residue burning and promote alternative uses for straw, such as composting or mulching, with compliance monitored via satellite imagery. Machinery use is not expected to be required as the majority of the farmers operate in flat lands. Impact to air quality is monitored and largely compensated by CH_4 emissions reductions

Risk Likelihood: Negligible (Positive)

12. Biodiversity and Ecosystem Services

Potential Risks:

Altering hydrology may affect field flora and fauna, potentially reducing local biodiversity if not managed with ecological sensitivity.

Risk and Safeguard assessment:

AWD supports integrated pest management and reduces periods of stagnant water, which can benefit soil organisms and beneficial insects.

Risk Likelihood: Positive

Conclusions

The programme contributes to 4 SDGs: climate action (SDG 13), zero hunger (SDG 2), good health and wellbeing (SDG 3) and clean water and sanitation (SDG 4).

The Safeguard assessment is summarized in the following table:

Risk Area	**Potential Risks**	**Mitigation Measures (safeguards)**	**Likelihood**
Non-Discrimination, Gender equality, Inclusion & Freedom of Expression	Exclusion of marginalized groups	Broad eligibility; outreach; continuous monitoring	Negligible
Labour, Child Rights & Equal Opportunity	Child labour, unfair practices	Adheres to law; anti-harassment policies; grievance mechanism	Negligible
Corruption & Governance	Resource misallocation, fraud	Financial controls; audits; digital traceability	Minor
Privacy & Data Security	Data misuse or breaches	Restricted use; incident response plan	Minor
Occupational Health & Safety	New operational risks	No complex new technologies required; feedback loops	Negligible
Cultural Heritage & Practices	Impact on traditional practices and local identity	AWD adapts existing rice farming; no significant cultural loss expected	Negligible
Economic & Livelihoods	Yield, income risks	Monitoring; financial incentives; support platforms	Minor
Programme Governance, Participation & Communication	Poor communication, lack of transparency, insufficient engagement	Routine stakeholder engagement; effective communication tools; annual review of feedback mechanisms	Negligible
Water quality & accessibility	Water disruption	Coordination with authorities; adaptive management; AWD	Negligible (Positive)

		practices reduce water usage	
Soil quality	Soil changes	Promotion of sustainable practices	Negligible (Positive)
Air Quality	Increased machine use and Residue burning	Training on avoid use of heavy machineries; Discourage burning; Reduce CH_4 emissions	Negligible (Positive)
Biodiversity	Biodiversity impacts	AWD support ecosystem services	(Positive)

This Environmental and Social Risk Assessment demonstrates that the AWD programme in Thailand developed under the framework of the Article 6 of the Paris Agreement and the bilateral agreement between Switzerland and Thailand, as structured in the Mitigation Activity Design Document, is well-aligned with international best practices and does not generate significant negative impacts. Minor negative impacts are further mitigated by the safeguards in place. The programme includes robust safeguards, transparent monitoring, and strong stakeholder engagement, ensuring that AWD implementation not only reduces greenhouse gas emissions but also delivers social, economic, and environmental co-benefits for Thai rice farmers and their communities.