Chapter 2

Details of the project

Royal Thai Navy (RTN) and Eastern Special Development Zone Policy(EEC) The goal is to develop U-Tapao International Airport to be an aviation hub capable of accommodating up to 70 million passengers a year in 2048, which is to estimate the airport's volume in case of higher growth than the base case (Aggressive Scenario) for exceeding thecapacity of Suvarnabhumi Airport(BKK) and Don Mueang International Airport which the development of U-Tapao International Airport can accommodate the passengers as estimated above. It is essential todevelop U-Tapao International Airport(extension)with the area size of 4,415 Rai, which will be constructed on the Runway 2, the length of the route is 3,505 meters, by which the airport extension including 2 parts are 1) the components that are air transportation system and 2) the commercial gateway. Once construction is complete, the components of the air transportation system comprise the current airport, combined with the extended airport area, which covers the operational period in which the airport's activities covering the number of flights and the expected number of passengers up to year. 2048 (Ultimate Phase) for the grey part will not be included in the environmental impact assessment in this report, but the development area will be provided to show an overview of all of U-Tapao Airport Airport development as detailed in **Chapter 1, Topic 1.3, The airport development plan** for the scope of this field of study and preparation of the environmental impact assessment report will review the Runway 2 development activities with tunnel under the runway and parallel driving route in Terminal 3, Satellite Terminal, Apron, U-Tapao HSR Station, and the Commercial Gateway, Airport City, Cargo Terminal which is located in extended airport.

2.1 Study location and area of the project

U-Tapao International Airport is located in Phala subdistrict, Ban Chang District, Rayong, and has an area of approximately 12,689 Rai, as **Figure 2.1-1.** The following contact areas are:

North, contact Ban Chang Municipality

South, contact Tthe Gulf of Thailand coast.

East contact Ban Chang Subdistrict Municipality

West, contact Phlu Ta Luang Subdistrict Administrative Organization

The construction area for runway and driveway 2 and related components are located in the extended airport area. The project has set the study area framework (purple line) based on the nature of the project operations and the main impacts, covering the east and west areas from the scope of U-Tapao International Airport (green line frame) out to 6 kilometers each side and the north and south side 10 kilometers each, shown in **Figure 2.1-1** The study area covers 2 provinces, namely Rayong (Ban Chang District and Mueang Rayong District) and Chonburi (Bang Lamung District and Sattahip District), details of which are already mentioned in **Chapter 1, Article 1.5 Areas and methods for studying environmental impacts**.

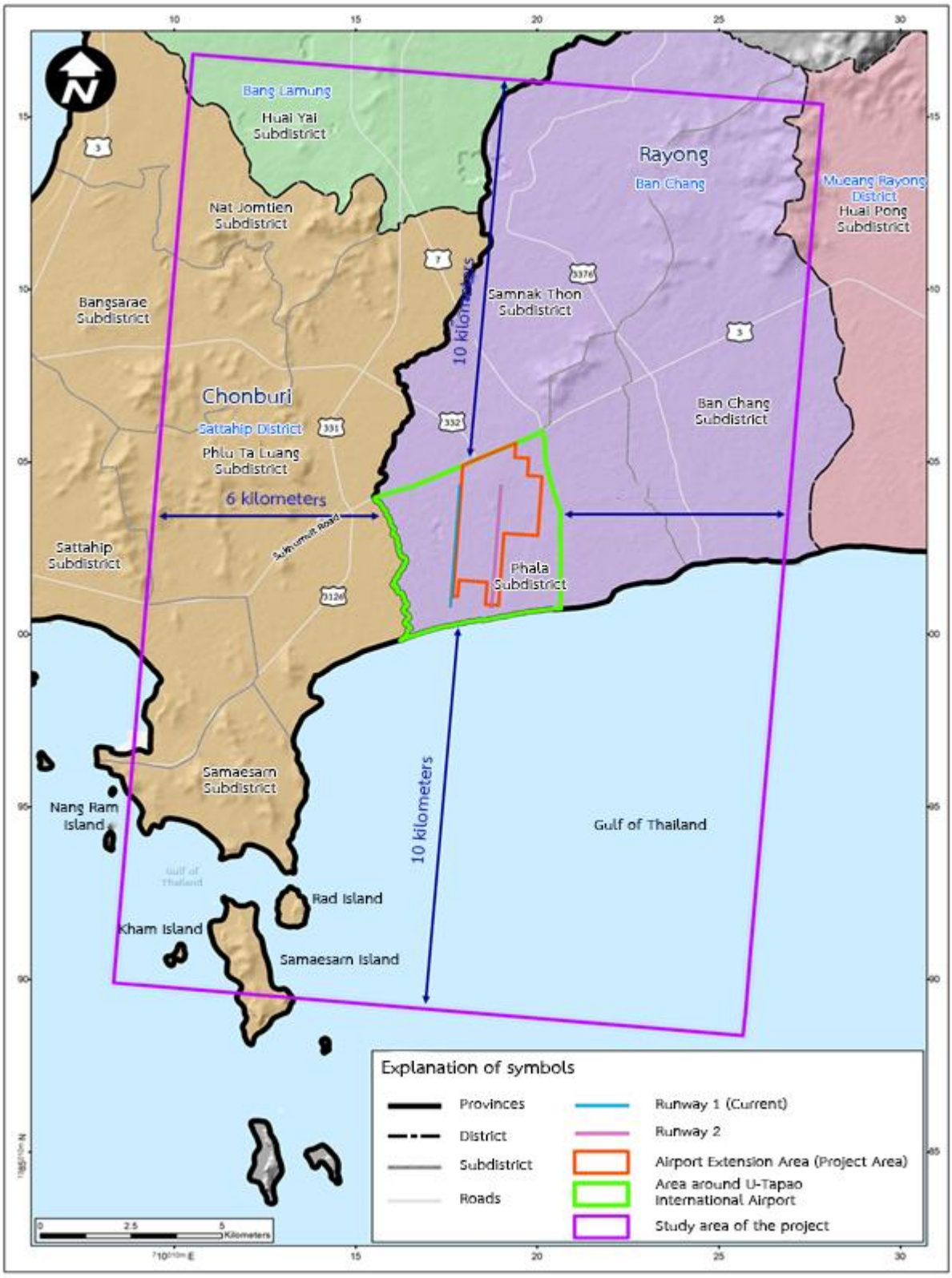


Figure 2.1 1 Study location and area of project

2.2 Consideration of optional location of runway 2

Details of alternative locations are provided for the runway 2. Based on the results of the appropriate runway distance assessment, the project prepared a master plan for the feasibility study of the U-Tapao airport development project and the surrounding area, Rayong, 2018. In the study, there were 3 options for distance, namely at 1,140, 1,400 and 1,525 meters, based on the limitations of the area obstructing the aircraft's level of erosion, including Kao Kho Ta Bak and Highway number 7 (Motorway), as well as plotting the use of the area at the airport, especially at Terminal 3. Details of the route's location selection are as follows:

Option 1: Distance from runway 2 and the current runway is 1,140 meters

This option number 1 can avoid adjusting the height of Khao Kho Ta Bak and without needing to adjust the height of the Highway Number 7. However, due to the relatively narrow distance between routes, there are limitations for planning the functional area of the airport. Details are shown in **Figure 2.2-1**

Option 2: Distance between runway 2 and current runway is 1,400 meters

In the case of Option 2, there must be reduced by lowering the height of Kao Kho Ta Bak because some areas are in the aviation sector, including lowering the height of Highway Number 7 due to being in the air sector. However, this distance allows flexibility in planning the use of the airport area in the future, and space between runway can also be used to develop the terminal and parking area sufficiently. Details are shown in **Figure 2.2-2**

Option 3: Distance from runway 2 and current runway is 1,525 meters

For option 3, Khao Kho Ta Bak must have been reduced the height because some areas are in the aviation sector, including lowering the height of Highway Number 7 because of the air sector. However, with the wide range of distance between routes, it allows for greater flexibility in laying down the use of airport space in the future, and the development of large/or multi-storey terminals is shown in **Figure 2.2-3**

According to the government's review, Eastern Region Special Development Zone Policy Committee, according to the meeting on 4 October 2018, the 1,140-meters runway distance was specified in the planning for the development of U-Tapao International Airport, which is the appropriate running distance and the least impact. The summary of details is shown in **Figure 2.2-4.**

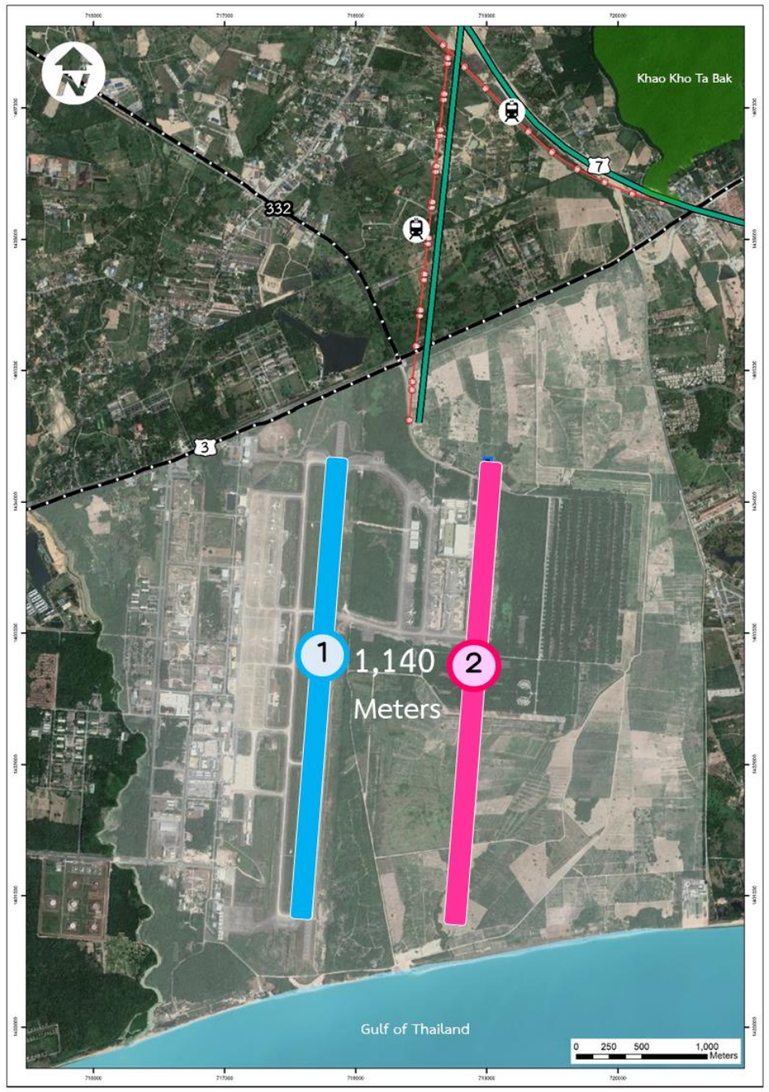


Figure 2.2□1 Option 1 : Distance between runway 2 and current runway is 1,140 meters

- Avoid adjusting the height of Kao Kho Ta Bak
- No need to adjust the height of the Highway number 7.
- The distance is narrow. There are limitations on how the airport uses the area.

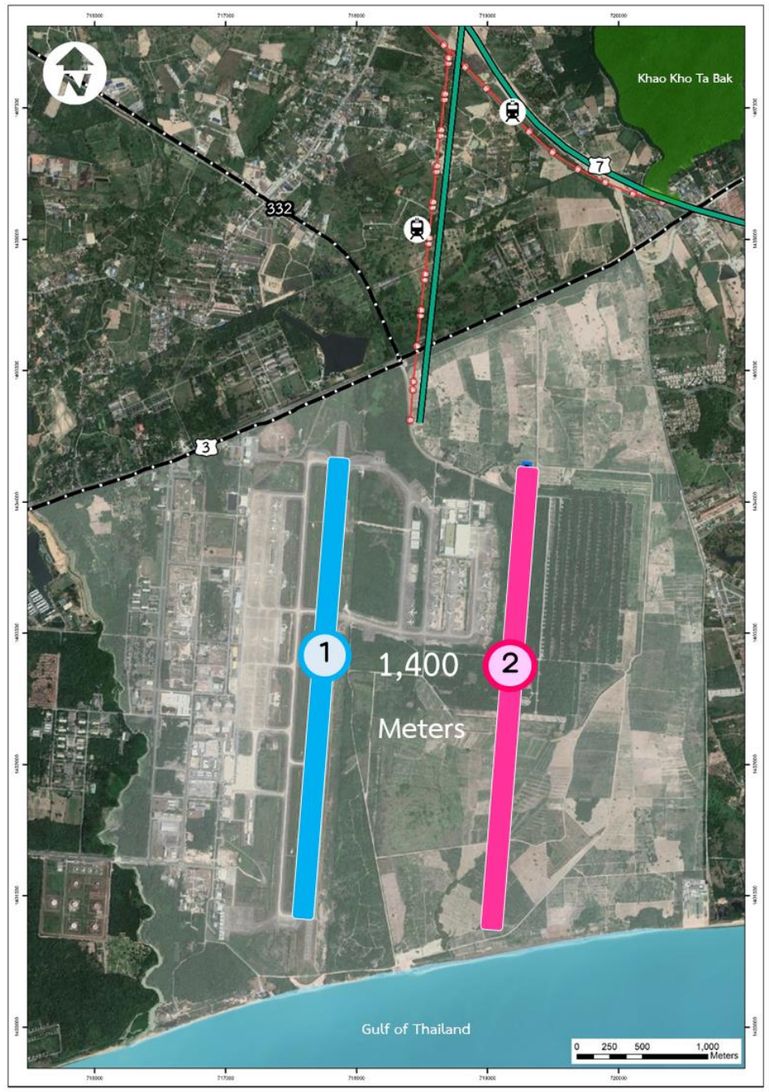


Figure 2.2□2 Option 2 : Distance between runway 2 and the current runway is 1,400 meters

- There must be a reduction in the height of Kao Kho Ta Bak as some areas are aligned with the aviation sector.
- There must be a height reduction height of Highway number 7.
- Have the flexibility to map future areas of the airport.

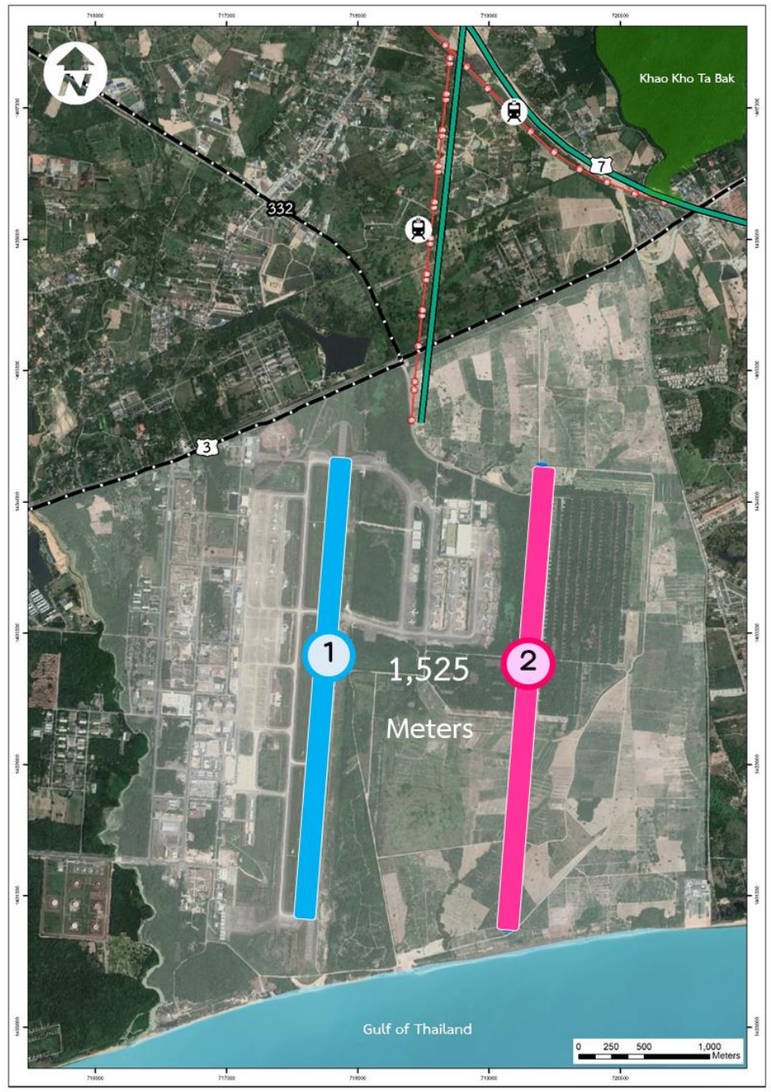


Figure 2.2□3 Option 3: Distance between runway 2 and current runway is 1,525 meters

- There must be a reduction in the height of Kao Kho Ta Bak as some areas are aligned with the aviation sector.
- There must be a height reduction height of Highway number 7.
- It has the flexibility to map the use of airport space in the future well.

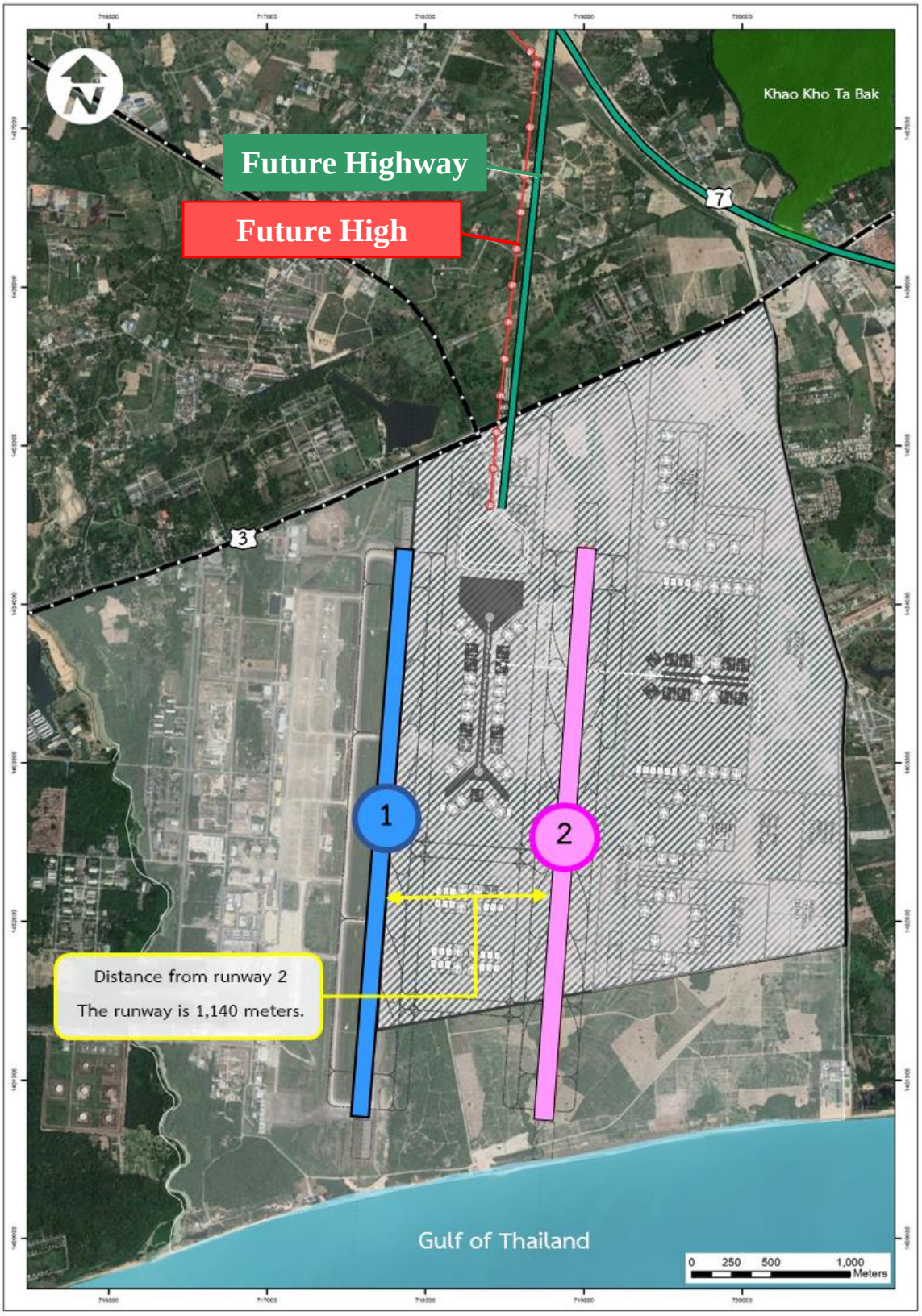
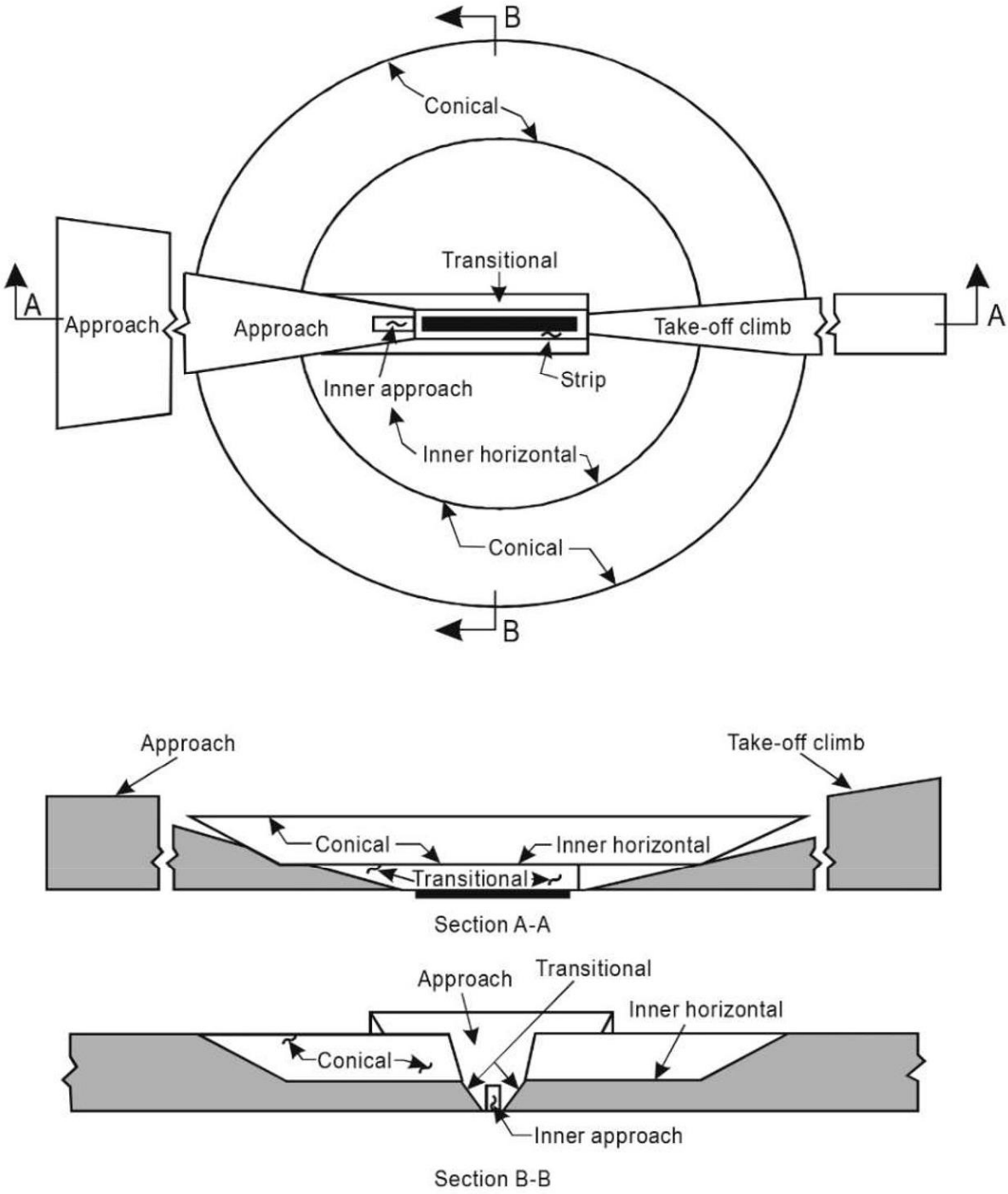


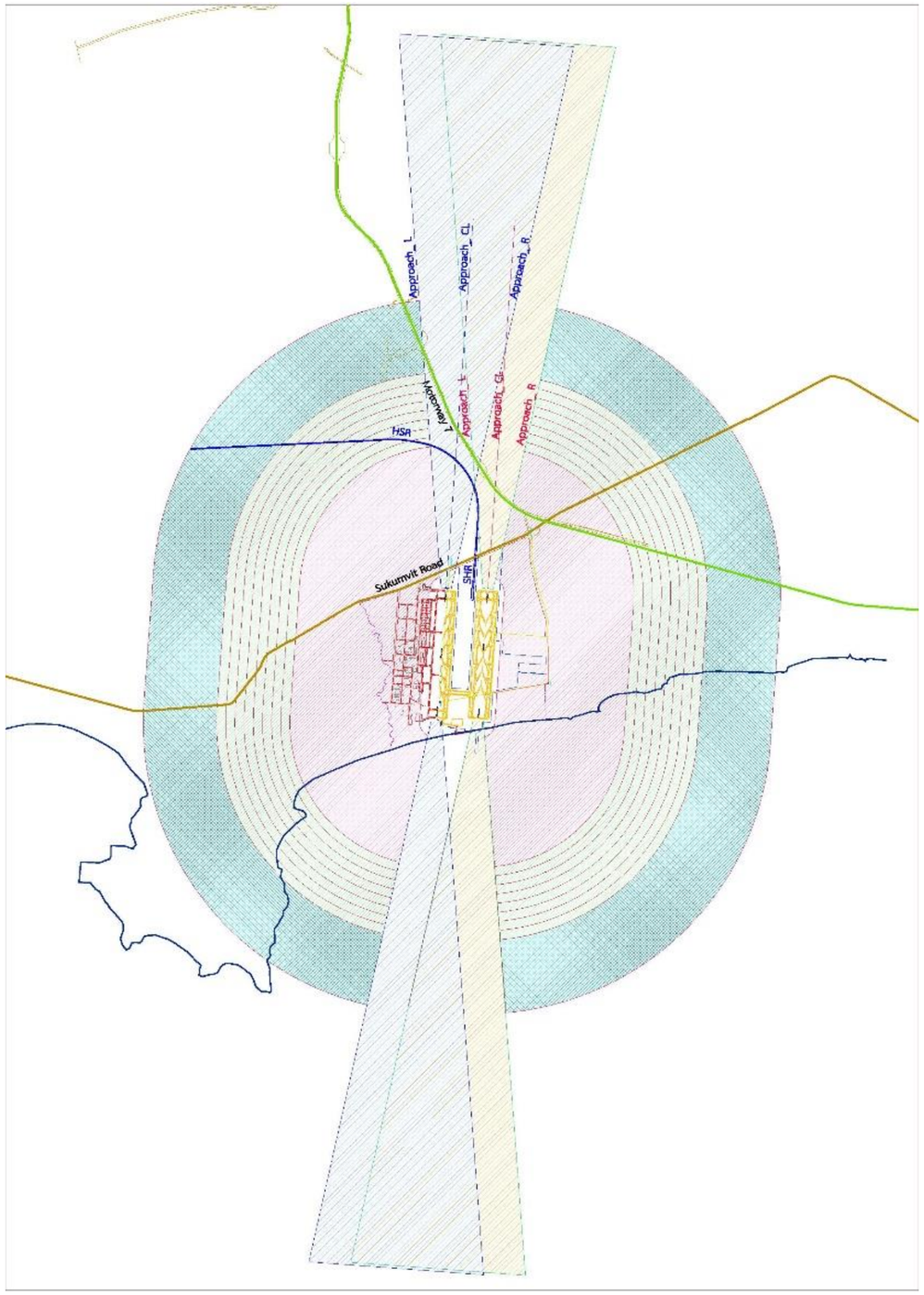
Figure 2.2□4 Distance from Runway 2 to Current Runway is 1,140 meters

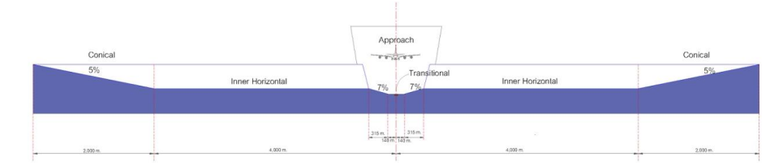
The project considered the obstacles to takeoff and landing of the plane in accordance with the requirements of the Civil Aviation Authority of Thailand's 14th edition on Airport Standards, shown in **Figure 2.2-5** and found that the structure of the high-speed train that was underground cut through the head section of Runway 1 does not obstruct the taking off and landing that go along the Approach Surface of runway 1 and 2 shown in **Figure 2.2-6** to **Image 2.2-8**



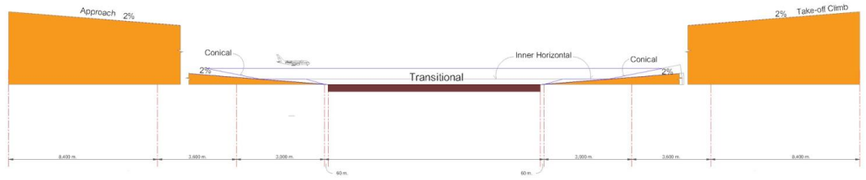
Source: Project to hire a consultant to support the Office of the Eastern Economic Corridor Policy Committee to administer and supervise contracts U-Tapao Airport Development Project and Eastern Aviation City for the fiscal year of 2020.

Figure 2.2-5 surface limiting obstruction in accordance with the requirements of the Civil Aviation Authority of Thailand



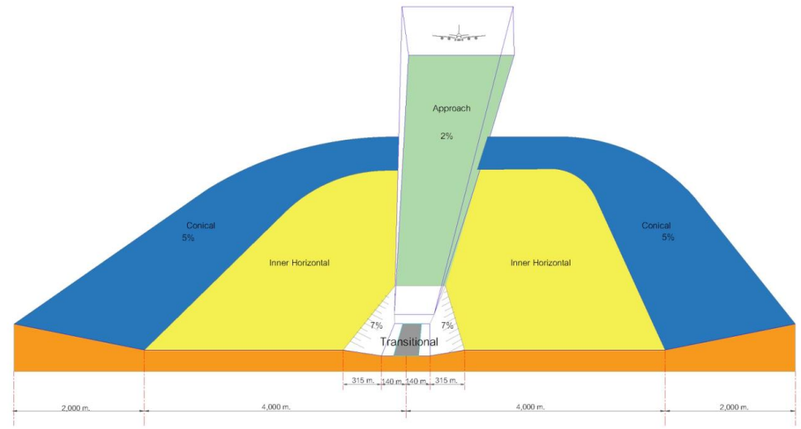


Section A-A

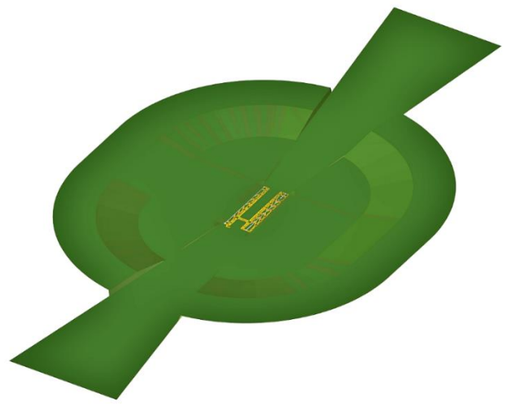


Section B-B

Requirement of the CAAT

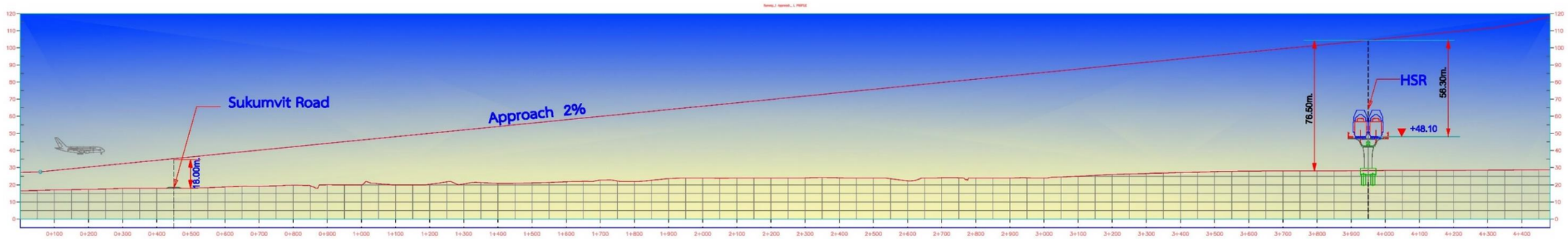


Requirement of the CAAT

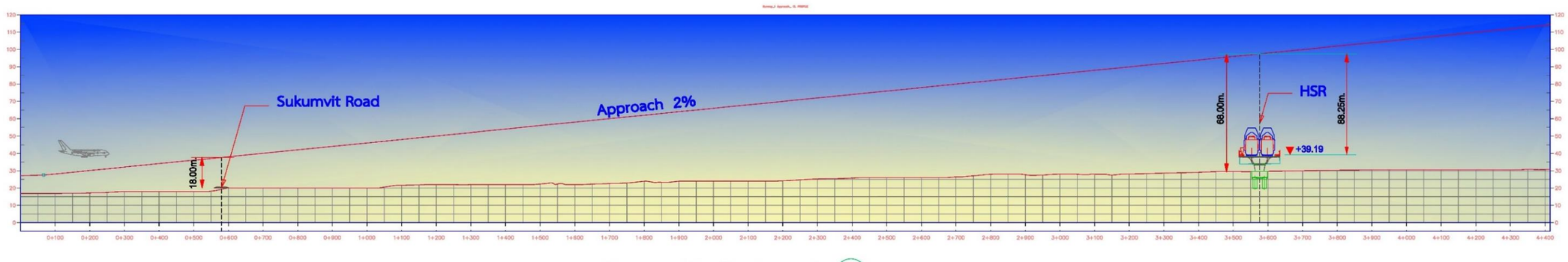


Source: Project to hire a consultant to support the Office of the Eastern Economic Corridor Policy Committee to administer and supervise contracts U-Tapao Airport Development Proje

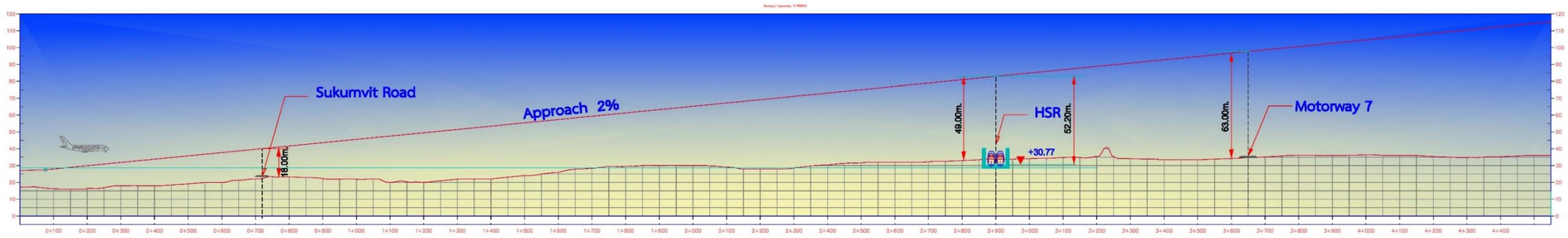
Figure 2.2 6 Surface limiting the obstruction of runway1 and 2



Runway_1 Profile Approach_L



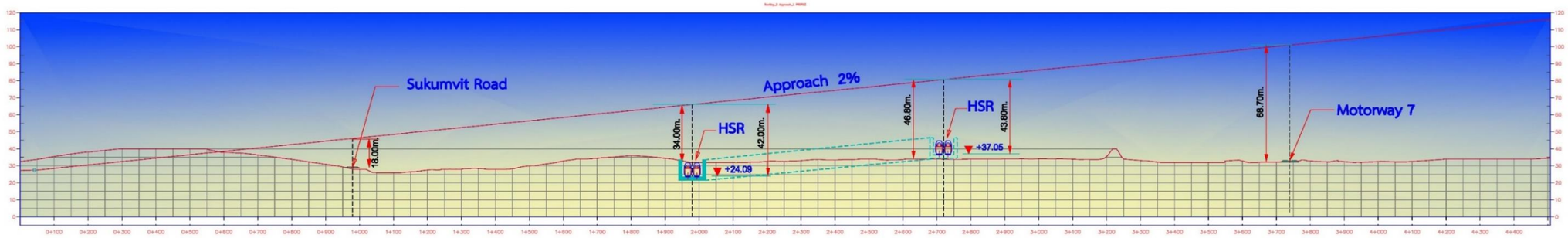
Runway_1 Profile Approach_CL



Runway_1 Profile Approach_R

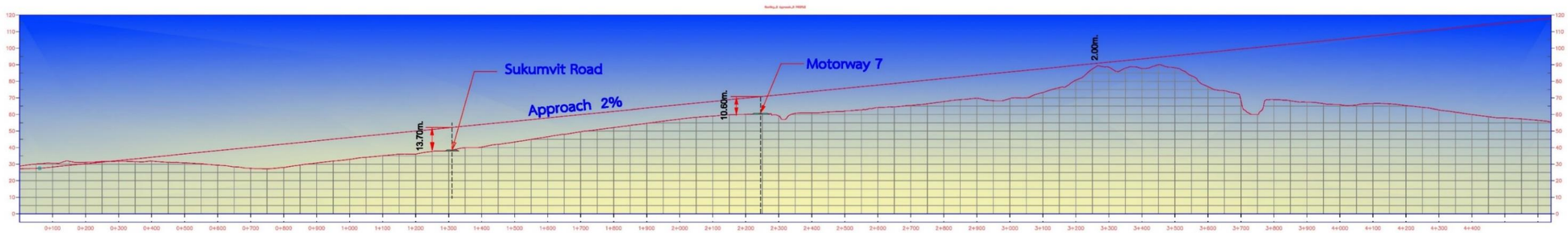
Source: the Office of the Eastern Economic Corridor Policy Committee to administer and supervise contracts U-Tapao Airport Development Project and Eastern Aviation City for the fiscal year of 2020.

Image 2.2□7 Approach Surface of Runway 1 U-Tapao International Airport



Runway_2 Profile Approach_L

Runway_2 Profile Approach_CL



Runway_2 Profile Approach_R

Source: Project to hire a consultant to support the Office of the Eastern Economic Corridor Policy Committee to administer and supervise contracts U-Tapao Airport Development Project and Eastern Aviation City for the fiscal year of 2020.

Image 2.2□8 Approach Surface of 2nd Street at U-Tapao International Airport

2.3 Guidelines for the Development of U-Tapao International Airport (Extension)

In developing an extended area of the airport, there will be Royal Thai Navy and EEC. It is the main agency in the implementation of the project as assigned by the board. It is within the scope of the joint venture agreement to invest in the development of U-Tapao Airport and the Eastern Aviation City. There are major government agencies and private operators that will be involved in the development, including:

- Royal Thai Navy is responsible for construction of runway and driveway 2, including construction of the Thai Airways International Aircraft Repair center (TG: MRO).
- EEC manages land use in the promoting area of 6,500 Rai, which is acting on behalf of the Treasury Department as specified in the act of EEC Section 53. In addition, There is still responsibility as specified in the contract, jointly invested in projects to develop the U-Tapao Airport and the city of the Eastern aviation, as EEC is state party of the joint venture agreement
- U-Tapao International Aviation Company Limited (UTA) as a private company to invest in the project to develop an airport and the aviation city of east, to develop a building section for U-Tapao International Airport (extension) and develop the Airport City and will manage U-Tapao International Airport under a Public Airport Operations Certificate instead of U-Tapao Airport, the Royal Thai Navy, when the new passenger terminal (3rd building) was completed. Prior to the opening of U-Tapao International Airport, the Royal Thai Navy will transfer a public airport operating certificate so that UTA can serve all U-Tapao International Airport. This will transfer commercial aviation activities from Terminal 2 (and Terminal 1 if it was in use during that time) to Terminal 3, whereby the Royal Thai Navy will implement it. Mutual Benefit Between Military Aviation and Civil Aviation As the Royal Thai Navy and UTA have signed a Joint Use Agreement (JUA) in accordance with the Air Navigation Act.
- Aeronautical Radio of Thailand Company, Limited develops a new air control tower and provides aviation services.
- Private sector, operator of public utilities services, namely operator of electricity and cold water production system (B.Grim Public Company Limited), operator of water supply and waste water treatment system (Eastern Water Resources Development and Management Public Company Limited) or East Water Public Company Limited, and operator of aviation gas system service
- Thai Airways International Public Company Limited provides service to U-Tapao Aircraft repair center.
- The Civil Aviation Institute conducts the development of training centers for aviation personnel.

The development of components according to the overview chart as mentioned above, in accordance with the guidelines of the master plan for study of suitability, the development project of U-Tapao Airport and the city of Eastern aviation, and surrounding areas, Rayong, 2018, divided the development into 3 stages. Details are shown in **Table 2.3-1** and **Figure 2.3-1**

Project area

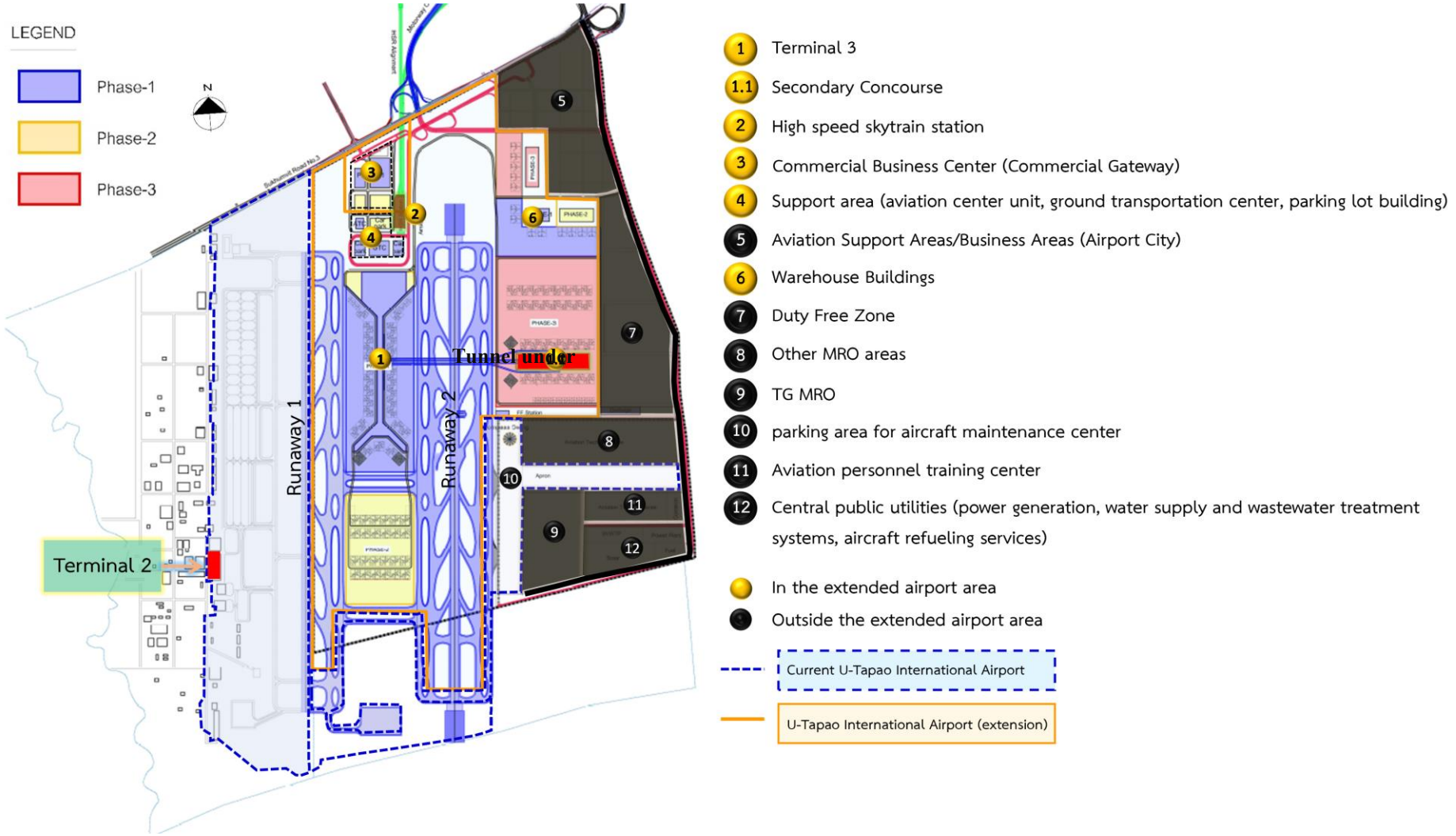
Table 2.3□1 Elements of the activities that will take place in the areas of Uthapa International Airport, expanded areas, and surrounding areas

Sequence	items	Activity Location	Phase 1 (2028) was developed in 2021-2023	Phase 2 (2038) was developed in 2030-2033	Phase 3 (2048) was developed in 2040-2043
1	Runway 2 and Taxiway	In the project area	Runway 2, 60 meters wide, 3,505 meterslong and parallel driving runway on the driveway 1 and 2	-	-
2	Passenger Terminal 3 (Terminal 3) and Satellite Terminal	In the project area	Terminal 3 (supports 14 million passengers per year)	Terminal 3 (extension for passenger capacity increases to 38* million passengers per year)	Sattellite Terminal, for passenger capacity has increases to 70* million passengers per year)
3	U-Tapao High Speed Railway Station (U-tapao HSR Station)	In the project area	U-Tapao High Speed Railway Station and underground tunnel work	-	-
4	Commercial Gateway and Airport City Support Areas	In the project area	Private investment	Private investment	Private investment
5	Aviation Business Support Areas/Business Areas (Airport City)	Outside of project area	Private investment	Private investment	Private investment
6	Cargo Terminal and Cargo Village	In the project area	0.194 million tons per year	0.591 million tons per year	1.108 million tons per year
7	Free zone of trade Free Trade Zone	Outside of project area	Product building and assembly area Free Trade phase 1	Product building and assembly area Free Trade phase 2	Product building and assembly area Free Trade phase 3
8	Other aircraft maintenance centers	Outside of project area	MRO Phase 1	MRO Phase 2	MRO Phase 3

Table 2.3□1 Elements of the activities that will take place in the areas of Uthapa International Airport, expanded areas, and surrounding areas

Sequence	items	Activity Location	Phase 1 (2028) was developed in 2021-2023	Phase 2 (2038) was developed in 2030-2033	Phase 3 (2048) was developed in 2040-2043
9	Aerospace Maintenance Center of Thai Airways (TG MRO)	Outside of project area	Thai Airways Aerospace Maintenance Center Building, Phase 1 and driveway pavement	Thai Airways Aerospace Maintenance Center Building, Phase 2	-
10	Apron of Maintenance Repair and Overhaul(MRO)	Outside of project area	Apron of the aircraft repair center (MRO)	-	-
11	Training Center for Aerospace Personnel	Outside of project area	Phase 1 Training Center for Aerospace and Aviation Personnel	Aerospace and Aviation Personnel Training Center, Phase 2	-
12	Central public utility systems				
	Electrical	Outside of project area	80 MW (during EIA operation) of combined thermal power plant. The solar powerplant of 15 MW and 50 MWh power storagesystem		-
	Public water supply	Outside of project area	10,000 cubic meters per day	10,000 cubic meters per day	-
	waste water treatment systems	Outside of project area	8,000 cubic meters per day	8,000 cubic meters per day	
	Aerospace Fuel Service	Outside of project area	15 million liters	10 million liters	-

Source: Project feasibility study master planning project U-Tapao Airport Development Project and surrounding areas, Rayong, 2018



Source: Project to hire a consultant to support the Office of the Eastern Economic Corridor Policy Committee to administer and supervise contracts U-Tapao Airport Development Project and Eastern Aviation City for the fiscal year ofthe fiscal 2020 was prepared by referring to guidelines provided in the Master Plan of the Feasibility Study Project U-Tapao Airport Development Project and Eastern Aviation City and surrounding areas, Rayong, 2018

Figure 2.3□1 Project areaframe and overview chart of components of activities that will occur in the extended U-Tapoa International Airport area and surrounding area

2.4 Components of the project within the project area

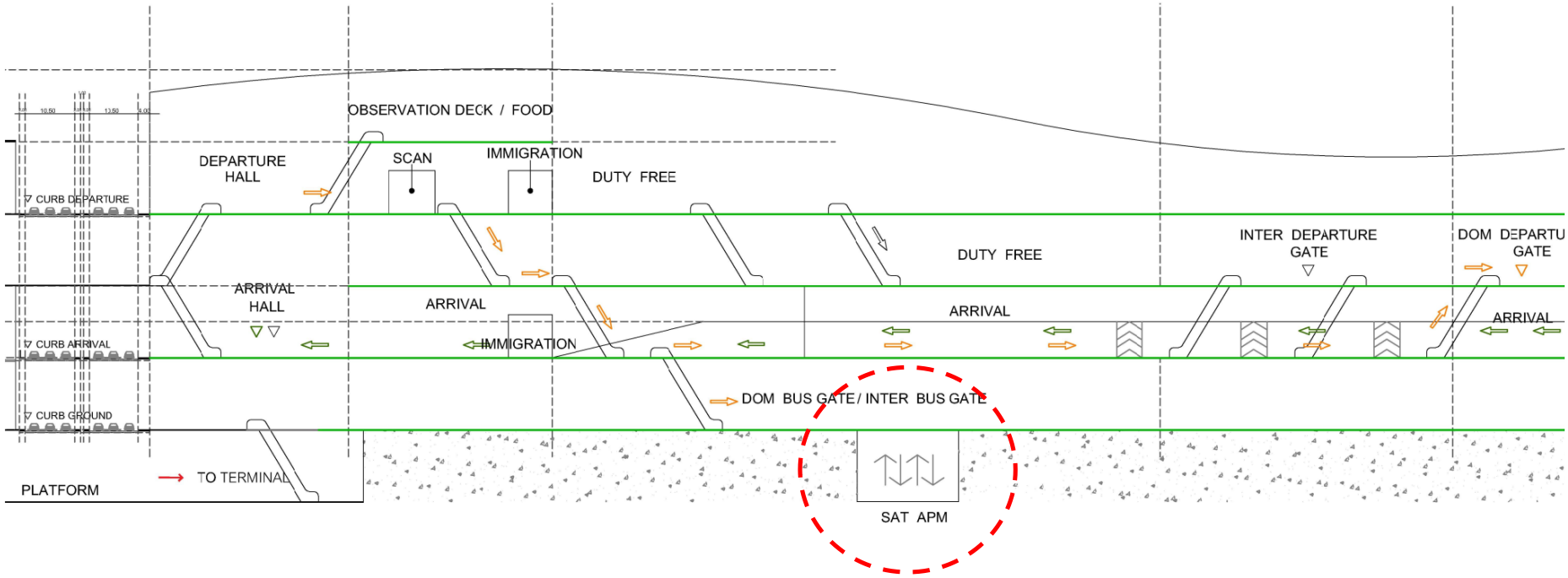
For the scope of the study and to prepare an environmental impact assessment report, the runway 2 development activity will be reviewed along with a tunnel under the runway and parallel driving route, Terminal 3, Satellite Terminal, Apron, U-Tapao HSR Station, Commercial Gateway, Airport City, Cargo Terminal in the extended airport area **as shown in Figure 2.3-1** Project area and **Table 2.3-1. These** components are supporting up to 70 million passengers per year in 2048. Details are as follows:

2.4.1 Runway and Driveway 2

Runway and Driveway 2 take about 36 months for construction. The runway 2 is located on the east side of runway 1 and is parallel to runway 1 at 1,140 meters. The length of a runway measured from both ends of the runway (runway threshold 18 and threshold 36) is 3,505 meters, code F, runway width 60 meters, and the shoulders of each side are 15 meters long, while the driveway 2 is parallel. With 6 lines of runway 2 (2 lines left, 2 lines right and 2 lines to the right of runway 1), the F code driveway is 23 meters wide.

For construction of a tunnel under the runway 2 that connects the terminal 3 (number 1 in **Figure 2.3-1** Project area) with the satellite terminal (No. 1.1 in **Figure 2.3-1** Project area) which needs to be carried out with the construction of the runway 2 in order to not have construction of the main structure under the runway 2 already open. After completing the construction of the tunnel under runway 2, this part of the Phase 1 and 2 will not be activated. Thus, the use of the terminal 3 in Phase 1 is designed to have a road inside the avaiation zone to connect to the east side activities.

In this regard, the Runway 2 Tunnel is constructed to support the APM Tunnel, Luggage Tunnel, and Public Utility systems Tunnel in accordance with the Royal Thai Navy master layout, which requires connection between Terminal 3 and the Satellite Terminal, as shown in **Figure 2.4-1 Link tunnel location**. The scope of the construction of the Runway 2 Tunnel is under the responsibility of the EEC and Royal Thai Navy, which ends at about 200 meters before Terminal 3. After that, the private sector will build the remaining tunnel in line with the next level of the terminal.



Source: Project to hire a consultant to support the Office of the Eastern Economic Corridor Policy Committee to administer and supervise contracts U-Tapao Airport Development Project and Eastern Aviation City for the fiscal year of 2021

Figure 2.4 1 Link tunnel locationconcept between the Terminal and Satellite Terminal

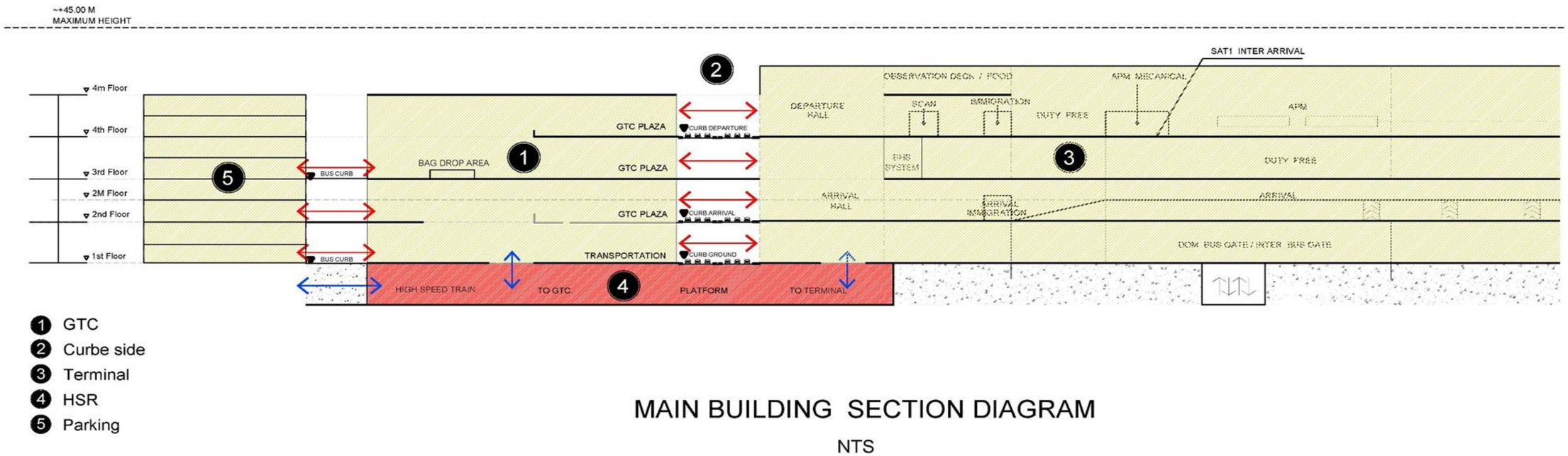
2.4.2 Terminal 3 and Satellite Terminal

Terminal 3 will be built and operated by private sector to joint invest in the project of development of U-Tapao Airport and the Eastern aviation city. The public sector has a plan to prepare before delivering the area, using a period of approximately 18 months after signing the joint investment contract. The private co-investment will be conducted in parallel during this period in providing capital sources and preparations before the construction work is set up within 3 years after delivering area. The initial design concept of Terminal 3 will accommodate arrivals and departures by separating the direction of the flowof passengers in the building according to their movement behavior so that the airport can provide full service airlines and low cost airlines. Initially, it will be a 4-storey high-rise building and will have a basement to support the connection between air travel and trough travel by high-speed rail as follows:

- Ground floor, the area for APM systems, connects Terminal 3 and the Satellite Terminal
- 1st floor, the area for connecting to public transport and the Ground Service & Loading area.
- 2nd floor, the arrivals area, commercial area, immigration and baggage claim area.
- 3rd floor, commercial and retail store area and the BHS & X-Ray work area.
- Level 4, the departure area, check-in counters, retail and retail areas.

For the Satellite Terminal, there is a service area for arrival and departure, which is a 4 floors building and a 1 ground floor. The ground floor is the area for the APM system which is connected to Terminal 3 and the second floor is the Ground Service & Loading area. For the arrival area, the 3rd floor is a commercial and retail area and the 4th floor is departure area.

Passengers can walk to Terminal 3 to the ground transportation center, the high-speed railway station, and the car park building in front of Terminal 3, with details shown in **Figure 2.4-2** and **Figure 2.4-3**

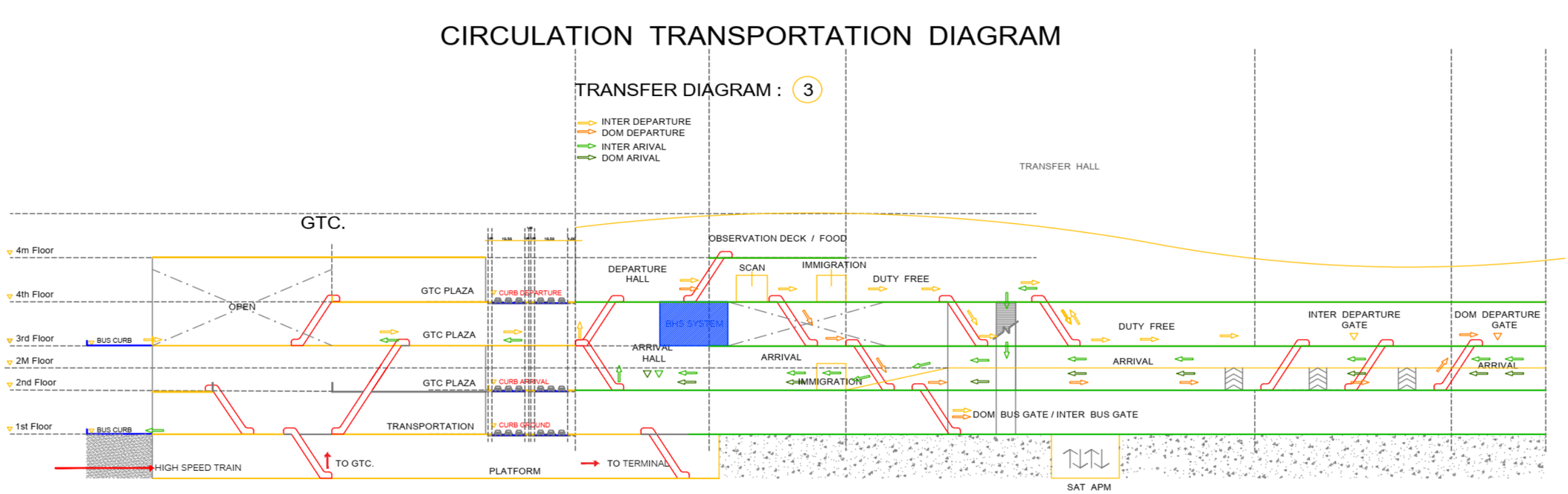


MAIN BUILDING SECTION DIAGRAM

NTS

Source: Proposal for the private sector to invest in the U-Tapao Airport Development Project and the Eastern Aviation City, 2019

Figure 2.4 2 Main Building Section Diagram



Source: Proposal for the private sector to invest in the U-Tapao Airport Development Project and the Eastern Aviation City, 2019

Figure 2.4 3 Terminal 3 Cut-off and Arrival and Departure flow

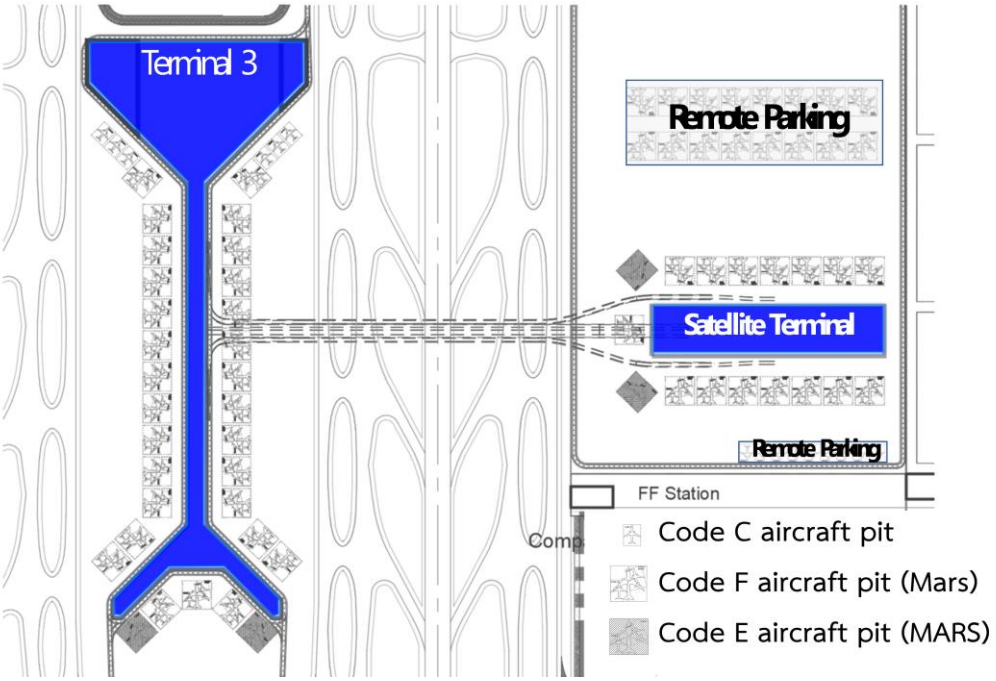
Main components and facilities within Terminal 3 building comprise of:

1) Contact Gates which supports 54-103 aircraft pit (accommodating for 70 million passengers per year), is shown in **Figure 2.4-*4***, comprise of:

1.1) The door to connect a pit for Code C sized machine, total of 6 pits

1.2) The door to connect a pit for Code E MARS sized machine (one pit for each lot can support 1 plane of Code E or 2 planes of Code C), total of 44 pits.

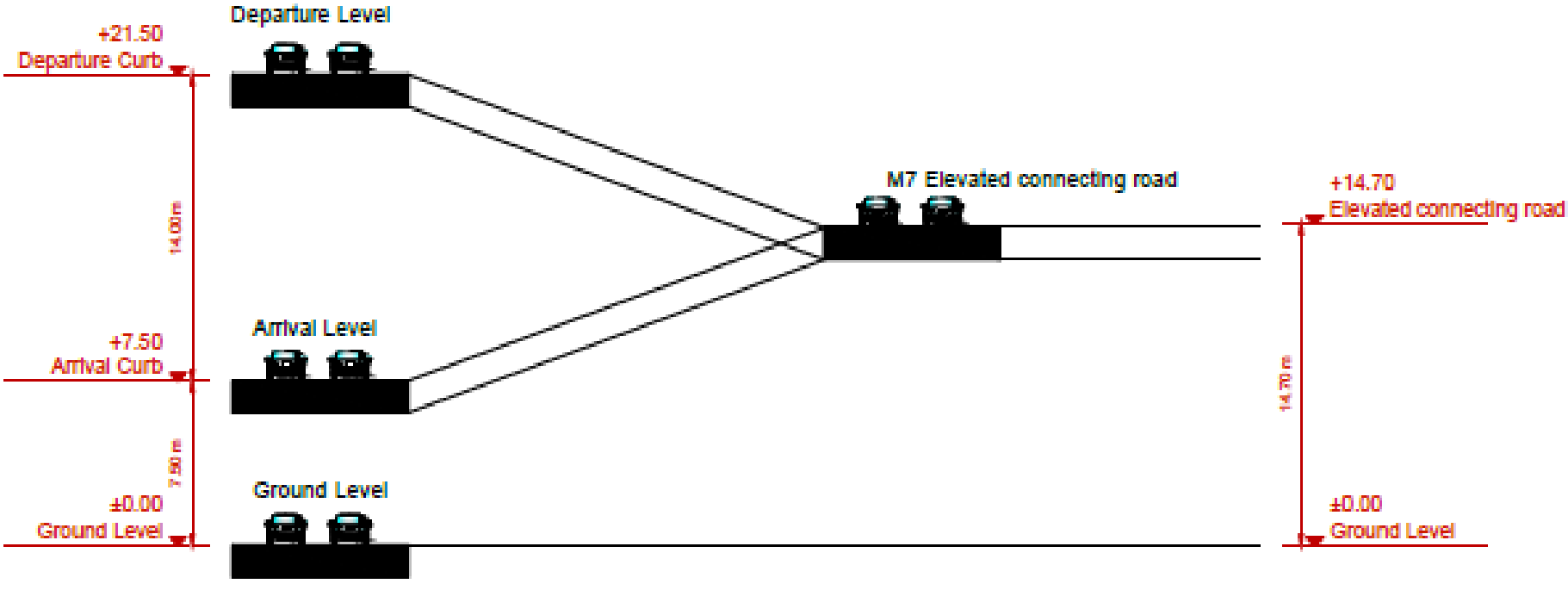
1.3) The door to connect a pit for code F MARS sized machine (1 pit for 1 plane of Code C or, 2 planes for Code C), total of 4 pits.



Source: Project to hire a consultant to support the Office of the Eastern Economic Corridor Policy Committee to administer and supervise contracts U-Tapao Airport Development Project and Eastern Aviation City for the fiscal year of 2021

Figure 2.4-4 Contact Gates

2) Dual-Level front road are shown as **Figure 2.4-**5 Dual-Level Front, with parking areas for arrival and departure, which is an elevated entrance to the airport, can be connected from Intercity Motorway No. 7 (Motorway No. 7) before reaching Terminal 3, the road is divided into two levels, going to the 2nd floor for the arrivals and the 4th floor for departure passengers with an example of the entrance-exit at Suvarnabhumi Airport, shown in **Figure 2.4-6**



Source: Proposal for the private sector to invest in the U-Tapao Airport Development Project and the Eastern Aviation City

Figure 2.4 5 Dual-Level FrontRoad

Figure 2.4 6 Example of road to 4th floor, Departure and 2nd floor, Departure of Terminal at Suvarnabhumi Airport.

In order to support access to the airport, nearby Terminal 3 area. Parking areas are located in front of the terminal building. There are car park building and a parking lot at the nearby high-speed train tunnel connecting three airports which can support around 4,300 cars at the beginning, shown in **Figure 2.4-7**

Source: Project to hire a consultant to support the Office of the Eastern Economic Corridor Policy Committee to administer and supervise contracts U-Tapao Airport Development Project and Eastern Aviation City for the fiscal year of 2021

Figure 2.4-7 Car park building located in front of terminal 3.

3) The longitudinal administrative building consists of a registration points, baggage claim points, CIQ (Customs Immigration Quarantine), security check system, waiting area

4) Central baggage inspection area

5) Retail center in the aviation area

6) Specific area for future expansion of the Administration Building

7) Most boarding gates (both early and mid-term developments) are within 500 meters from the Administration Building.

8) Automated People Mover (APM)

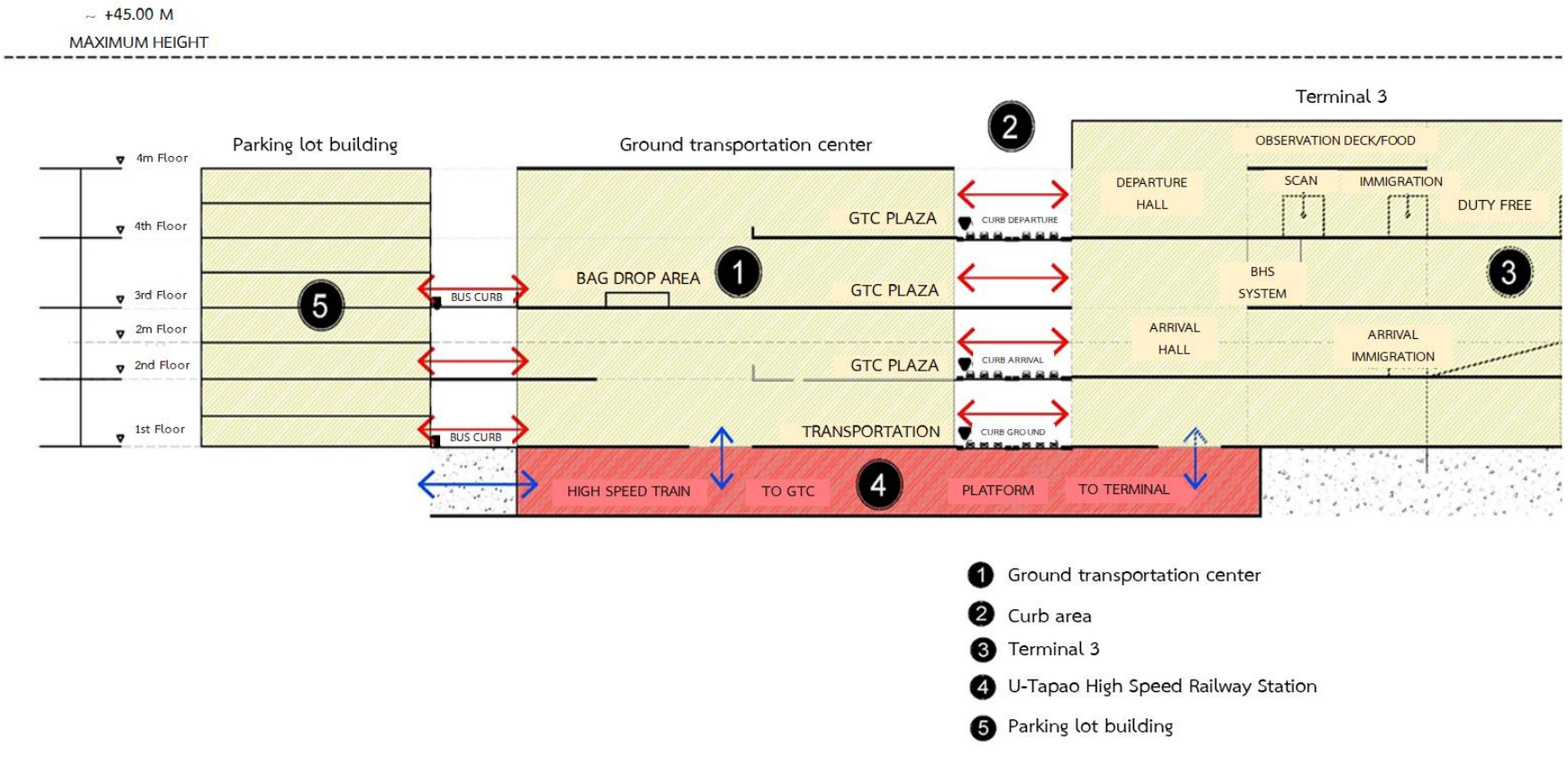
9) Support areas include ground transport center buildings, parking areas, aviation control units. The car park for the terminal 3 will be designed as a separate car park for the terminal 3, located in front of Terminal 3, and a car park is located at the top of the high-speed train tunnel line and parking for approximately 4,300 vehicles, with the car park connected to the ground transportation center, to Terminal 3 building shown in **Figure 2.4-8** in front of Terminal 3 building, there is a Drop Off/Curb Side area for departures on the 4th floor and the arrival hall on the 2nd floor which has a traffic flow similar to Suvarnabhumi Airport.

There are 3 phases for the development of air operations at U-Tapao Airport, as follows:

Phase 1: Approximately 14 million passengers per year are served in Terminal 3 Building, parkings adjacent to buildings and remote parking.

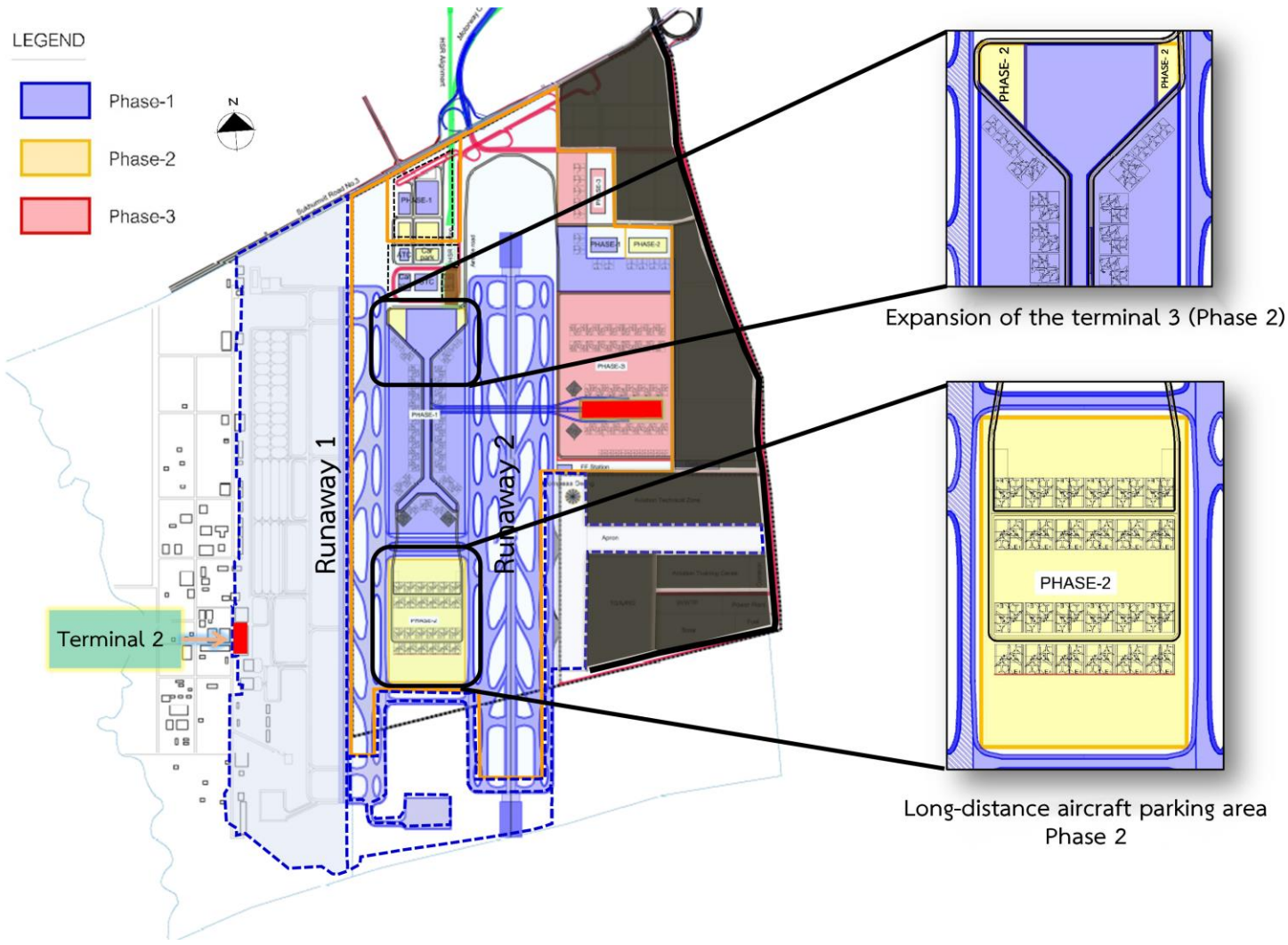
Phase 2: It has a capacity of approximately 38 million passengers per year, expanding the Terminal 3 and building a remote parking, where passengers are required to take the Ramp Bus to airplanes, as shown in **Figure 2.4-*9***

Phase 3: Support for approximately 70 million passengers a year is the construction of a satellite building and is connected to the terminal 3 with the APM system, parkings adjacent to buildings and remote parking.



Source: Project to hire a consultant to support the Office of the Eastern Economic Corridor Policy Committee to administer and supervise contracts U-Tapao Airport Development Project and Eastern Aviation City for the fiscal year of 2021

Figure 2.4-8 Link between the areas for parking for cars that use the service in the project and Terminal 3



Source: Project to hire a consultant to support the Office of the Eastern Economic Corridor Policy Committee to administer and supervise contracts U-Tapao Airport Development Project and Eastern Aviation City for the fiscal year of 2021

Figure 2.4-9 Development of a Phase 2 Operating Area - Additional Remote Parking on the South side of Terminal 3

2.4.3 Commercial Gateway

The Commercial Gateway, in Figure **Figure 2.3-**1 Project area, is operated by private sector, invests in the development of U-Tapao InternationalAirport, which is part of the project to develop U-Tapao International Airport and the Eastern Aviation City, located in the front of U-Tapao InternationalAirport, to attract local population and visitors to use service of various facilities.

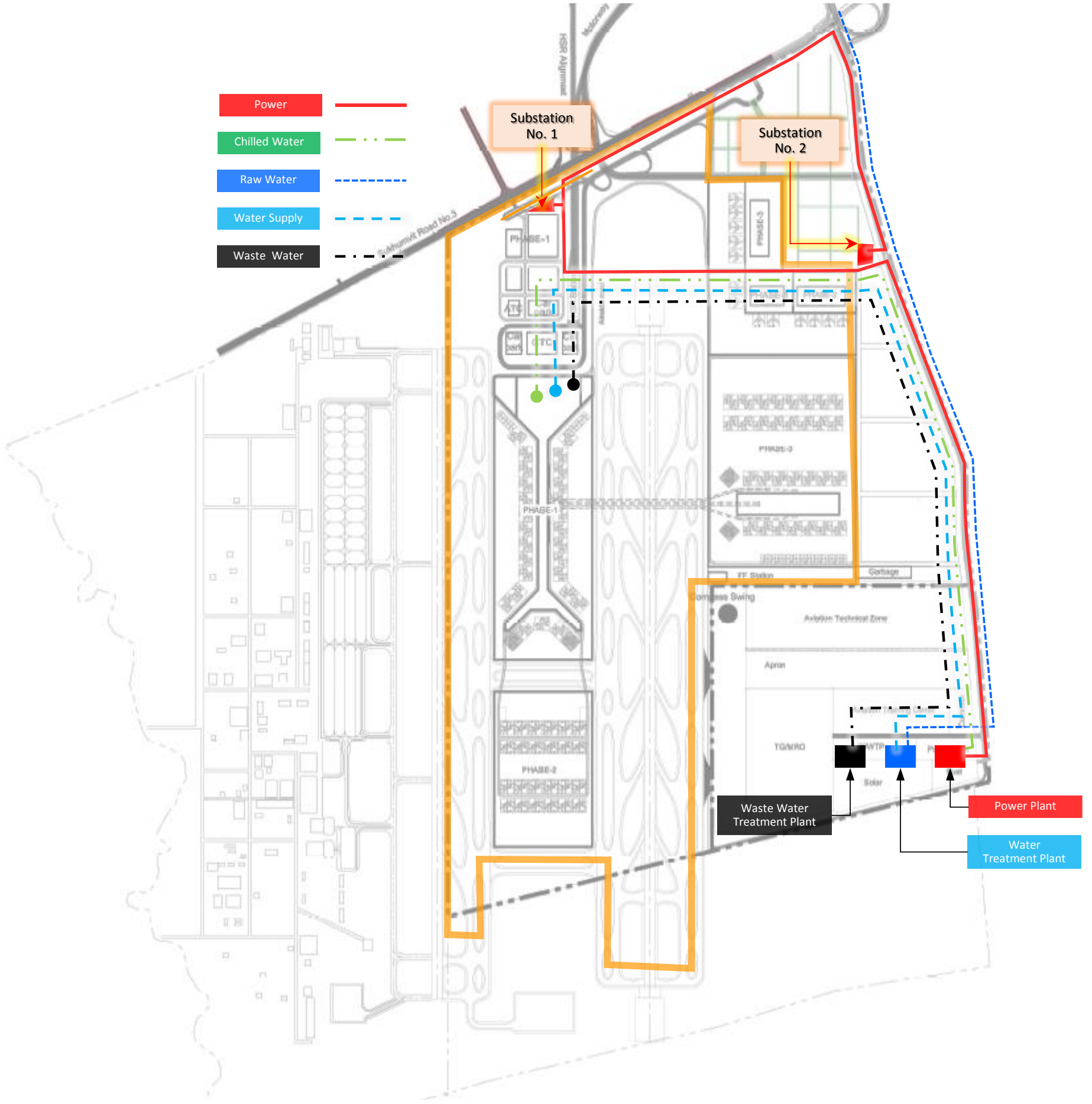
2.4.4 Cargo Terminal and Cargo Village

Cargo Terminal and Cargo Village, area No. 6, in **Figure 2.3-1** Project area) operated by private sector to invest in the development of U-Tapao International Airport as part of the project of development of U-Tapao International Airport and Eastern aviation city, Cargo Terminal and Cargo Village has components to support the transportation of goods about 600,000 tons per year or more, consisting of cargo buildings and cargo aircraft park. Most products are expected to be transported through the freight carriers. Therefore, it may be designed to have roads run under Runway 2 or roads in Airside area, at least 1 route for cargo truck passing through without crossing runway

2.5 Public utility systems for developing U-Tapao International Airport in project area

2.5.1 Electrical systems, water supply systems, and waste water treatment systems

The project at U-Tapao International Airport will receive electricity, water supply, and waste water treatment from public utility systems outside the project area. The concept of using roads on the east side of U-Tapao International Airport is Main Utility Corridor (out of project area) to place pipes for work, such as electricity lines, public water pipes, and waste water collection pipes, which are installed as underground systems for service in the area of the project, such as Terminal 3, Business Support area in front of the Terminal (Gateway), and Cargo, as shown in **Figure 2.5-*1*** **Basic.** For the previous aviation zone, the current public utility systems will be determined to continue to be separate from the airport extension.

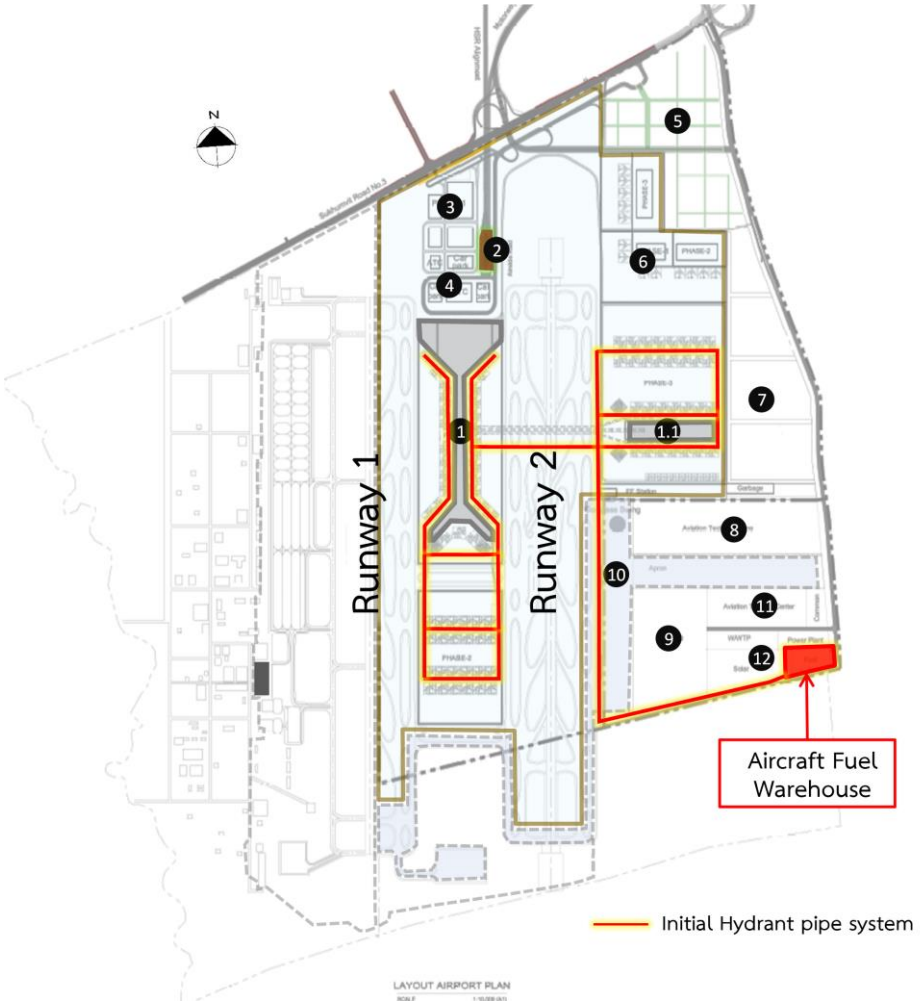


Source: Project to hire a consultant to support the Office of the Eastern Economic Corridor Policy Committee to administer and supervise contracts U-Tapao Airport Development Project and Eastern Aviation City for the fiscal year of 2021

Figure 2.5□1 Basicconcepts for laying piping systems for various public utility systems in the project area

2.5.2 Aerospace Fueling System

The project will arrange for the service of JET A-1 aircraft refuelling by using Refueling Truck and an underground Hydrant pipe to the ground pit, receiving the JET A-1 aircraft fuel from the depot and Hydrant Pump Station outside the project area, with approximately 19 rai shown as **Figure 2.5-2** Initial

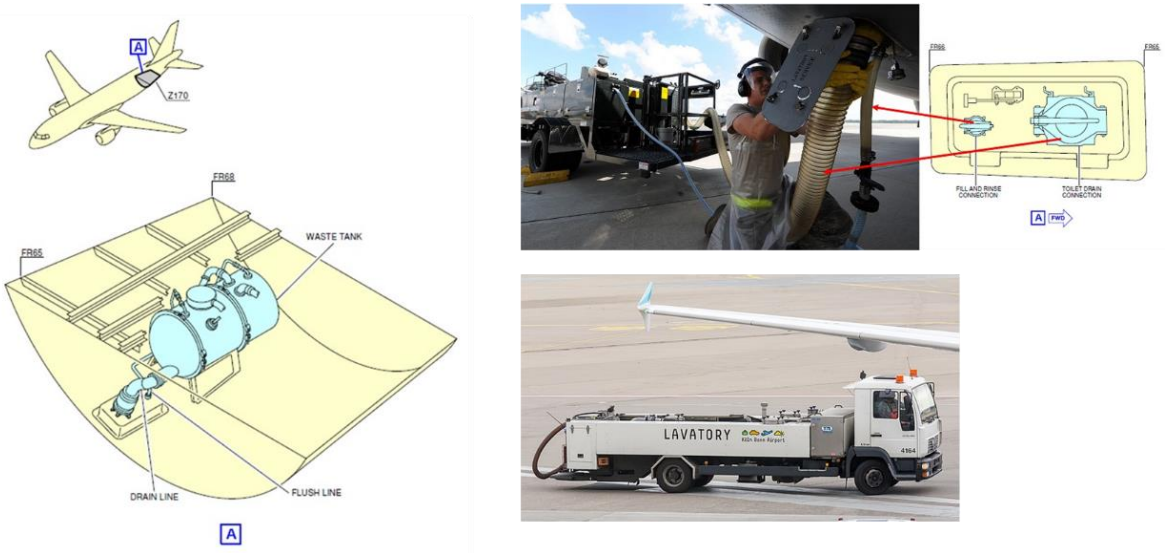


Source: Project to hire a consultant to support the Office of the Eastern Economic Corridor Policy Committee to administer and supervise contracts U-Tapao Airport Development Project and Eastern Aviation City for the fiscal year of 2021

Figure 2.5-2 Initial Concept of the Hydrant pipe installation for Aircraft Fueling Service

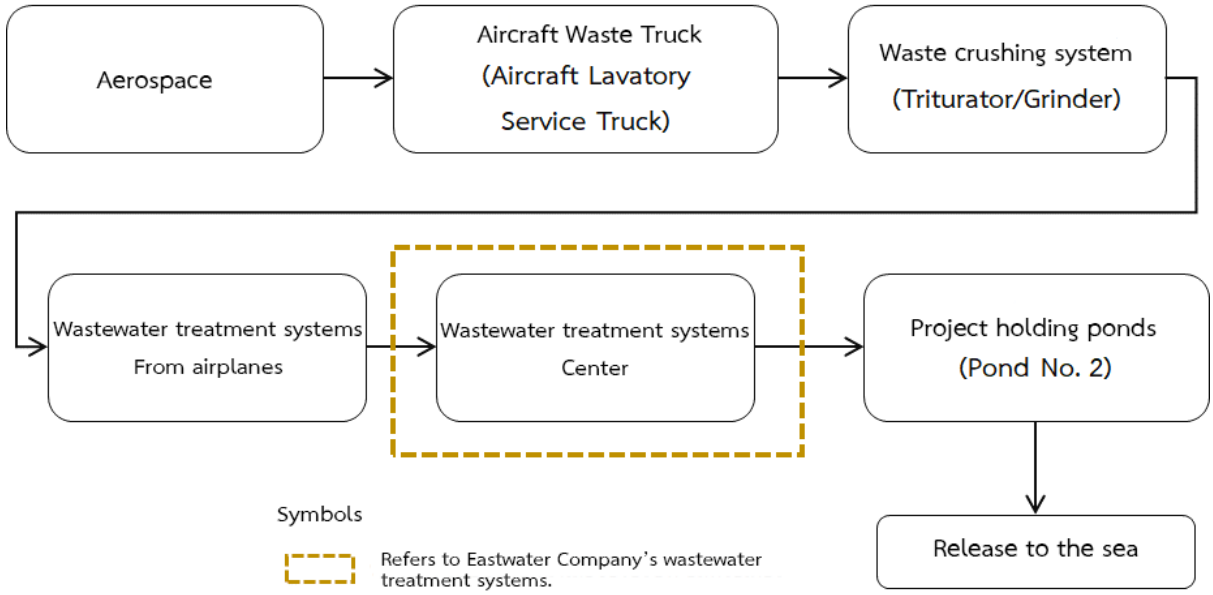
2.5.3 Aerospace waste water treatment system

Aerospace waste water is caused by the detergency of aircraft passengers. Most waste water and air wastes are found in both solid and liquid conditions. The project will be managed when the aircraft is at the pits and there is a Lavatory service truck to dock and catch the waste from the aircraft. For example, transferring the waste from the aircraft shows in **Figure 2.5-3** in order to be taken into Triturator and waste water treatment systems from aircraft to meet the requirements of the table attached to the Industrial Estate Notification of Thailand No. 76/2560, entitled "General Standards for waste water treatment in industrial waste water treatment systems before being transferred to the central waste water treatment system managed by Eastern Water Resources Development and Management Public Company Limited or East Waterto treat it as a waste water that has the qualifications according to the notification of the Ministry of Natural Resources and Environment Re: Determination of Standards for Controlling waste water from a Source Type industrial plant Industrial estate and industrial zones dated 29 March 2016 before draining into the project's reservoir (Pond No. 2) and further released to the sea. Details show as **Figure 2.5- 4**.



Source: Aviation Learnings Sharing Knowledge of Airport Operations. https://aviationlearnings.com was searchedon 9 August 2021

Figure 2.5-3 Example of handling waste from airplanes



Source: Project to hire a consultant to support the Office of the Eastern Economic Corridor Policy Committee to administer and supervise contracts U-Tapao Airport Development Project and Eastern Aviation City for the fiscal year of 2021

Figure 2.5 4 Aircraft waste water managementchart of the project

2.5.4 Main road within the project and on the road to U-Tapao International Airport

U-Tapao International Airport has provided entrance and exit for passengers using Sukhumvit Road and the Inter-City Highway No.7 mainly as follows:

Inter-City Highway No. 7

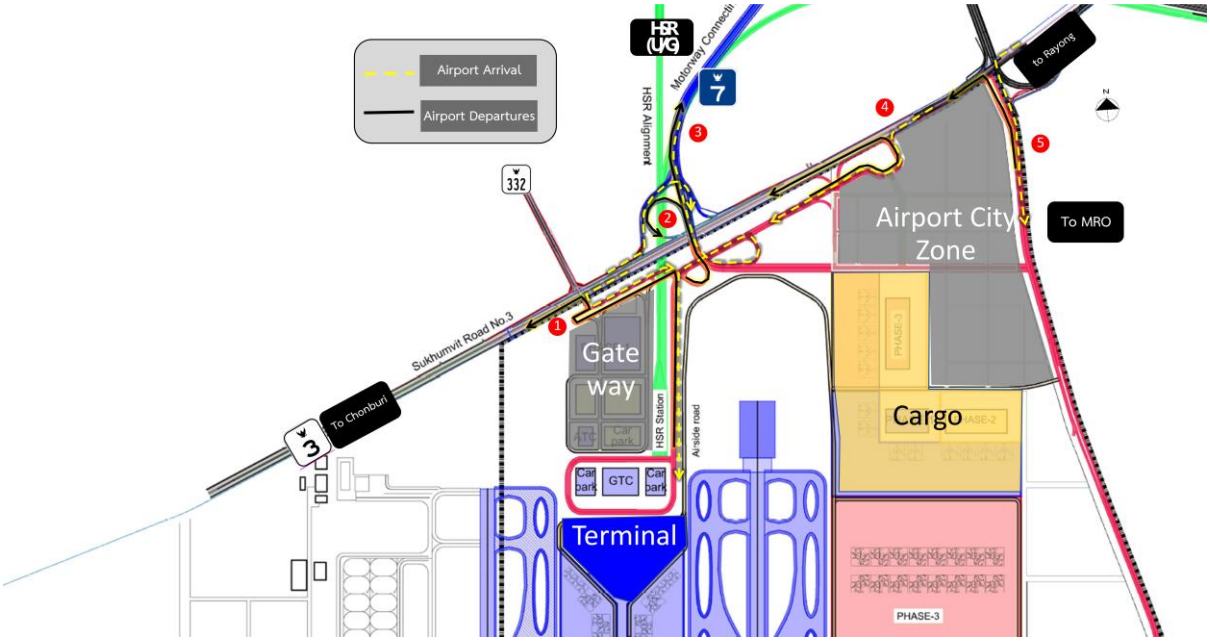
The Department of Highways is responsible for the construction of Inter-City Highway No.7 and the extension connecting to U-Tapao Airport, area 3, in **Figure 2.5-**5 Entrance-Exit traffic, which can support traffic on both arrival and departure from U-Tapao Airport. The Department of Highways is responsible for designing and construction only areas that are outside U-Tapao Airport. The private contractors are responsible for designing and construction inside of U-Tapao Airport.

Sukhumvit Road

For connections to Sukhumvit Road, 3 locations for U-Tapao Airport to reach Terminal 3, area 1, 2 and 4 in **Figure 2.5-**5 Entrance-Exit traffic the elevated route allows visitors to travel from Road number 332 or Chonburi to the airport via Sukhumvit Road so that the highway is easily accessible to the airport, and the arrival passengers (Arrivals) can also leave the airport and take the elevated route to continue their way to Rayong. The Highway department is in the phase of the elevated route design which will have 4 traffic lanes.

In addition, the project has specified an entrance to the east (Area No. 5 of **Figure 2.5-**5 Entrance-Exit traffic) to enter the Airport City Zone (Airport City Zone), Free Zone, and Cargo Zone, the aircraft maintenance center, aviation personnel training and central public utilities locations to separate traffic from passengers who will use the new terminal. In front of the Airport City Zone, additional entrances and exits will be constructed as an alternative to the service users in this area. It has been established that the main road on the east side has at least 4 traffic lanes

with a road area of approximately 60 meters for allocating road areas and the installation of various public utility systems as for the connection between the said road and Sukhumvit Road, it has been integrated through the U-Tapao Airport Development Project Integration Working Group and the Eastern Aviation City appointed by Sub-Committee Driving the Development Project of U-Tapao Airport and Eastern Aviation City The Deputy Minister of Defense has ordered No. 001/2563 to appoint a working group to integrate the U-Tapao Airport Development Project and the Eastern Aviation City, as in **Appendix 2-1**, so that the project has a plan, scope and guidelines. carry out various construction projects together in the project area to be effective in accordance with the set goals. The composition of the working group consists of EEC, representatives from government agencies and related agencies which has the Department of Highways as a working group including local representatives.



Source: Project to hire a consultant to support the Office of the Eastern Economic Corridor Policy Committee to administer and supervise contracts U-Tapao Airport Development Project and Eastern Aviation City for the fiscal year of 2021

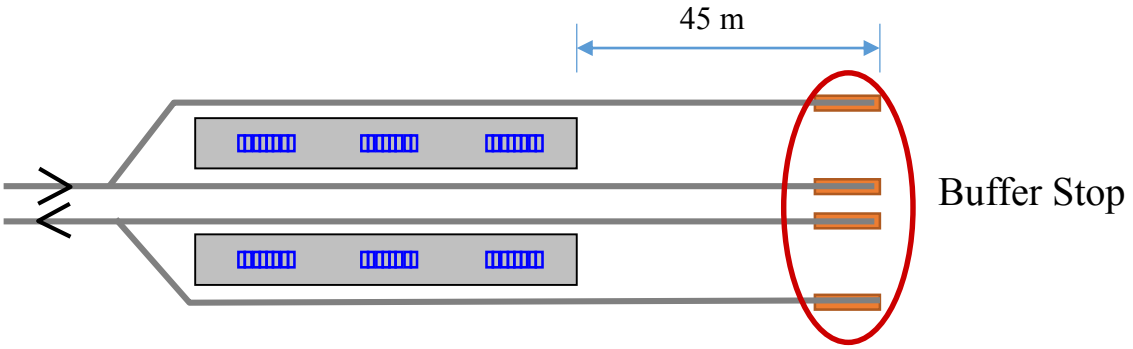
Figure 2.5 5 Entrance-Exit trafficof every roads

2.5.5 U-Tapao High Speed Railway Station

The high-speed rail project (Don Mueang Suvarnabhumi-U-Tapao) is operated by a private company, investing in the high-speed rail project of the three-Airport Links, which has been studied and prepared for environmental impact assessment. It was approved in 2019, and the route consists of 9 high-speed stations, including Don Mueang Station, Bang Sue Station, Makkasan Station, Chachengsao Station, Chonburi Station, Sriracha Station, Pattaya Station, and U-Tapao Station which are located on ground floor of Termianal 3 of U-Tapao International Airport with building assembly systems such as electrical systems, mechanical systems, fire protection system, water supply and sanitation to support the use of the building for passengers and service users to be comfortable and safe. There is a central platform that can support 4 platforms. The station building can connect to the building of U-Tapao International Airport.

For the area boundary of the project to develop Runway and Driveway 2 at U-Tapao International Airport, there is a high-speed train station in the area boundary with the consent of U-Tapao International Airport, which is connected to the ground transportation center building on the basement, which is the Commercial Gateway/Support Zone located on the Landside. The ground transportation center building is located in front of Terminal 2, with a path connecting between the ground transportation center building and the new terminal as shown in **Figure 2.4-2.** Therefore, construction of the U-Tapao high-speed railway station must be coordinated in order to coordinate the design and construction plan of the construction. The Eastern Special Development Zone Policy Committee has **announced the appointment of a joint subcommittee to coordinate the high-speed rail project connecting three airports and the U-Tapao Airport Development Project and the Eastern Aviation City**, to coordinate the positioning of the high-speed trains, to coordinate the design of the U-Tapao high-speed train station new terminal design and ground transportation centers to be systematically linked in order to provide the greatest benefit to serving the people and to coordinate the linkages on construction methods, procedures and technologies in order to reach an agreement on the persons responsible for the construction of each connected/related work; to be clear as in **Appendix 2-2**.

For the preliminary concept of designing a high-speed train station from the high-speed rail linking three airports to a 2-storey underground station, the slope of the high-speed rail tunnel into the U-Tapao basement station has a slope of 16 Permille **(Figure 2.5-*6*)**. Before entering the station with the number of platforms 2 platforms located opposite each other and there are 4 trough located on each side of the platform, divided by trough . The platform is 210 meters long with all trough ridge heights. The end of the platform will have a length of trough 45 meters, with a buffer stop installed at the end of the trough to prevent the train from derailing. Therefore, the incoming trains at U-Tapao Station will gradually reduce the speed to zero at the station. If there is a flow of the car, there will be enough margin and there is a collision pad at the back of the trough to help stop the car safely.



Source: The Eastern Economic Corridor Policy Office, 2021

Figure 2.5-6 Basic concept of the design of a high-speed rail station connecting three airports

From the high-speed train station concept of the high-speed rail linking three airports project, the assumption of high-speed train platform height, measured from the rail trough level to the platform height of 1.25 m (refer to the study on the design of the high-speed rail linking three

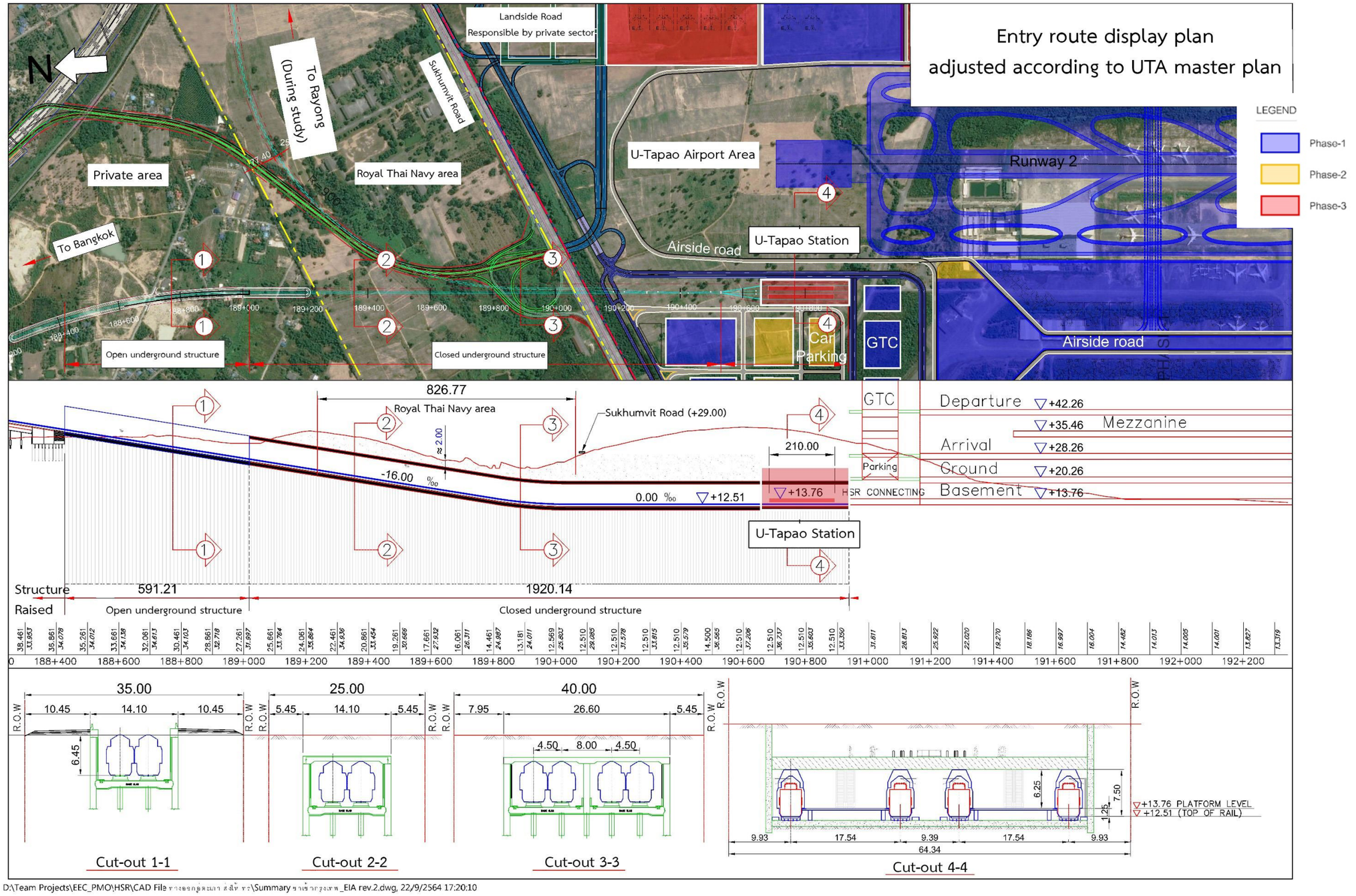
airports), is shown in**Figure 2.5-7**. However, the platform height depends on the system. Therefore, the three airport high-speed rail project will have to rethink the design concept of this high-speed train station. It should consider setting the height of the platform to be equal to the height of the car in accordance with the Universal Design principles so that all groups of users or people with disabilities can use the service equally which must comply with the design standards of the structural profile of safety zone (Structural Profile) and between the safety zone of the car (Loading Profile) and the edge of the platform to have a safe distance according to the requirements.

For the main components of U-Tapao High Speed Railway, which is a 2-storey underground station, it consists of:

(1) The 1st floor is the platform level for trains, stopping at the station for arrival to get off at the station or departure passing through which tickets are sold for boarding the trains. There is an escalator or lift for disabled persons to the 2nd floor, which is a sales floor (Concourse Level).

(2) Concourse Level is a floor facilitating for visitors, with key components in the station, including:

- The arrival area for passengers is divided into 2 parts, i.e. 1) an Unpaid area, such as an elevator/escalator, toilets, and 2) a Paid area, such as a ticket gate, a waiting area.
- Staff areas include ticket office, information office, staff working office, meeting room, toilets.



Source: Project to hire a consultant to support the Office of the Eastern Economic Corridor Policy Committee to administer and supervise contracts U-Tapao Airport Development Project and Eastern Aviation City for the fiscal year of 2021

Figure 2.5□7 High-speed rail line in U-Tapao International Airport area (introductory)

2.5.6 Drainage System and Flood Protection

1) **The design of the drainage system** contains the following inspection specifications:

- **Rainwater data :** The study has collected the necessary data for designing the drainage system by analyzing related data such as rainwater intensity data in the project, using data of KGT.19, station code 09171, Panasnikom District, Chonburi, and the data in 1998-2018. The rainwater data collection agency is Royal Irrigation Department, which is summarized as Intensity-Duration-Frequecy Curve (IDF),andDepth-Frequency Curve (DDF)as shown in **Figure 2.5-**8 and **Figure 2.5-**9 respectively.

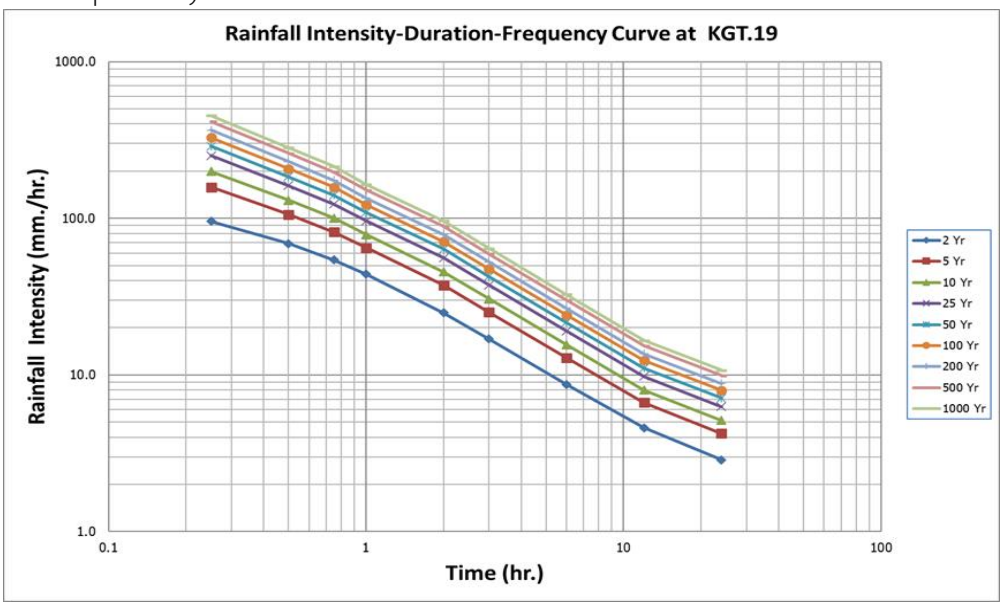


Figure 2.5-8 Intensity-Duration-Frequency Curve(IDF)

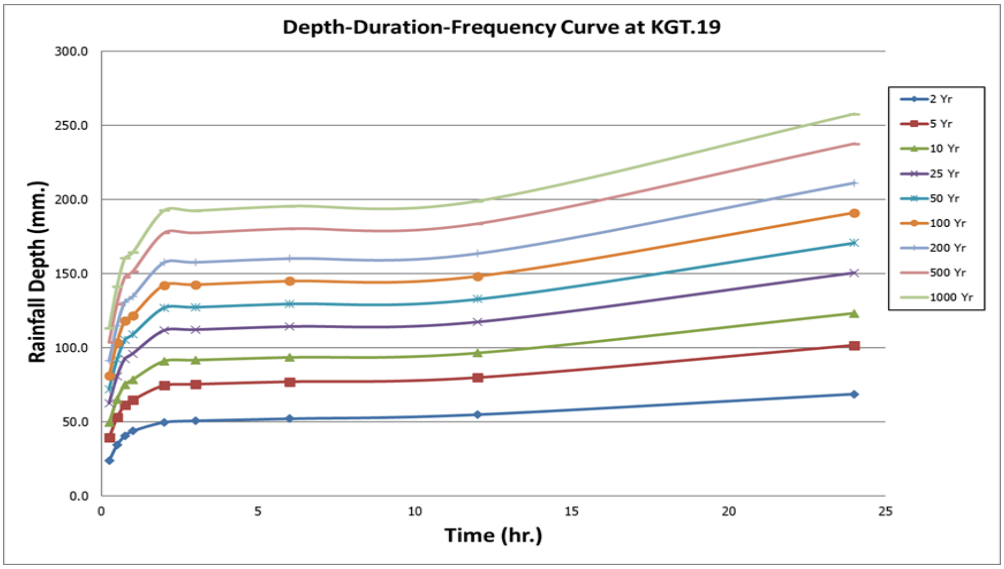


Figure 2.5-9 Depth-Duration-Frequency Curve(DDF)

Note : Calculation of the water flow rate in the project for trough(permanent), 100-year Return Period, and trough(temporary) for 5 years Return Period.

Source: Design of the project's drainage system, B.E. 2563 based on information from the Royal Irrigation Department. Ministry of Agriculture and Cooperatives, 2015.

2) Principles that apply to the project

- **Maximum flow rate (Rational Formula):** It is calculated for the Catchment Area less than or equal to 25 square kilometers. Based on the characteristics of the terrain and profile of the runway and driveway, it is to find the maximum flow rate for the water. It is calculated from the amount of rainfall that falls in the receiving area (the amount of rain water left from the soil evaporation, permeate to soil, evaporation and storage in the surrounding water trough). It is assumed that the rainwater is evenly distributed.

Maximum flow rate calculation can be found by following equations:

$$Q = 0.278CIA$$

When Q = Maximum waterflow rate at the points of review, the unit is cubic meters/second.

C = The coefficient of runoff depends on the characteristics of the rainwater receiving area.

I = Rainfall intensity is measured in millimeters/hours

A = The rainwaterarea is in square kilometers. It can be found by dividing the rainwater area on the high-floor map or by the map showing the water flow structure.

To find out the rainfall intensity (I) value from the graph, you need to know the following parameters:

1) Return Period used in design
2) The duration of the rain to be calculated is defined as the period when excess rainwater in the receiving area comes along with the time of the concentration, which can be obtained from the following equation.

$$Tc = \frac{(0.87L^3)^{0.385}}{H}$$

When T_c = Time of Concentration (Time of Concentration) in hours

L = distance from the far end to the outlet points, in kilometres

H = Altitude difference between the farthest points and the outlet points, in meters

- **The Manning Formula:** It is a method used Principle of Energy to determine the average speed of the waterway. The calculation is based on the information or measurement of water surface slopes along with the waterway for the approximate use of the level of energy or energy gradient with the average speed calculation.

$$Q = \frac{1}{n} AR^{2/3} S^{1/2}$$

When Q = flow rate, (m^3/s)

n = Coefficient of roughness

A = Perforated floor, ($m^{2)}$

R = radius of kinetics, (m)

S = grade of the trough, (m/m)

3) Calculation of the flow rate and the accumulated water volume in various cases.

The calculation of Coefficient of Runoff (C) In the calculation of sea coefficients in the project area is divided into 2 cases, i.e. calculating the coefficient of water from the original area and calculating the coefficient of sealines of the post-development area (as shown in **Figure 2.5-**10 and **Figure 2.5-**11), as follows:

- **Calculation of the sea coefficient of the original area**

Source: Design of drainage system of the project, 2020.

Figure 2.5-10 Areas that are expected to be grassy for the original project

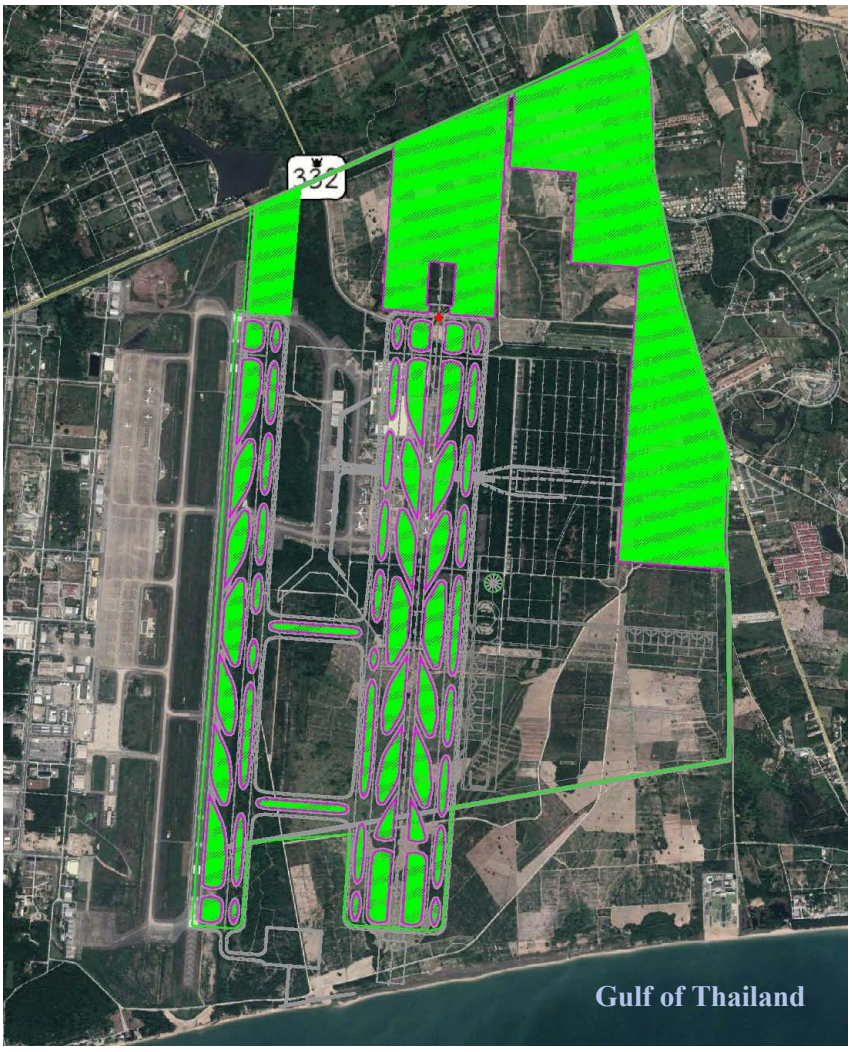
where green represents an area assessed as grass in the original area with an area of 10,036,990.24 square meters, concrete floor with an area of 1,073,324.05 square meters.
Concrete C value = 0.90, Grass C value = 0.40
C can be calculated as follows:

From the formula $C = \frac{C_1A_1+C_2A_2+..+C_nA_n}{A_1+A_2+..+A_n}$

Therefore, $C = \frac{0.90(1,073,324.05)+ 0.40(10,036,990.24)}{(1,073,324.05 +10,036,990.24)}$

The water coefficient of the original area will be gained, (C value) is equal to 0.45.

- **Calculate the sea coefficient of the area after development.**



Source: Design of drainage system of the project, 2020.

Figure 2.5 11 Area assessed as grass for project after development

By green color represents an area that is assessed as grass in the area after development, with an area of 3,578,943.56 square meters, concrete flooring with an area of 7,531,370.73 square meters.

Concrete C value = 0.90, Grass C value = 0.40

C can be calculated as follows:

From the formula $C = \frac{C_1A_1+C_2A_2+..+C_nA_n}{A_1+A_2+..+A_n}$

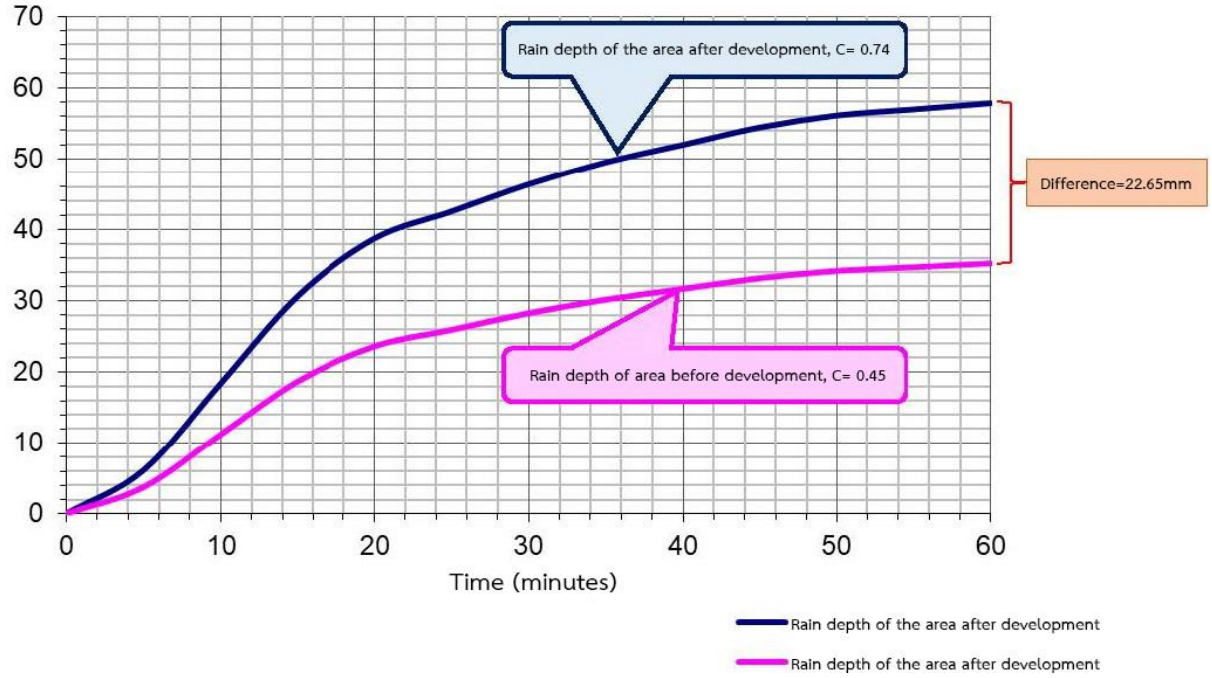
Therefore, C = $\frac{0.90(7,531,370.73)+0.40(3,578,943.56)}{(7,531,370.73+3,578,943.56)}$

This indicates that the water coefficient of the development area, C is equal to 0.74.

4) Project area drainage system calculation

The development of the area of U-Tapao International Airport, both runways and building, caused the changing of drainage conditions in the area, i.e. the volume of storm water increased, which was in the undeveloped area, including shrub, copse and wasteland area.

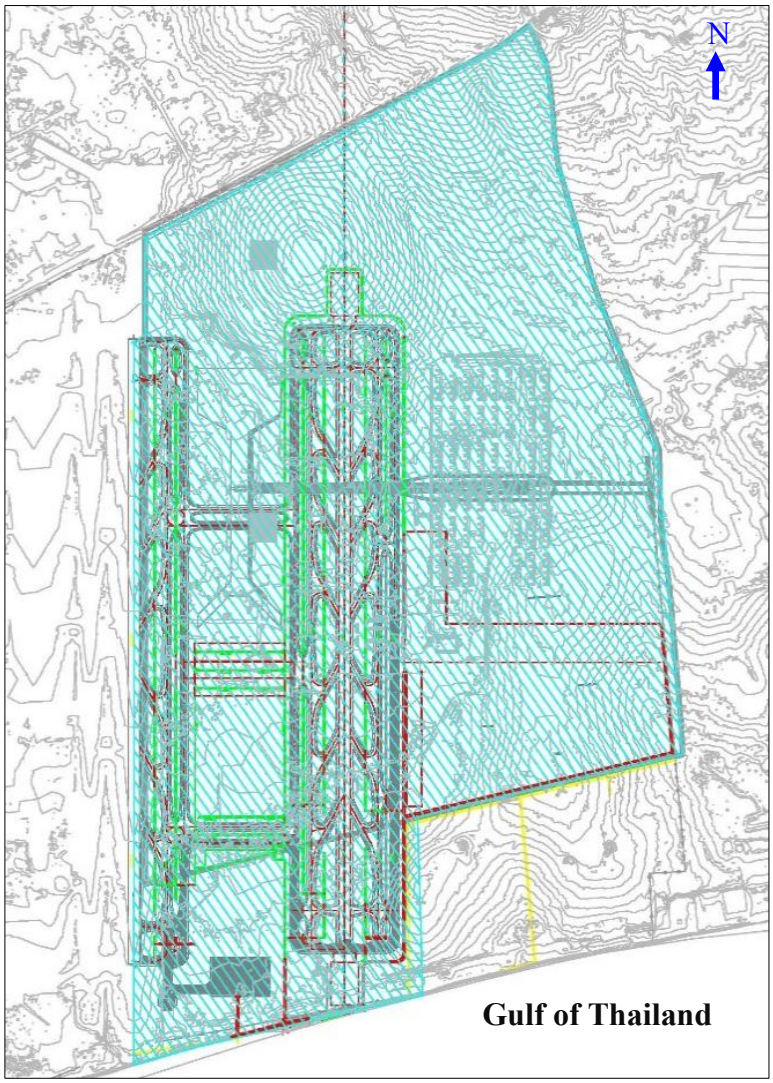
Development of the area increases the flow coefficient due to reduced water permeate due to changes in the area, which causes the average of the original coefficient of water from the waste area at C=0.45 changed to C=0.74. When calculating the accumulated water depth, the excess water is generated from the pre-developmental water depth compared to the post-developmental water depth. The excess water depth is equal to 22.65 millimeters shown in **Figure 2.5-*12*** graph showing the comparison of the accumulation of water depth in 1 hour, occurring in the case of the coefficient of water formation.



Source: Design of drainage system of the project, 2020.

Figure 2.5 12 A graph comparing the accumulated water depth in 1 hour that occurs in the case of a port water coefficient.

When water depth is used to calculate the accumulated volume from the construction area, as shown Figure **2.5-13**, it was found that the accumulated water in 1 hour was at a volume of 251,691.20 cubic meters, which is the excess water that occurred in the project. It is neccessary to design a well to hold this part of the water and will pump and release it into the public drainage system after a rainy (no less than 1 hour).



Source: Design of drainage system of the project, 2020.

Figure 2.5 13 All water areas of the project to be constructed

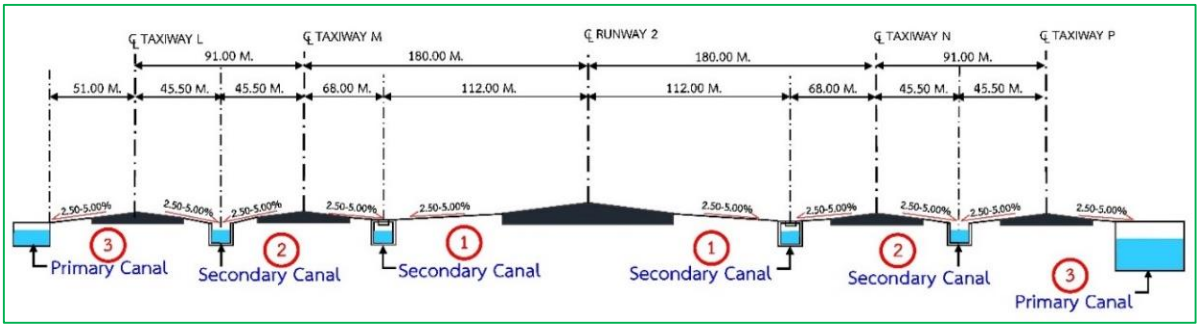
The project designed a rainwater drainage system to drain water from the runway and driveway area. It acts as a means to prevent external water from entering the airport area to control the water volume. Design of the drainage system of the project is divided into 2 parts according to their use, shown in **Figure 2.5-*14***. Details are as follows:

1) Secondary Canal drainage system (number 1 and 2) will drain water flowing on surface from the Runway and the driveway, as well as other areas that can be carried into the open trough system by dividing by drainage system structure as follows:

- BOX CURVERT : LINE 1S-S/1, 1S-S/2, 4S-S/1, 4S-S/2, 7S-S/1 and 7S-S/2
- TRAPEZOIDAL DITCH: LINE 2S-S/1, 2S-S/2, 5S-S/1, 5S-S/2 8S-S

2) Water from number 1 and 2 will be conveyed to the Primary Canal (number 3), the characteristics of U-DITCH.

- U-DITCH : LINE 3S-P/1, 3S-P/2, 6S-P, 8S-S/1 and 9S-P



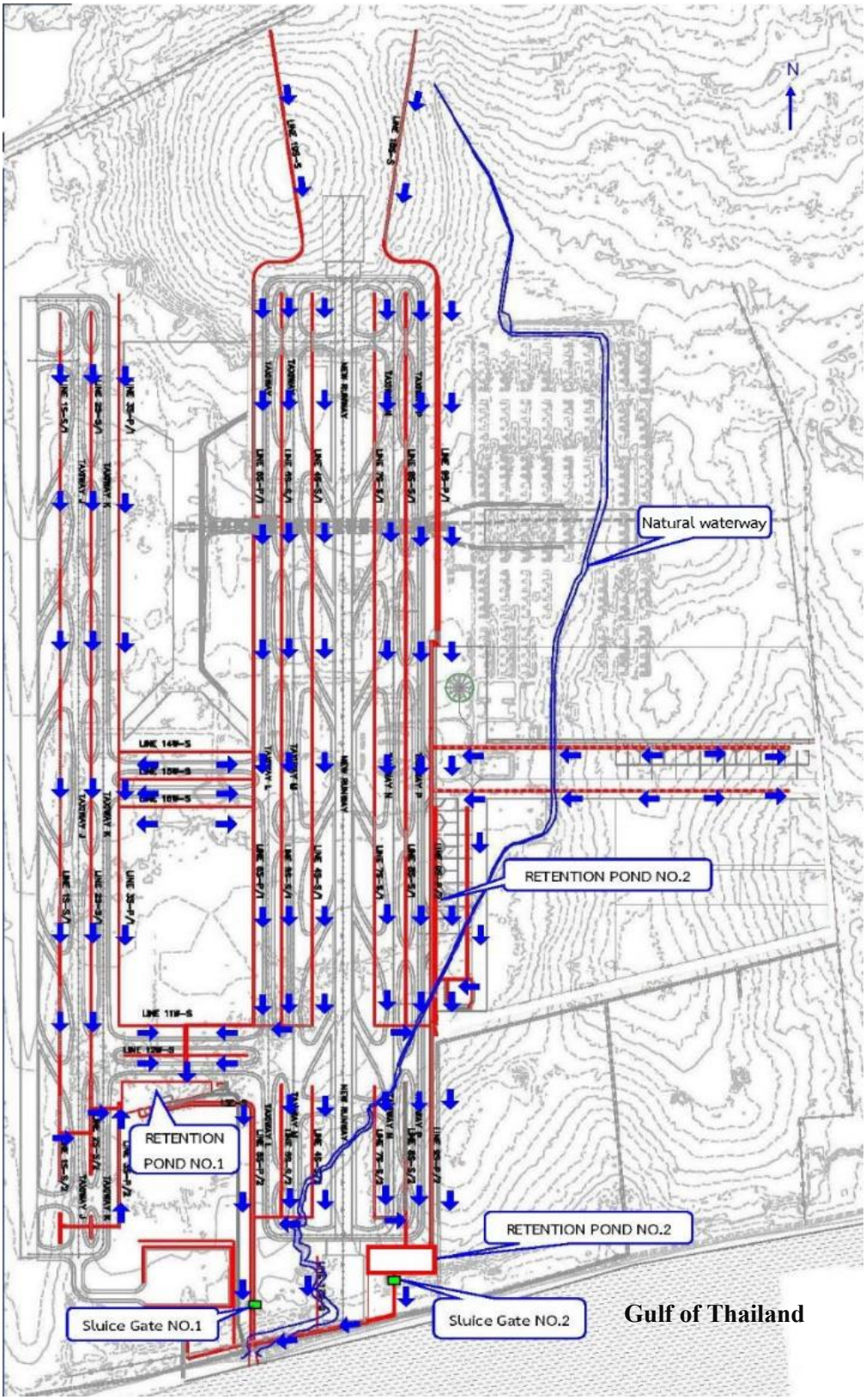
Source: Design of drainage system of the project, 2020.

Figure 2.5 14 Concrete draining trough system in between the runway and parallel driveway

Details of the calculation of the size of each drain trough (as shown in **Annex 2-3**) in which the various sizes can support a maximum water volume of approximately 120.21 cubic meters per second to transport water into the holding pond, which will cause the water to be delayed while raining into the airport area. The drainage will continue to enter the project's drainage system, which, after rain has stopped or rainfall, can be reduced, with no impact.

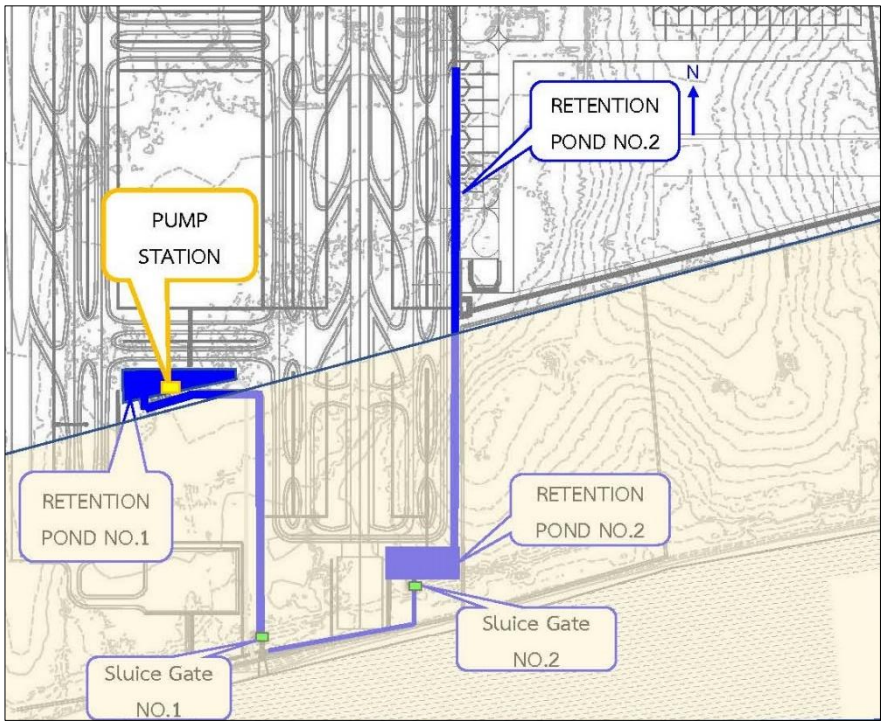
The rainwater in the area of the runway and driveway 2 will combine in the holding pond, which can be delayed for 1 hour. Considering the recurrence in 10 years, the excess water draining will be carried out after the storm has passed. The highest seawater level is +1.1 meters from the average seawater level. The water flow direction is shown in **Figure 2.5-15**

The location of the wells of the project is shown in **Figure 2.4-16**, in which the consultant designed the 2 parts of the well, well 1, with a maximum holding volume of 124,820 cubic meters and well 2 has a maximum storage volume of 195,257.41 cubic meters, with the sum of water retention of the well 1 and well 2 water is 320,077.41 cubic meters, with sufficient volume for the excess water generated for the entire project, which is 251,691.20 cubic meters, however, there is a limit to use the lower space for 1 kilometer from the shore that needs to be reservedfor military operations. In addition, the holding pond cannot be built in the area for project development.



Source: Design of drainage system of the project, 2564

Figure 2.5 15 Diagram showing the direction of water flow in the project area



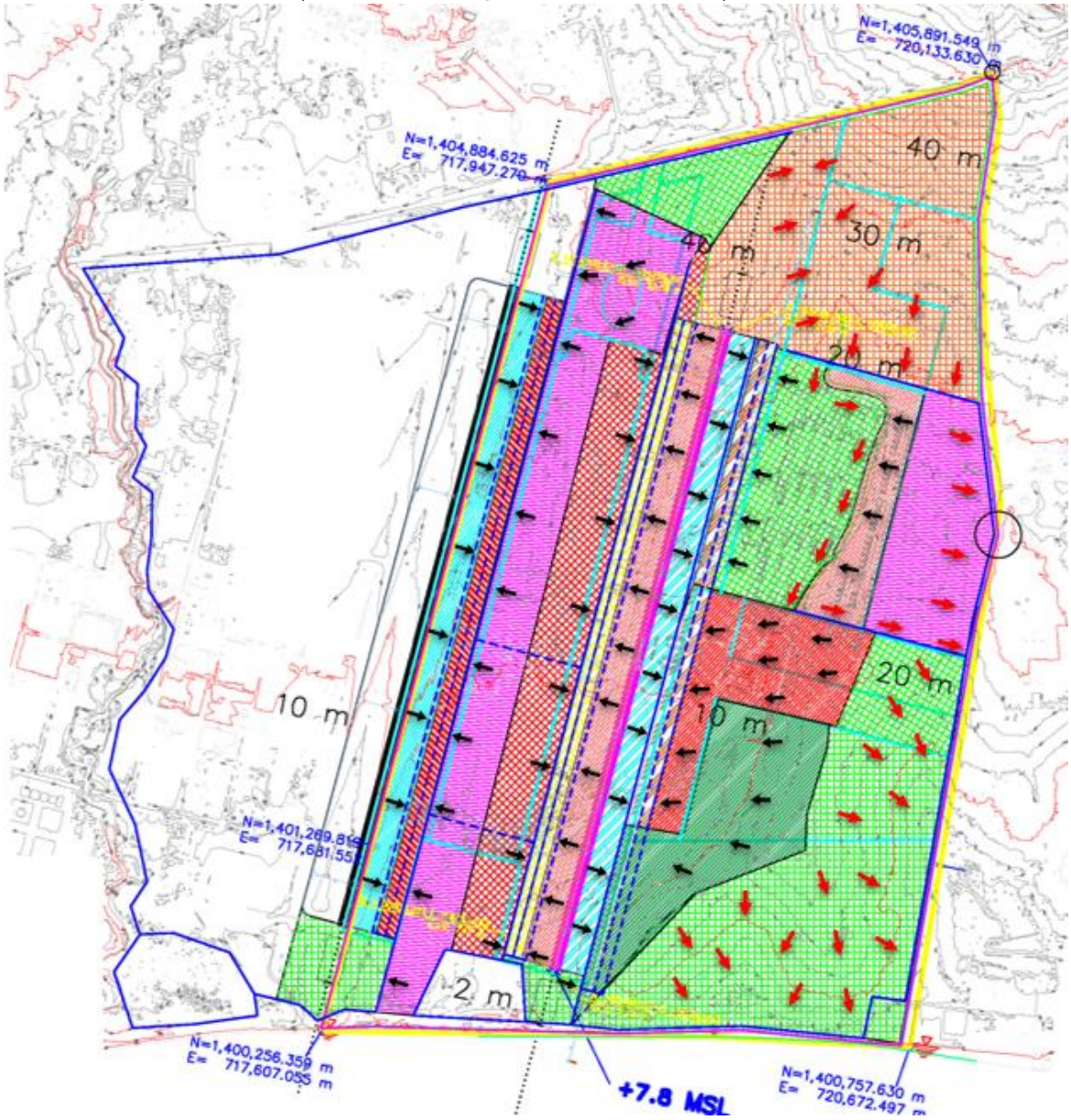
Source: Design of drainage system of the project, 2020

Figure 2.5 16 Location of project's holding pond

According to the position of the above pond, the project considered separating water into 2 parts, namely areas above the reserve area and areas in the reserve area. Based on the development of the project, the total amount of water to be drained will be 388,137 cubic meters, in an area above the reserve area and through the holding pond system in an amount of 369,966 cubic meters and in the reserve area of 18,171 cubic meters, which will not be drained by holding pond. This section of water is less than the amount of water before developing the project (275,453 cubic meters) drained without significant delay, which is considered to have no impact on the drainage conditions of the original unit.

In addition, the project will construct 1 pumping station at the water tank number 1 to pump out excess rainwater that is stored to the outside. Installed 4 pumps of 2 cubic meters per second (use 3 pumps, reserve 1 pump), which will be used together with a maximum of 3 pumps. Total pumping rate is 6 cubic meters per second. The staff will control the pumping of water for the entire day. Machinery are ready to pump out from the U-Tapao International Airport which has criteria for water pumping as period of going up and down of seawater including coordinating with Meteorological department to monitor rainfall information and rainfall forecast in advance to estimate the amount of water.

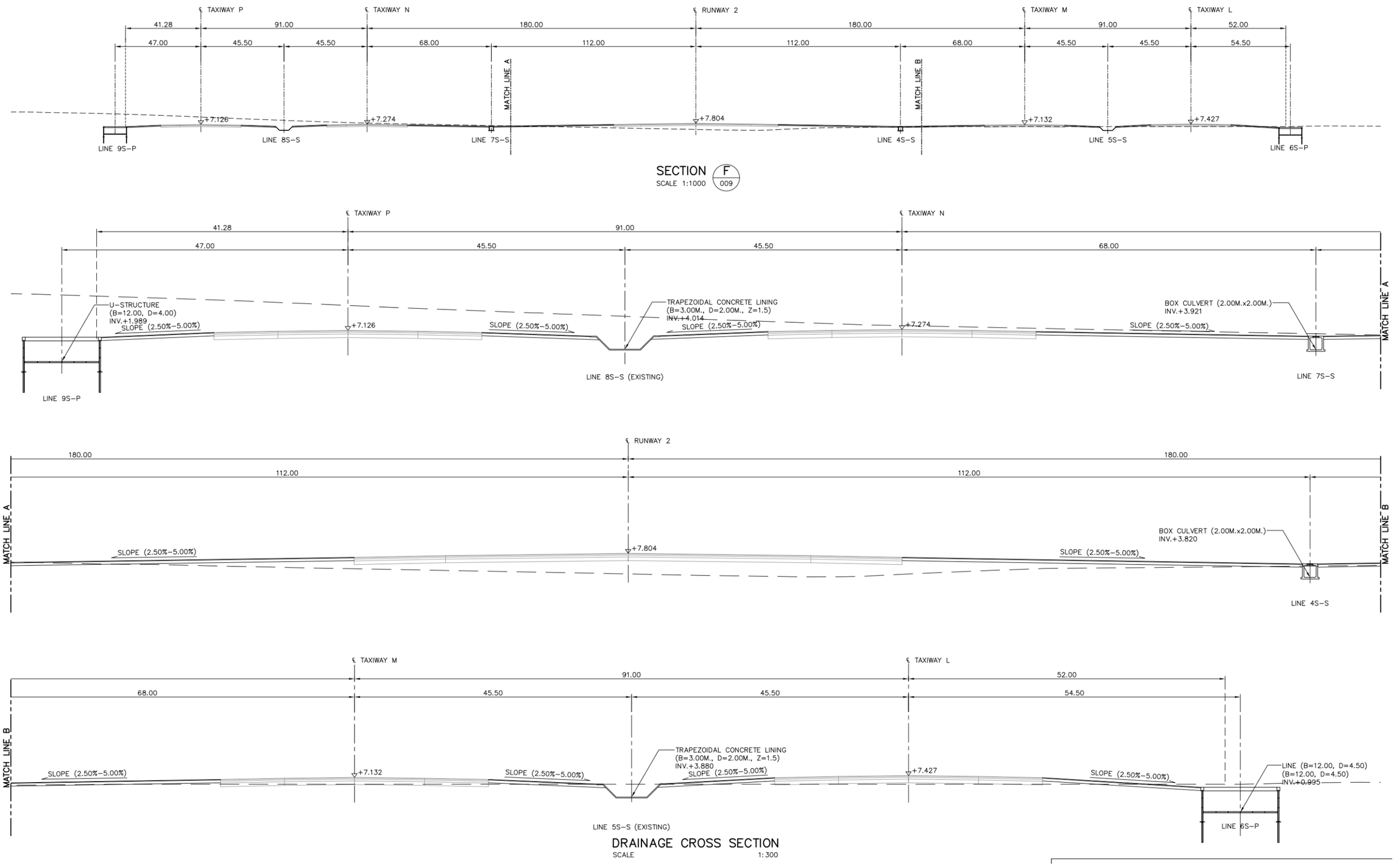
Procedures for project drainage system, current and future drainage capacity, total drainage to the sea at one point on the south to the sea. Design of drainage system in the project 6,500 rai of rainfall is based on rainwater assessment in project area, and design to cover the area of the building within the airport shown in **Figure 2.5-17** Map



Source: Design of drainage system of the project, 2020.

Figure 2.5-17 Map of Rainfall Thinking Areas and Water Flow Direction in Development and Undeveloped Areas

By design of the drain trough system, it designs to receive rain water from surface water and rainwater from the building, with the various drainage trough systems on the side of the runway and driveway shown in **Figure 2.5-**18 Diagram showing the location



Source: Design of drainage system of the project, 2020.

Figure 2.5 18 Diagram showing the locationof the drain trough beside the runway and various driveway

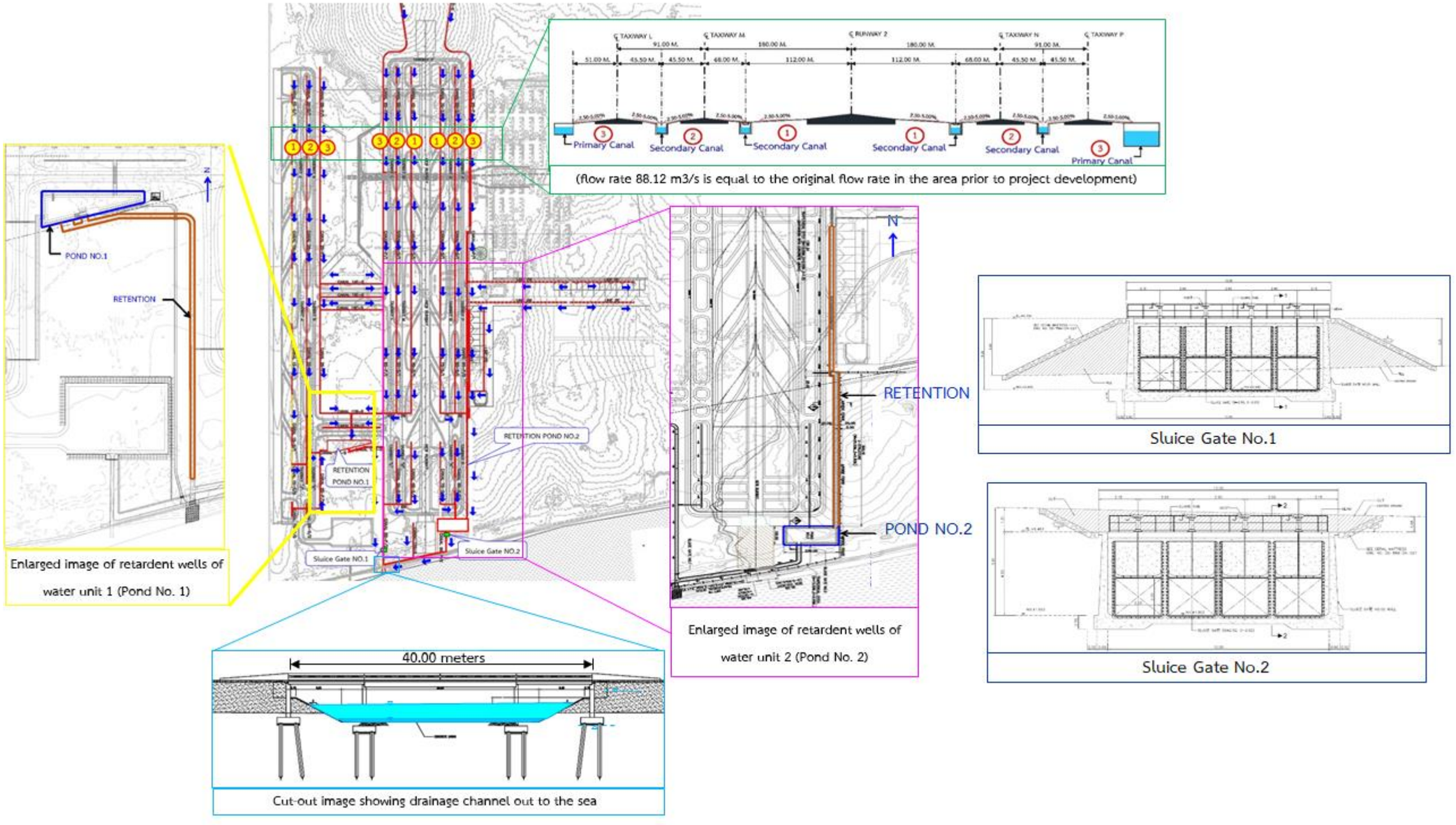
In regards to the various amount of waste water from buildings that are not rainwater, the total waste water treatment system will be imported to central waste water treatment system without being integrated into the rainwater drainage system.

The design has been carried out for water drainage. During rain storms, rainwater will be carried through the trough in which draining water is in the direction of the water into the sea. The whole project will drain into the 2 holding pond, with the water trapping capacity of the rain storm for 1 hour. The holding pond will retain excess water from the development of the project area. Also, water drainage rate will be same level as the original water drainage rate. When the rain storm has passed, it will be pumped to drain the water that is stored in the holding pond which will drain at a rate that does not exceed the original drainage rate before the development of the project area as well. Drainage during the highest seawater level rise. It will still be able to drain water when a rain storm occurs without overflowing the drain trough. Due to the height of the rail ridge is higher than seawater level 2 meters and the height of the airport area about 6 meters above seawater level

The rainwater drainage of the building groups, runway and driveway to be newly built (East side) have the following details:

- Water from various building/office groups: It is an area outside runway and driveway in which concessions are in the process of designing sub-systems to drain water into the main drainage system that the project designed to cover the eastern aviation city area. In estimating rainwater receiving area, the project has considered designing building area within U-Tapao International Airport to cover the development area of Phase 3.

- The runway and driveway area: The design of the drainage system has considered the rainwater drainage that occurred in the Eastern Aviation City Area as shown in **Figure 2.5-19**

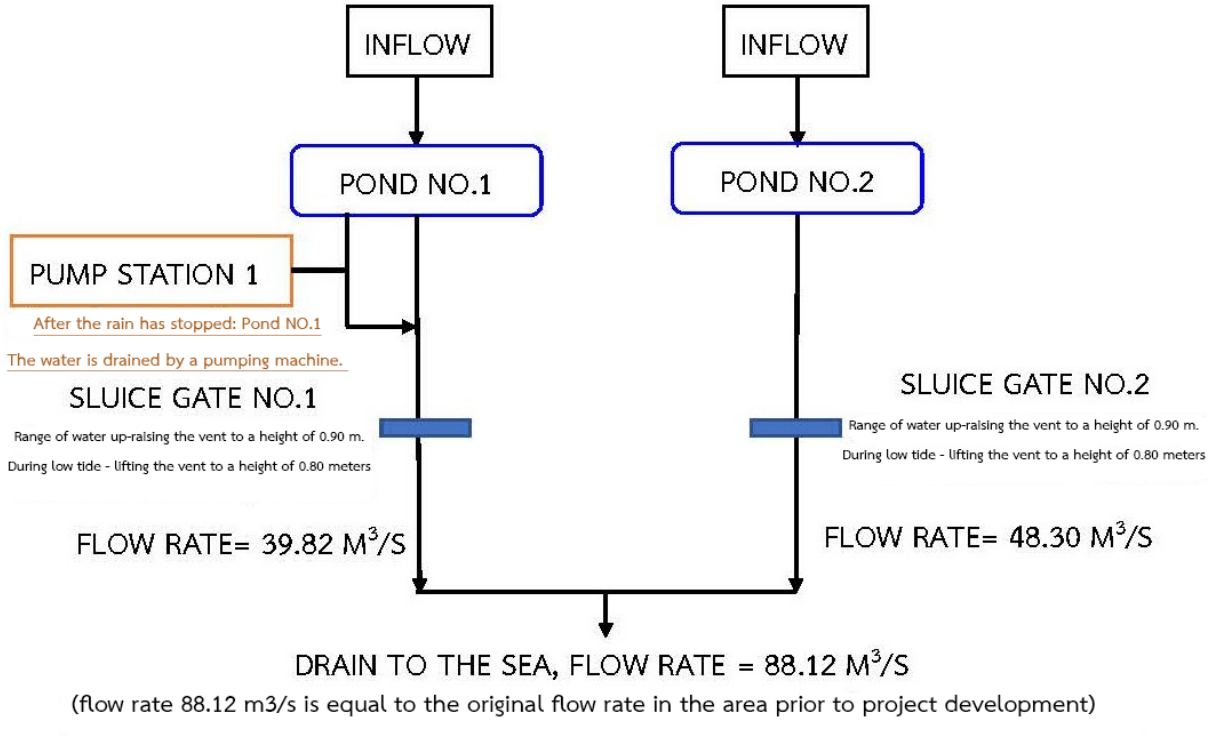


Source: Design of drainage systems for the project, 2020

Figure 2.5 19 Project Drain System

Principles of Project Draining System Operation

Draining of Pond No. 1 and Pond No. 2 are shown in **Figure 2.5-*20*** **Drainage management**



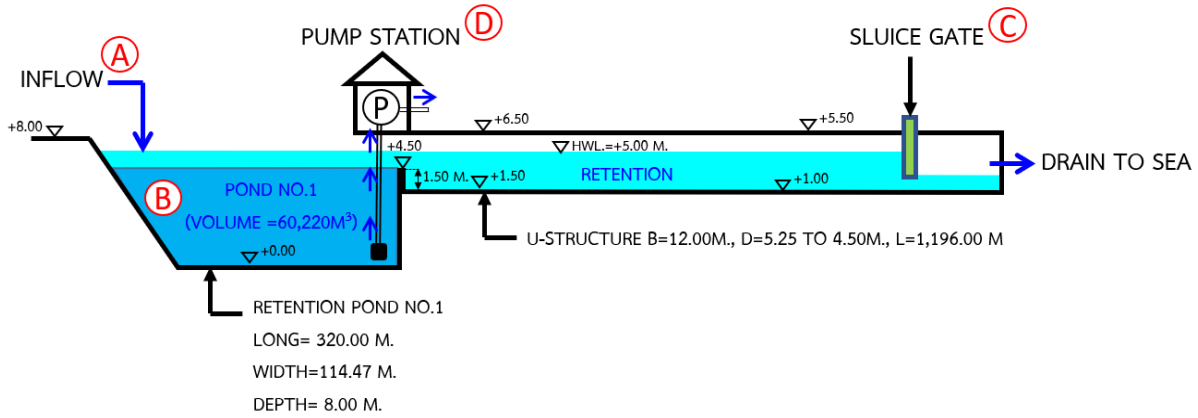
Source: Design of drainage system of the project, 2020.

Figure 2.5-20 Drainage managementformat of Pond No. 1 and Holding Pond No. 2

From **Figure 2.5-*20* Drainage management** could be explained that while it rains, the water will flow from Pond No. 1 through the drain gate number 1 with a drain rate of 39.82 cubic meters per second and water will flow from Pond No. 2 through the drain door no. 2 with a drain rate of 48.30 cubic meters per second, with these 2 parts of water coming together at the exit points near the sea and entering the sea with a maximum discharge rate of 88.12 cubic meters per second, which is the same rate as the original rate of flow in the area before development. After the rain, Pond No. 1 will drain the water with the pump to drain the water at a rate of up to 6 cubic meters per second. Pond No. 2 will drain the water continuously in the holding pond through the water gate at a rate of 48.30 cubic meters per second until the pond is completely up. When water flows to the points near the ocean, the maximum flow rate will not exceed 54.30 cubic meters per second, Pond No. 1 and Pond No. 2 drainage process are as follows:

- **Pond No. 1 Drainage process**

  The draining process of Pond No. 1 can be explained as shown in **Figure 2.5-21**



Source: Design of drainage system of the project, 2020

Figure 2.5 21 Pond No. 1 Drainage process

Draining water during rain in the project area can be described as follows:

Point A:is the point where water from the project will drain into Pond No. 1 which will drain the water from the receiving area of 2,500 rai, consisting of 2 parts, part 1 is the storage pond, and part 2 is Retention, with a total volume of 124,820 cubic meters. The volume of water remaining from the development of the project area is at least 1 hour (the amount of rainfall is equal to 92,038.30 cubicmeters).

Point B: Water from point A will drain into Pond No. 1 with a capacity of approximately 60,220 cubic meters' which will store excess water from the area development. When water flows into the Pond No.1, the water will overflow and be carried into the Retention with a capacity of about 64,600 cubic meters. Capacity of Retention will be controlled by Sluice Gate at point C.

Point C : The Sluice Gate area is comprised of 4 gates, each with a width of 2.50 meters, water gate management during the rising water flow is done by raising the floor above the water gates at intervals of 0.90 meters, the down time of the water is made by raising the floor above the water door at intervals of 0.80 meters, which is the retention of water in the Retention Ditch, to enable control of drainage rate at 39.81 cubic meters per second is water draining at the same rate as the original drainage rate of the project area before development. The said control of the flow rate intends not to affect the original drainage conditions of the area.

Management and control of the water gate can be done by lowering the drain gate to the level of water gate belly or point that the drain gate can be closed. When water is to be stored for use in the project area or for maintenance if it is necessary to drain the water urgently by lifting the maximum water gate (2 meters from the gate belly, it can be drained at a rate of 75 cubic meters per second.

Drainage after a rain storm has passed through the project area can be explained as follows:

Point D: Pumping Station will pump water after the Retention is completely drained. The excess water is held in the Pond No. 1 to allow the pond to be empty, the condition that is ready for receiving new rainwater. The pump will be installed in 4 pumps, consisting of 3 main pumps and 1 reserved pump in the case of maintenance. This will allow water to be drained from the holding well, up to 6 cubic meters per second.

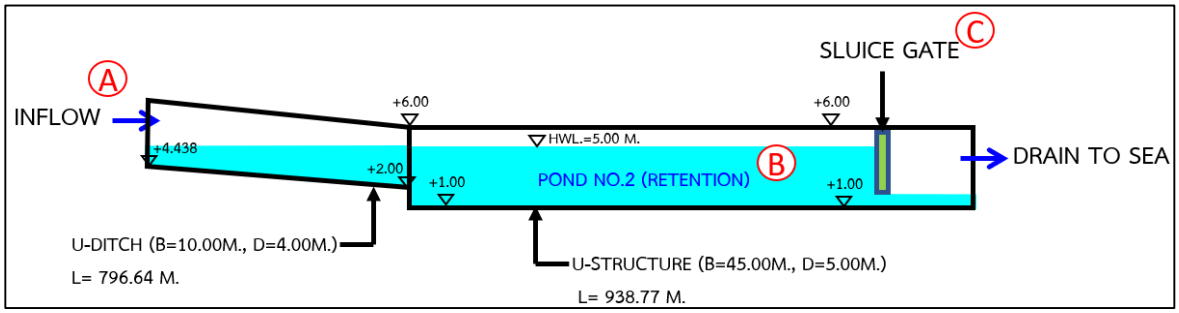
Mode of pump operation is detailed as follows:

- 3 pumps operate when the water level is at 5.45 meters from the bottom of the pond at a rate of 6 cubic meters per second.
- When the water level falls to 5.25 meters from the bottom of the well, only 2 pumps will be run at a rate of 4 cubic meters per second.
- When the water level rises to 4.75 meters from the bottom of the pond, only 1 pump will be required to operate at a rate of 2 cubic meters per second at a rate that will drain to the bottom of the Pond No. 1.

Each work is required to rotate the pumps so that one pump does not overwork.

- **Pond No. 2 Drainage process**

The draining process of Pond No. 2 can be explained as shown in **Figure 2.5- *22***



Source: Design of drainage system of the project, 2021

Figure 2.5 22Pond No. 2 Draining Process

Pond No. 2 water draining process is as follows:

During a rain storm in the project area

Point A: The water from the project will enter Pond No.2 which will drain from the water receiving area 4,000 rai. The Pond No. 2 has a volume of 195,257.41 cubic meters. The volume is sufficient for the water held caused by the development of the project area to be at least 1 hour. The rainfall per 1 houris equal to 159,652.90 cubicmeters.

Point B: Water from Point A will drain into Retention and Pond No.2 with a total capacity of approximately 195,257.41 cubic meters, which is responsible for holding excess

water caused by the development of the area. The retention volume of the Retention will be controlled by the Sluice Gate at point C.

Point C : The Sluice Gate area is comprised of 4 gates, each with a wide area 2.50 meters, water gate management during the rising water flow is done by raising the floor above the water gates at intervals of 0.90 meters, the down time of the water is made by raising the floor above the water door at intervals of 0.80 meters is the hold in the Retention to control the rate of water drain at the rate of 48.30 cubic meters per second, which is water draining at the same rate as the original water drain rate of the project area before development. The flow rate control is intended to not affect the original drainage conditions in the area.

Water gate management and water gate control can be done by lowering the drain gate to the level water gate belly or point that the drain gate can be closed. When water is to be stored for use in the project area or for maintenance if it is necessary to drain the water urgently by lifting the maximum water gate (2 meters from the gate belly). It can be drained at a rate of 75 cubic meters per second.The project has designed the Retention Pond No.1 and Retention Pond No.2 as a sedimentation pond and the built-in-holding pond.

The project added details of the cut-off window showing the sea drain channel, showing the bridge image and location of the drain gate. The details of the Retention Pond No. 1 and No.2 as well as implementing preventive measures and environmental impact monitoring measures as specified in this EHIA report. The details are strictly shown in the construction form as detailed in **Figure 2.5-23** and **Figure 2.5-24**

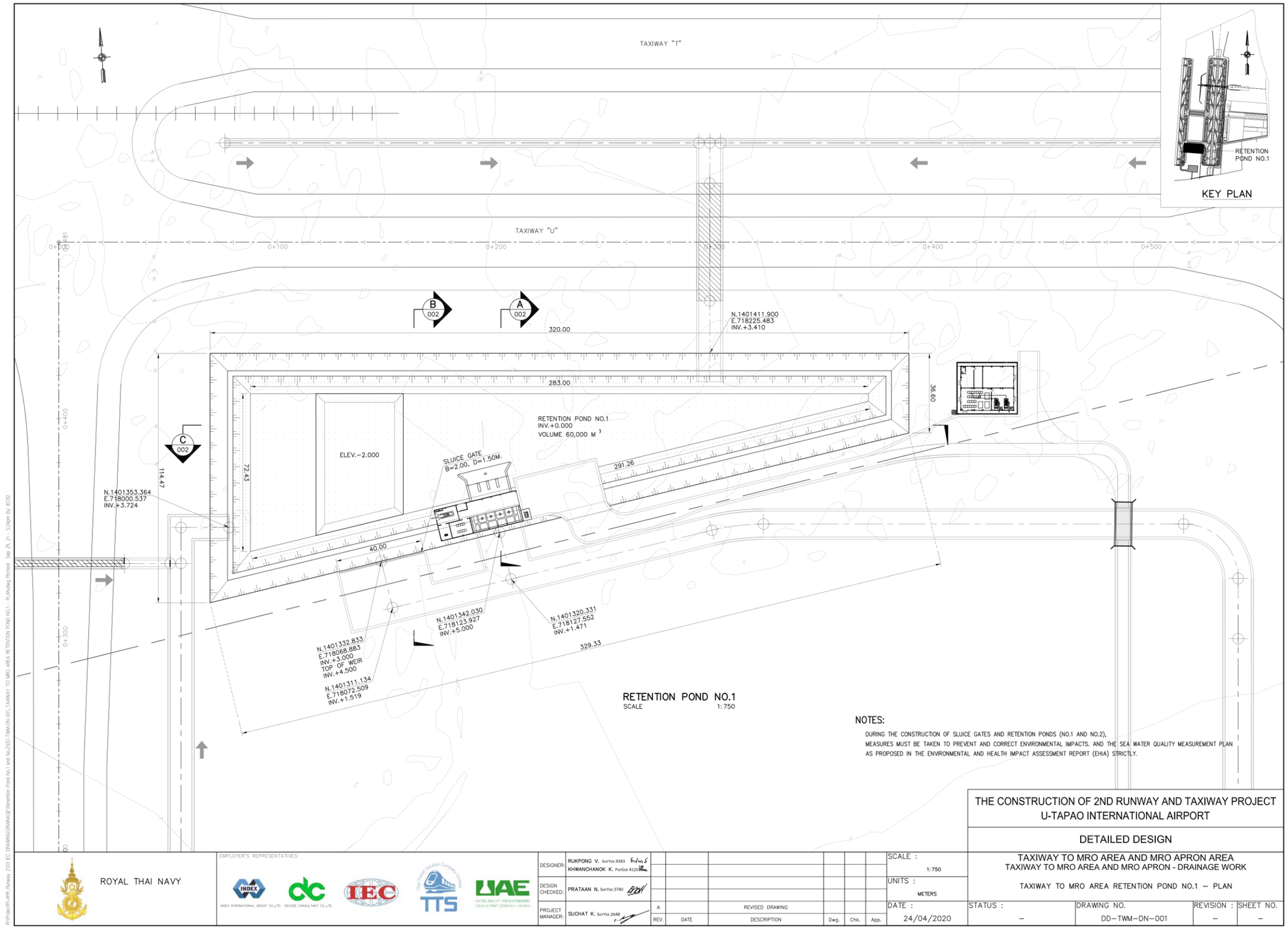


Figure 2.5□23 Image of a cut-out showing a water drain channel with a bridge in the location of the drain gate and a description of Retention Pond No. 1 appearing in the construction plan

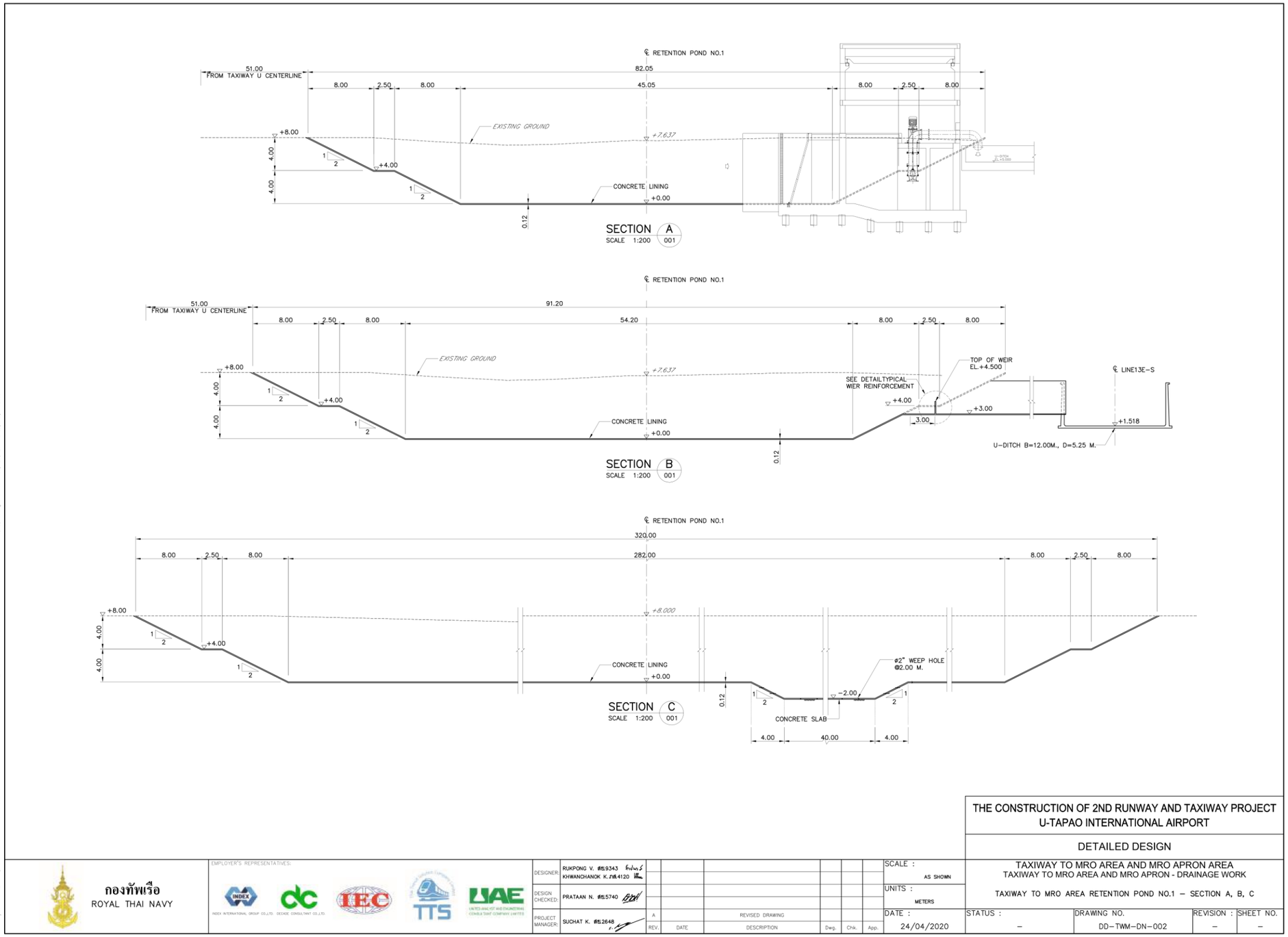


Figure 2.5-23 Image of a cut-out showing a water drain channel with a bridge in the location of the drain gate and a description of Retention Pond No. 1 appearing in the construction plan

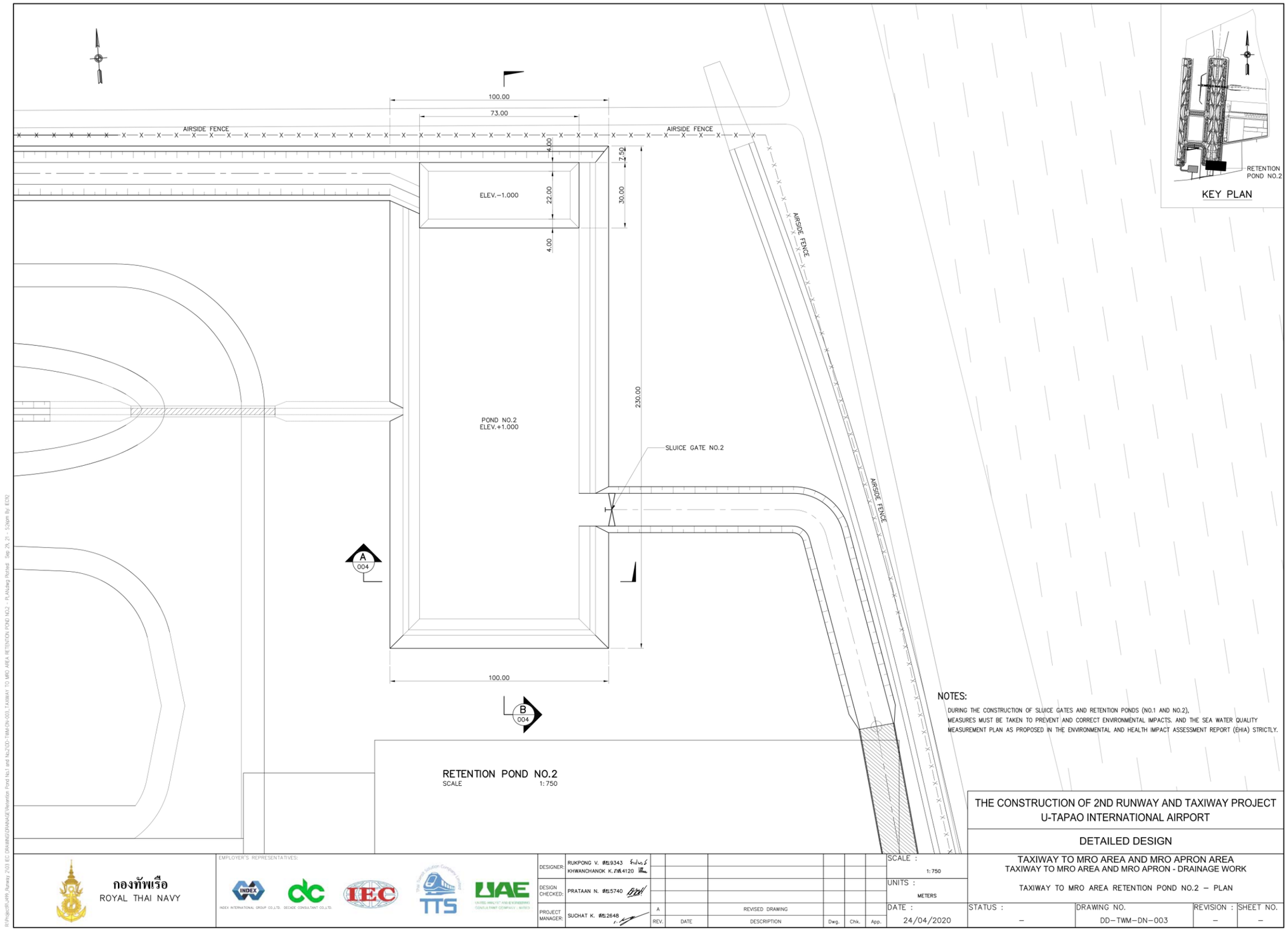


Figure 2.5 24 Image of a cut-out window showing a water drain channel with a bridge in the location of the drain gate and a description of Retention Pond No.2 appearing in the construction plan

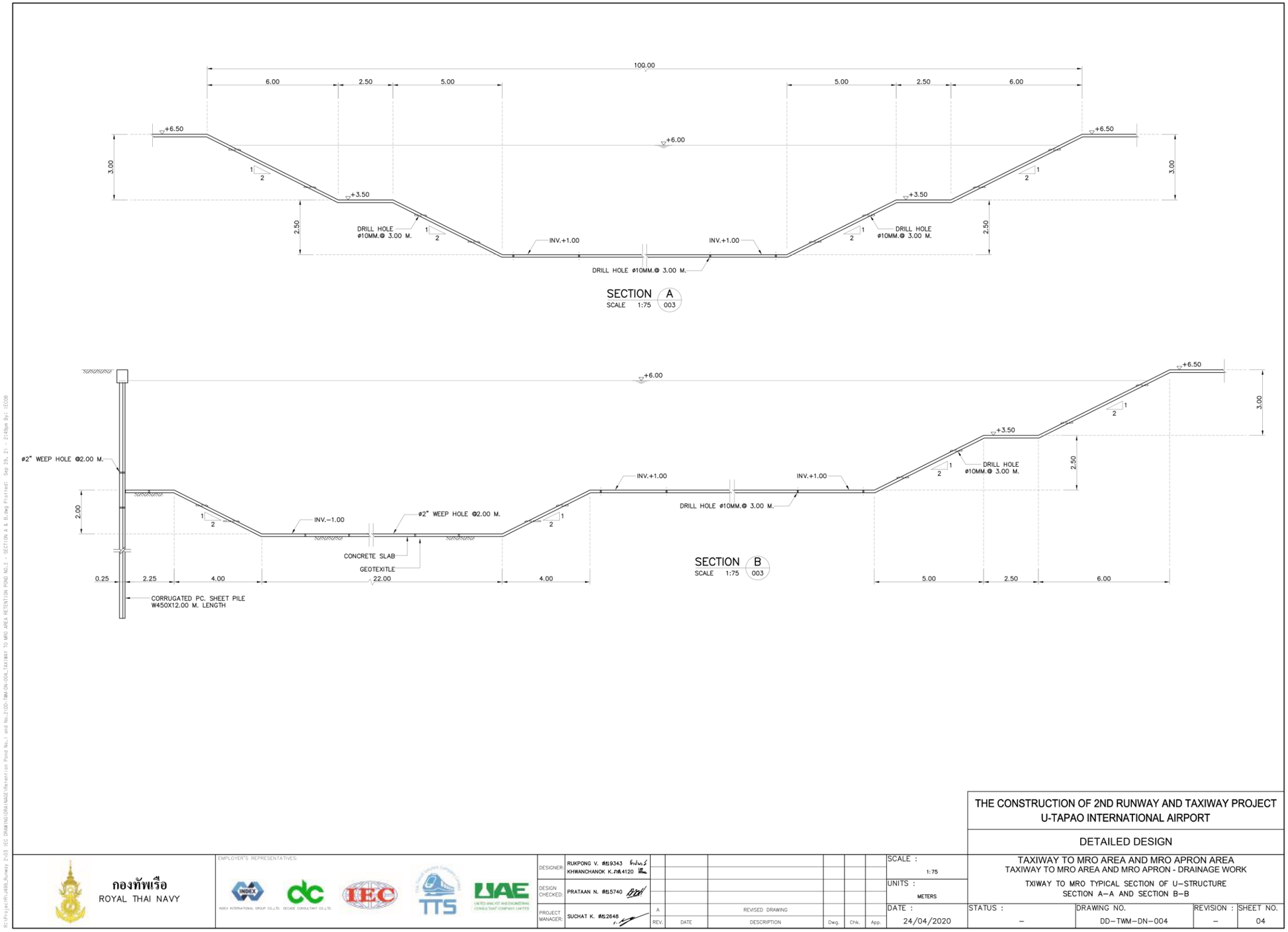


Figure 2.5-24 Image of a cut-out window showing a water drain channel with a bridge in the location of the drain gate and a description of Retention Pond No.2 appearing in the construction plan

2.5.7 Solid Waste and Waste Management System

The waste and waste management that occurs within U-Tapao International Airport contains details of types of waste volume and waste management, as follows:

1) Source and type of waste

Normal waste occurring in the U-Tapao International Airport area is classified into 3 characteristics:

1.1) Normal solid waste that is recyclable and cannot be reused, such as food scraps, paper scraps, rags, plastics, etc.

1.2) Hazardous waste such as fluorescent lamps, flashlights, batteries, etc.

1.3) Infectious Waste is solid waste from the nursing room, including air-borne waste from aircraft from countries that have been declared as areas of infectious disease or pandemic such as cottons, gauze, etc.

2) The volume of solid waste

The amount of solid waste from various sources in the U-Tapao International Airport area according to the study results of the master planning project, the project to develop the U-Tapao International Airport and the surrounding areas of Rayong, in order to design the system for the management of the volume of solid waste that will occur, it is found that the volume of waste is likely to increase according to the increased volume of air traffic and passengers in the project over 30 years. The expected amount of solid waste is 101.27 tons per day (in 2048), when expected peak traffic volume of 70 million passengers per year, a solid waste estimate is expected to occur in 84.38 tons per day, which is less than the expected total volume of waste and can be managed

3) Waste Management within U-Tapao International Airport

Waste management occurring at U-Tapao International Airport. Private companies that operate the airport management must manage solid waste arising from buildings and various activities to waste handling stations located in the airport for classification and disposal in accordance with sanitation standards. Those authorized by government agencies or as required by law, the waste management plan is shown in **Figure 2.5-25.** Details of handling are as follows:

3.1) Collecting solid waste

The collection of waste or solid waste occurring in various areas of the U-Tapao International Airport will be suitably placed in the types and sources of solid waste. The waste container with solid waste containers will specify the types of solid waste on the side of the bin for sorting such as wet waste, general solid waste, infected waste, hazardous solid waste, etc. The waste container will be cleaned and inspected in good condition. In addition, employees are provided to keep waste solid waste not coming out of waste containers and collect regularly by dividing to:

- **Solid waste from the terminal, office building, and parking building groups :** Will collect from the receptacles separating the types of waste into sealed bags, tie the bag tight, and

then collect and use a transfer cart to hold the waste for storage point and wait for transporting to waste disposal station.

- **Solid waste caused by the Airside and Outer Group buildings :** Will be collected in large receptacles, such as a lugger tank or roll-off tank located at various points of the building, and use the waste storage vehicle to transport to a waste disposal station
- **Normal solid waste from airline inflight services :** Normal solid waste from domestic airlines will be collected and sent to the waste storage points. Food waste will be managed by the disposal provider. The solid waste from international flights which may contain contaminated germs will be disposed of in separate parts and will be managed by a licensed government disposal service provider.

3.2) Transfer of solid waste to the normal waste disposal station

Transportation of solid waste from the storage points of solid waste in the project area to the waste disposal station is carried out by using a vehicle classified by waste. Transportation of solid waste is routed. Transportation of solid waste can be done to prevent problems with passenger traffic and regular airport vehicles.

The normal waste handling station within U-Tapao International Airport is conveniently located around 16,000 square meters, consisting of a transfer building, a maintenance building, an office building, a weighing building, a parkinglot and a car wash area, and a waste segregation facility, an entrance road and a buffer area.

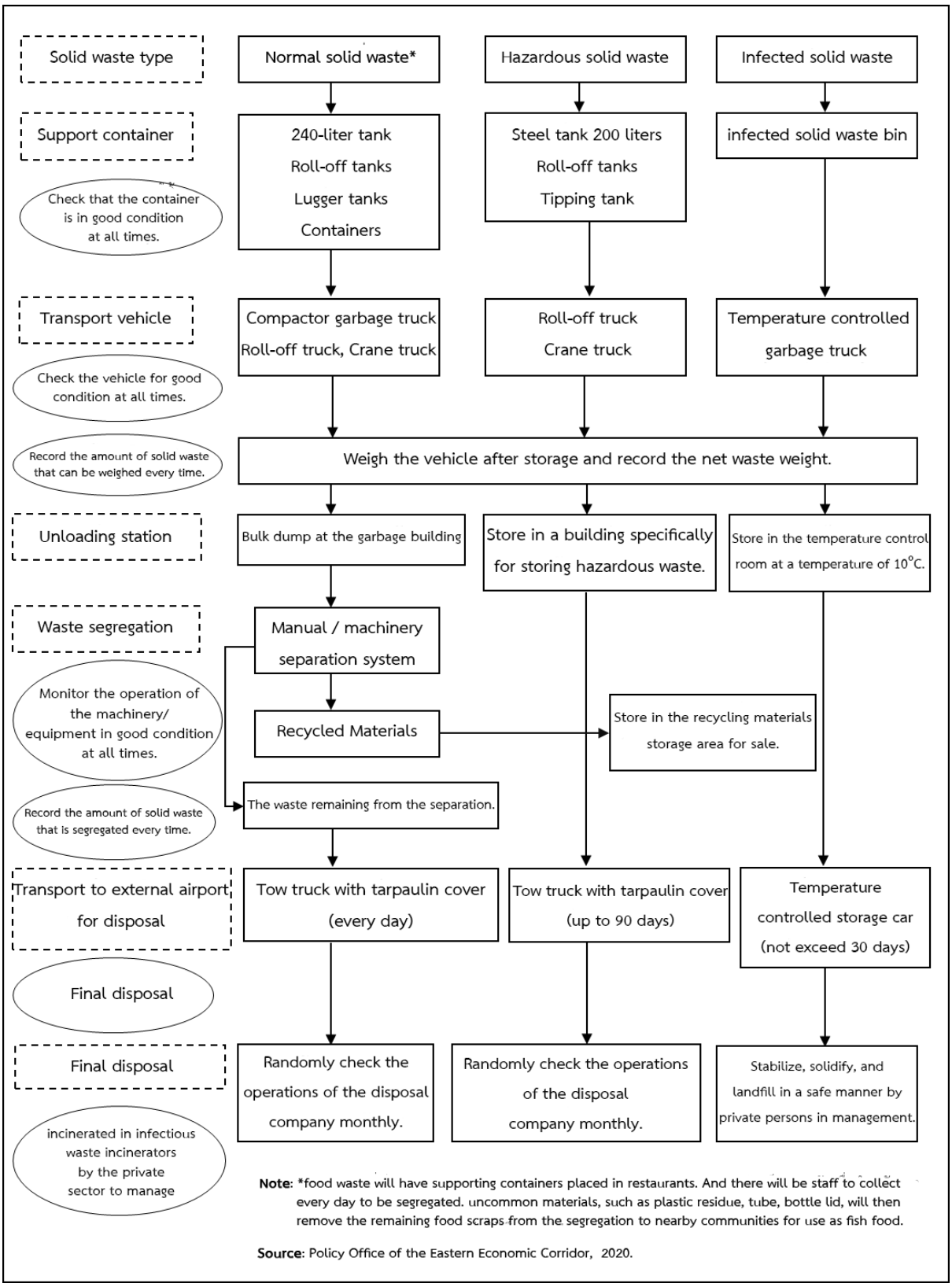


Figure 2.5 25 Solid Waste Management Plan at U-Tapao International Airport

3.3) Segregation of solid waste

The various types of solid waste that will occur here are:

- Normal solid waste will be imported into the process of segregating solid waste. Do not allow segregation of waste at the normal waste handling station within the airport area by separating the containers from the origin into 2 types:
  - Reusable, such as plastic bottles containing drinking water/drinks, glass bottles/metals, paper/plastic packaging materials that are discarded, etc. Put them into a container separate from ordinary, non-renewable waste, and put them on hold for sale. (This type of waste may not be sold at the price but when considering the investment in segregation machinery and problems in long-term operations/maintenance, it will be waste management of U-Tapao International Airport which will reduce the risk of long term environmental problems.
  - Non-reusable, for example, a plastic bowl with cream on that will be in non-reusable bin. When it is put into a container, store it in a trash storage building and take it to the disposal area outside the airport everyday so that there is no residue.
- Hazardous solid waste will be collected in the building for storing hazardous solid waste, especially therefore, it is not mixed with other waste.
- Normal solid waste will be stored in the temperature control room, not exceeding 10 degrees Celsius, to await further transportation for disposal outside of U-Tapao International Airport.

The waste segregration process will be completed every day to avoid any solid waste residues and floor cleaning will be carried out. The generated waste water will flow into the surrounding waste water drain trough and will flow together at the waste water treatment pond before gathering to the waste water pump for further transmission to the central waste water treatment system of the project.

3.4) Transportation of solid waste to the outside of the aircraft area

- **Normal solid waste**
  - Food waste: The project will allow Licensees from government agencies or as required by law to dispose of such food scraps in an sanitation standard.
  - Solid waste that can be recycled : There will be private pick up cars within the loading station area.
  - Solid waste remaining from segregating: Store in the waste segregation building to wait for daily removal and dispose with sanitation standard.
- **Hazardous solid waste**

  Hazardous solid waste is stored in a building to store hazardous waste in order to wait for disposal by authorized persons from government agencies.

- **Infected solid waste**

The infected solid waste will be stored in the temperature control room, not exceeding 10 degrees Celsius, to wait for the shipment to be disposed outside of the U-Tapao International Airport by burning in an infected solid waste incinerator by authorized persons from government agencies.

3.5) Inspection of the waste disposal contractor's operations

There will be a direct responsibility for overseeing and auditing the operations of the contracting company, which is a waste management contractor within U-Tapao International Airport, and in order to control the management of the generated waste more effectively. The private sector which will be operate this project must specify additional measures to be taken, as specified in the attached employment contract for waste disposal, to cover both the contracting company and other waste disposal companies to randomly inspect the waste disposal operations on a monthly basis.

2.5.8 Fire prevention system

Fire protection systems are provided for water supply under pressure to support the operation of the fire fighting and rescue station. (The level of fire protection is specified as Category 10. Water Storage Tank above the ground has capacity of no less than 300 cubic meters, so that it is sufficient to use. The fire pump is installed in accordance with NFPA20 standard (minimum pressure of the water supply head 5.5 bars), consisting of a fire extinguisher, pressurized water pump, water storage tank, pumping station, and distribution system and various facilities. The pumping station and water tank are located near the airport rescue unit to facilitate operations and maintenance and repair.

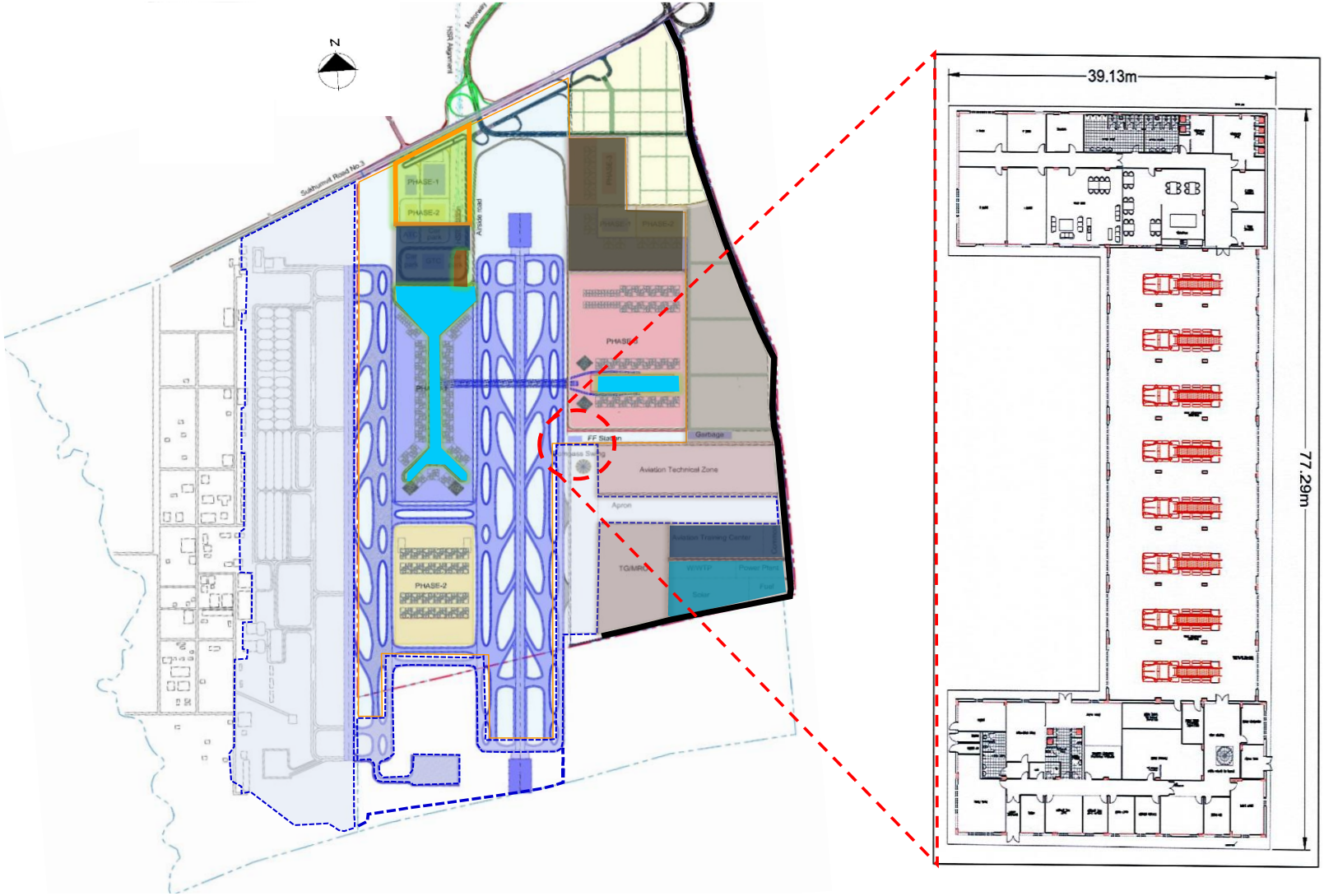
For a total system flow rate of approximately 3,000 gallons per minute, consisting of 3 diesel engine pumps, 1 pressure pump to give the system the desired pressure.

The water distribution system is a network-like system, equipped with a sprinkler near the parking area to facilitate fire fighting. There is a distance between 90-150 meters from each head.

2.5.9 Fire and rescue stations

Fire and rescue stations are designated on the east side of the airport and are located in the center of the runway according to ICAO requirements, which is considered the period of access to the accident areas in both runways. In the case of U-Tapao International Airport in the future, Code F type airplanes will be used. Therefore, the airport should install equipment that can support the level of fire and rescue according to the Category 10 international Civil Aviation Organization standards.

For fire and rescue stations, the project will be rebuilt further. It is located on the east side of the project area near the center of the P driveway. The actual distance used by the fire truck will depend on the speed of the fire truck. The route design for the appropriate fire truck will be in accordance with Requirements No. 14 Civil Aviation Authority Airport Standards. Fire trucks must be able to access the area within 2 minutes. Details shown in **Figure 2.5-26** The initial concept is designed with 8 parking spaces for extinction. Fire stations must have a surveillance room, training room, rest area, passing room, bedroom, kitchen, locker and storage room, laundry room, toilets and machine room.



Source: Project to hire a consultant to support the Office of the Eastern Economic Corridor Policy Committee to administer and supervise contracts U-Tapao Airport Development Project and Eastern Aviation City for the fiscal year of 2021

Figure 2.5 26 Basic locations of fire and rescue stations

2.5.10 Network communication system and security

Equipment that is connected to the main network designed, such as loT devices, VoIP Phones, WiFi, and others used within this network, which are capable of connecting and responding quickly and efficiently, with the principle of designing the main network, namely:

1) Flexibility to reduce network use time
2) High performance Real Time Networking
3) Punctilious management for easy administration with automatic network security
4) Security to protect the network from external attacks

The various types of automated network systems used in U-Tapao International Airport include:

1) Zero Touch Provisioning, both core and sub-systems to ensure 24 hours efficiency without any problems and ease of maintenance
2) Network management system (works on the cloud) that works well with the network through software designed to be used to manage all kinds of network equipment, such as Access Point, Ethernet Switch, Firewall and other programs.
3) The policy network management system to support communication consistent with the system to be used in setting the highest security policy within each network or equipment within the network to be fully effective.
4) Multi-Cloud network management enables management of multiple brand network equipment simultaneously in a single program and must work in the cloud.

The airport's data center is connected to 2 or more Internet service providers (ISPs) to be connected at any time. The main network (DWDM) is a 3-way optical fiber connection route with a minimum of 1,000 Gbps within the network to receive and transfer data from the core of each network to connect at least 100 Gbps. Also function to connect the system to find the complete range of Firewall Hight Performance to prevent attacks from inside and outside the network.

2.5.11 Air traffic control tower

In order to ensure proper control of the aircraft taking off and landing in U-Tapao International Airport and in the area of the aircraft drive, new aviation control towers and other operational building groups will be constructed by Aeronautical Radio of Thailand Company Limited (ABA) which will be will be the airspace administrator for U-Tapao International Airport, currently ABA is in the process of requesting approval for the project.

The new aviation control tower will be located between runway 1 and 2, which will build new air traffic control towers to control aviation in both runway 1 and 2. In the joint venture agreement, U-Tapao Airport Development Project is required by the public sector by Aeronautical Radio of Thailand Company Limited to conduct the project, which is deemed by EECO. Aeronautical Radio of Thailand Company Limited and private contractors will agree in detail on the implementation of the next project and for the original aircraft which does not conflict with the requirements of Civil Aviation Authority of Thailand.

2.6 Other supporting elements outside the project area

In this EHIA report, the construction of components in the project area was considered, which is the development of the U-Tapao International Airport (extension) for other components outside the project area. This is the construction of central public utilities and the construction of Airport City, for example, construction of Commercial Business center, Convention Center, etc. Since such components are outside of the project area and not air transportation system, in this EHIA report should not used to assess the environmental impact by the components that are outside the project. The feasibility study will be conducted according to the conditions of construction permit and legal aspects. In case that is under the criteria, there must be Environmental Impact Assessment Report. Private venture capital or public utilities operators must prepare an environmental impact assessment report in the next step of requesting a construction permit.

2.6.1 Airport City

Airport City is operated by a private sector, which invests in the development of U-Tapao International Airport, which is part of the project to develop U-Tapao International Airport and Eastern Aviaton City, comprising of:

1) Office Area: The objective is to promote business related to aviation industry to establish the business base within the area around U-Tapao International Airport, which will lead to the development of the area, to be an “the aviation metropolis of the eastern region” and support commercial activities that have resulted from the growth of the industry in the Eastern Economic Corridor Development Project Plan (EEC).

2) Business Park: It is a multi-purpose area to support and compile trade activities from various industries including distribution, display, import and export of warehouse management products, as well as Light Manufacturing.

3) Exhibition: To facilitate the travel of participants and the goods to be displayed, also close to the Warehouse (Cargo Village), which is convenient for the management of products for sale, both in Thailand and for export.

4) Luxury Outlet: A collection of brand name stores to serve both Thais and foreigners visiting Thailand, as well as attracting expats who live in Southeast Asia to buy brand name products.

2.6.2 Free Trade Zone

Free Trade Zones are operated by private parties to invest in the development of U-Tapao International Airport. It is part of the project to develop U-Tapao International Airport and the Eastern Aviation City. The establishment of Free Trade Zones to support and encourage manufacturers or operators to import goods and add value to the target market. It is possible to manufacture light manufacturing, including various logistics processes. In this regard, there should be an underground parking lot with a space that can support the product weights of 5 tons per square meters and has Clearing Floor with at least 15 meters height and structure of no pillar, has systems ready for all kinds of exhibitions.

2.6.3 Other aviation maintenance centers

Other aviation maintenance centers are operated by EECO. It is located at the aircrafts repair center of other operators, which is an area of approximately 400 rai, consisting of an aircraft repair center and a parking lot.

2.6.4 Training Center for Aviation Personnel

Training center for aviation personnel operated by the Institute of Civil Aviation (CEP) Due to the Royal Thai Navy and EECO. There is a need for the aviation personnel training center to be located in the Technical Zone, which is located in the same area as the Thai aviation maintenance center, so that students can receive training at the aviation maintenance center in accordance with the relevant requirements and standards.

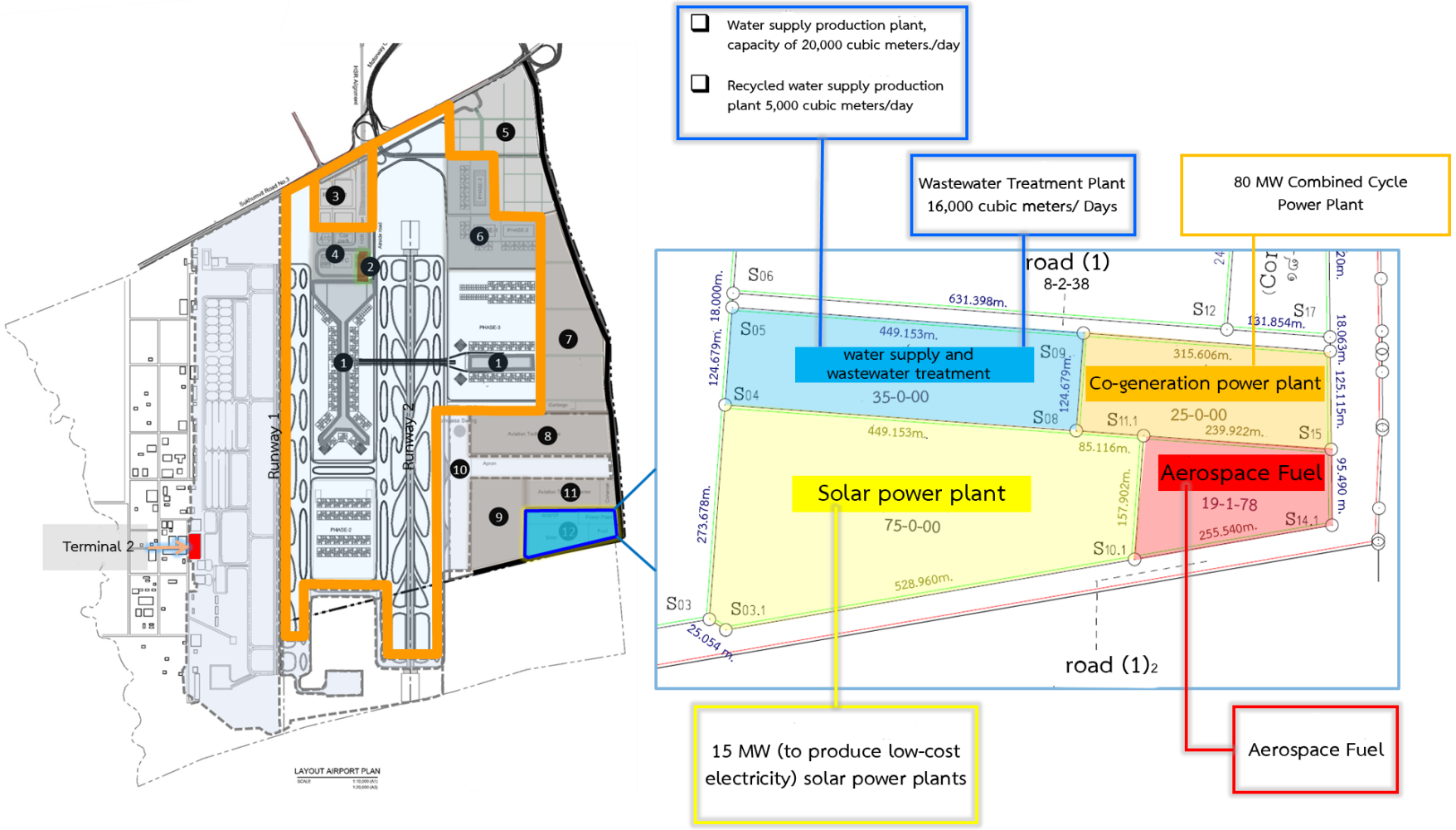
2.6.5 Support system for safety boarding and landing of aircraft

Structure for safe support in boarding and landing of aircrafts in U-Tapao International Airport requires to have Approach Lighting Support Structure for runway 2, the project has a letter to discuss with the Marine Department. And the Marine Department replied that "the nature of the building is not in the nature of the building and the encroachment of the river, as specified in Article 4 and Article 5 of the ministerial regulation No. 63 (1994). However, it is the government's project and is constructed for government's benefit, it may be in the condition of building that is allowed to build, as details show in **Appendix 2-4**. Therefore, Approach Lighting Support Structure is not in detail of EHIA.

2.6.6 Central public utility systems

Central public utility systems operated by EECO. The private sector leased land to develop central public utility systems to support the development of projects at U-Tapao Airport and Eastern aviation cities. The central public utility systems comprise of electricity and cold water production systems, public water supply systems, waste water treatment systems, and aircrafts fuel systems.

All central public utility systems to support development in the East Economic Development area are operated by RTN and EECO. By having private sector leased land to operate in the central public utility systems, which is in accordance with the Eastern Special Development Area Act 2018 (**Appendix 2-5**), Section 53, in which the central public utility systems comprise of electriciy and cold water production system, public water supply system, and aircrafts fuel system, with a total area of approximately 154 rai (asshown in **Figure 2.6-1**) is located on area outside project (area number 12 (electrical power generation system, water supply and waste water treatment system, aircrafts fuel service) as shown in **Figure 2.3-1** Project area with details as follows:



Source: Project to hire a consultant to support the Office of the Eastern Economic Corridor Policy Committee to administer and supervise contracts U-Tapao Airport Development Project and Eastern Aviation City for the fiscal year of 2021

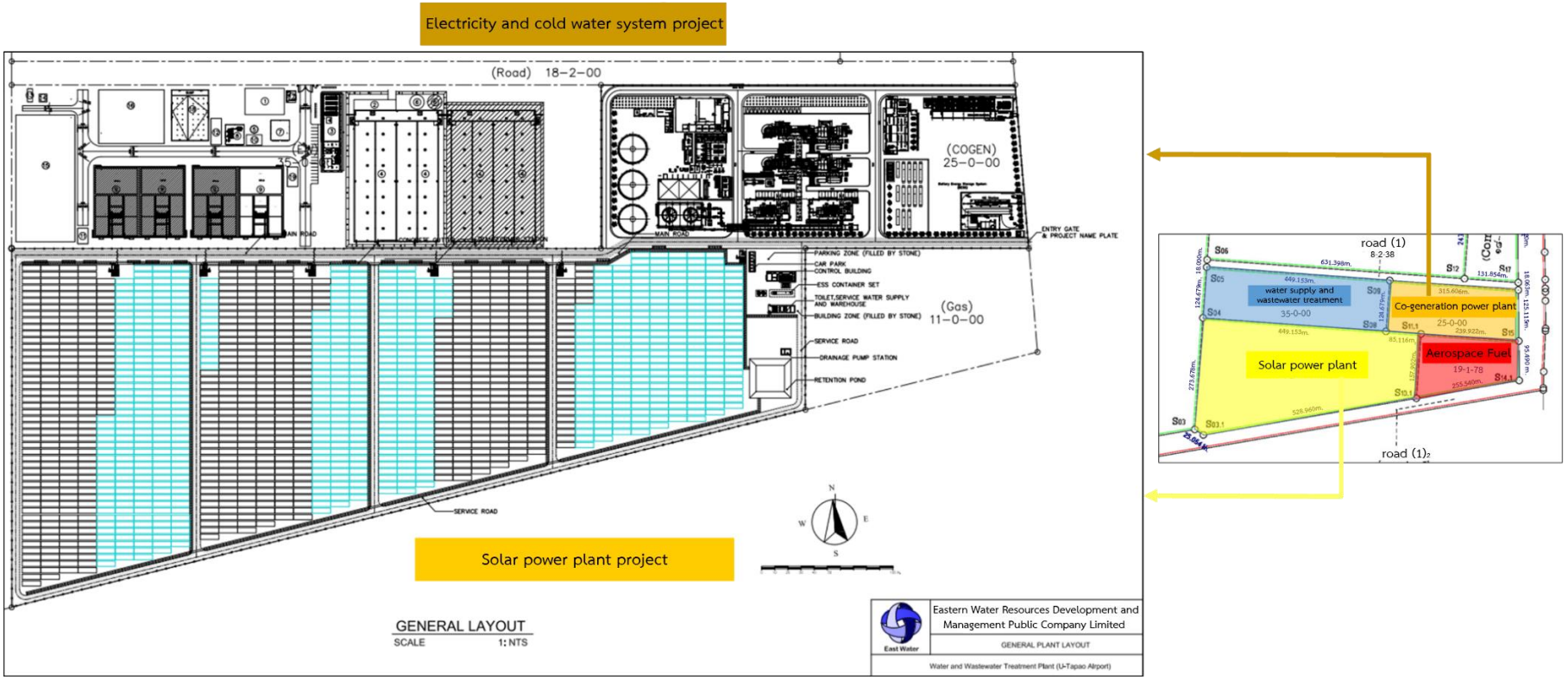
Figure 2.6-1 Area map for public utility systems, water supply system and waste water treatment systems, and aircrafts fuel service systems

2.6.6.1 Power generation system

The power plant is located in the support area of U-Tapao Airport outside of the extended U-Tapao International Airport. The objective is to sell electricity to U-Tapao Airport. The presence of a power supply plant in the airport area will cause the airport to have stable power supply, better power quality than electricity received from the electricity distribution system from the long-distance line, reducing the impact of problems from the external power transmission system. Therefore, the development of U-Tapao Airport requires that power plants be located near project areas, including at least 1 external backup power supply from production or regional electricity, which is in accordance with the N-1 standard. Electrical systems can continually supply electricity. In the case that the main equipment is disconnected from 1 electrical equipment EECO conducted the private recruitment to provide the said service provider, with B.Grimm Power Public Company Limited being selected to be the service provider, as the proposed share of income back to public sector was highest.

Electrical and cold water projects in The U-Tapao International Airport by B.Grimm Power Public Company Limited, is a power plant project that has integrated power generation system using more than 1 type of fuel (SPP Hybrid) as shown in **Figure 2.6-2** Electrical and cold water project comprising of

- Cogeneration Combined Cycle Power Plants that use natural gas as a fuel have a maximum installed capacity of 160 MW (2-phase of capacity combined) and power generation of 9,600 ton of cold water installed.
- A solar power plant with a 15 MW battery energy storage system



Source: B.Grimm Power Public Company Limited, 2020.

Figure 2.6 2 Electrical and cold water project flow of U-Tapao International Airport

Distribution of electricity from the B. Grimm Power Public Company Limited will pay to U-Tapao International Airport mainly through private investment (U-Tapao International AVIATION Company Limited), which will supply power to various areas of U-Tapao International Airport. For the amount of excess electricity during that period, it will sell to the electricity business(Royal Thai Navy Concession Welfare)to support the stability of electricity system in the concession are of electricity business (Royal Thai Navy Concession Welfare)only. Electricity business(Navy Concession Welfare) received the concession to provide electrical service from Ministry of Energy in area of Sattahip District, Chonburi total of 5 sub-district, 41 villages covering area of 348.12 square meters consisting of Sattahip Sub-district, Phlu Ta Luang subdistrict, Samaesarn Sub-district, Bang Sarae Subdistrict, Na Jomtien Sub-district.

Power plants have the highest installed capacity of 160 MVA and can deliver the actual electricity (Gross Power) of 140.60 MW. By predicting the amount of electricity shown in **Table 2.6-1**, which has been reviewed by the development area of U-Tapao International Airport and Commercial Affairs in accordance with the master plan (Project feasibility study master planning project U-Tapao International Airport Development Project and Surrounding Areas Rayong, 2018) It was found that in Phase 1 (2028), Phase 2 (2038), and Phase 3 (2048), the electrical power demand was 66.12, 27.17 and 22.69 MVA, respectively. In an overview of U-Tapao International Airport in 2048, the total demand for electrical energy is 115.98 MVA or 98.58 MW and remaining for sale to electricity business, Royal Thai Navy concession welfare for 36.3 MW as shown in **Table 2.6-2.**

Table 2.6 1 Production capacity and power distribution to various areas of U-Tapao International Airport

In the case of	Gross Power (MW)*	Used within B.Grimm Company (MW) projects	Net Power (MW)	Send to chiller to produce cold water (MW)	Sold to U-Tapao International Airport (MW)**	Distributed to electricity business, Navy Concession Welfare(MW)***
Case 1 Full Load	140.60	2.72	137.88	3	98.58	36.30
Case 2 Patial Load	90.86	2.58	88.26	3	N/A	N/A

Note: * In the case of expanded installation capacity to 160 MVA
** At Power Factor 0.85, it is 98.58 MW
*** The expected quantity of electricity in phase 3.

Source: B.Grimm Power Public Company Limited, 2020.

Table 2.6-2 Predicting Power Demand in Each Session

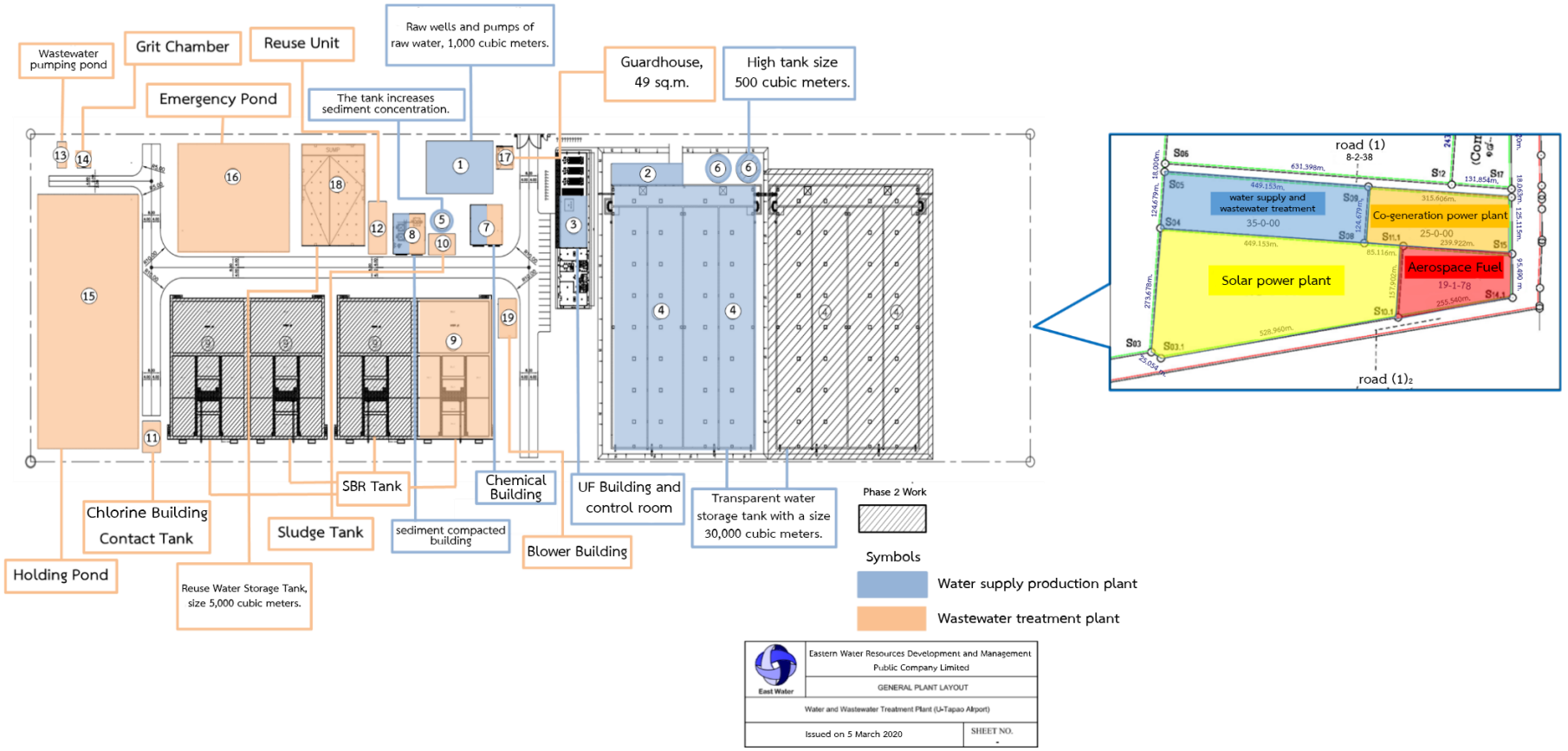
Area	Electrical Power Demand (MVA)		
	Phase 1	Phase 2	Phase 3
Commercial – Hotel	3.78	0.00	0.00
Commercial – Retail Store	2.66	0.00	0.00
Commercial - Office (10 square meters/person)	6.72	6.72	0.00
Commercial – Meeting Room	0.97	0.00	0.00
Terminals for 70 million people per year	13.06	5.80	14.63
Aviation support section	5.05	0.00	0.00
Cargo/Logistics	2.89	2.89	3.86
Aircraft Maintenance Center	10.08	0.00	0.00
Other Aircraft / Training Maintenance Center	0.00	10.08	0.00
Water refill for cooling system, group of buildings type	10.92	1.68	4.20
Filling water for power plants	10.00	0.00	0.00
Total	**66.12**	**27.17**	**22.69**
Total cumulative quantity	**66.12**	**93.29**	**115.98*** **

Note : *** at Power Factor 0.85 is equal to 98.58 MW

Source: Development Project for Development of U-Tapao International Airport and surrounding areas, Rayong, 2018

2.6.6.2 Water supply production system

The water supply plant is located in the support area of U-Tapao Airport Pao Airport outside of the extended U-Tapao International Airport. The manufacturer of such public water is Eastern Water Resources Development and Management Public Company Limited or East Water. The system was designed by Paragon Engineering Company Limited. The area plots of the system are shown in **Figure 2.6-3**. The water sourceused by Eastwater for the production of water supply has been allocated water from Office of Irrigation 9, Irrigation Department by using water from the main reservoir in the project area consisting of 3 water reservoirsi.e. Dok Krai Reservoir, Nong Pla Lai Reservoir and Prasae Reservoirand used the combined water source with the one that East Water Company has developed i.e. Thap Ma Reservoir a total water volume of 390 million cubic meters(as in **Table 2.6-3**) that is adequate with the designed production capacity. There will be no problem with the use of water for consumption by the public in any way. Private investment (The U-Tapao International Aviation Co., Ltd.) will install a central water supply system to distribute for the project area.



Source: East Water Company, Limited, 2021

Figure 2.6 3 Map of Water Supply and Waste water Treatment Plants of U-Tapao International Airport

Table 2.6-3 Water sources that supply raw water to projects and additional development plans for raw water resources

Water source	Location	Reservior capacity (Millions cubic meters)	Amount of water allocated (Millions cubic meters)
1. Water sources procured from Office of Irrigation 9, Irrigation department			
- Nong Pla Lai Reservoir	Pluak Daeng Sub-district, Pluak Daeng District, Rayong	164	120
- Dok Krai Reservoir	Pana Nikom Sub-district, Nikom Pattana District, Rayong	79	116*
- Prasae Reservoir	Chom Sang Sub-district, Wang Chan District, Rayong	248	40 (Raw Water Pipe System - Prasae-Khlong Yai of Irrigation Department)
			70 (The Company's raw water pipe system Prasae-Nong Pla Lai)
- Nong Kho Reservoir	Nong Kham Sub-district, Sriracha District, Chonburi	21	16.7
Total			**362.7**
2. Water sources from natural waterways			
Bang Pa Kong River	Khlong Khuean Subdistrict, Khlong Khuean District, Chachoengsao	-	27**
Total			**27**
Total water volume (1)+(2)			**390**

Note : * indicates the volume is greater than the water reservoir capacity, because the amount of water inflow from the reservoir area on the north river basin is greater than the reservoir capacity.

** This refers to the average volume of water that can be pumped from Bang Pa Kong river in accordance with the pumping capacity of the pump, which is only pumped during the rainy season.

Source: East Water Company, Limited, 2021

The raw water is delivered to the project via a pipe system with a diameter of 500 millimeters, and approximately 9.62 million cubic meters per year, with a water pressure of about 43 meters, sufficient water supply to support the water usage demand of U-Tapao International Airport.

Phase 1: Construction at the start of the project to serve the water supply demand at 10,000cubic meters per day. There are reserved water supply tank that can back up the supply of water for a minimum of 3 days (capacity of 30,000 cubic meters), supporting the demand until the start of Terminal 3 construction or around year 2020 - 2025

Phase 2 The water supply system will be additionally constructed by 10,000 meters per day. There is a reserved water supply tank that can be used for a minimum of 3 days (capacity of 30,000 cubic meters). The construction will be finished in the same period as the Terminal 3 which will be aroundyear2026 or will consider to construct when water supply usage in phase 1 exceeds 75 percent (of the total capacity).

The water supply production system for phase 1 and 2 will have a total production capacity of 20,000 square meters per day, which is higher than forecasted water consumption, based on the area that has developed the expansion of U-Tapao International Airport and the commercial as per the master plan. (Project feasibility study master planning project U-Tapao International Airport Development Project and Surrounding Areas Rayong, 2018), with water volume forecasted in 2028, 2038 and 2048 asequal to 8 ,610, 13,046 and 19,333 cubic meters per day, respectively. The amount of water used is caused by the number of passengers in 2028, 2038 and 2048 equal to 959, 2,603 and 4,795 cubic meters per day or 11%, 20% and 25% of the total water used in the sequence shown in **Table 2.6-4** to **Table 2.6-6.**

Table 2.6-4 Predicted water consumption and waste water in the U-Tapao International Airport area in Phase 1 (2028)

Area	Building area (square meters)	Water consumption (cubic meters/ day)	Waste water volume (cubic meters/ day)
Commercial – Hotel	18,420	74	66[1/]
Commercial – Retail Store	5,500	22	20[1/]
Commercial - Office (10 square meters/person)	40,000	320	288[1/]
Commercial – Meeting Room	2,000	8	7[1/]
Terminal (14 million people)	182,900	959	767[2/]
Aviation support section	15,000	60	54[1/]
Cargo/Logistics	50,250	201	181[1/]
Aircraft Maintenance Center	24,900	100	90[1/]
Other Aircraft/Training Service center	116,670	467	420[1/]
Water refill for cooling system, group of buildings type		900	-
Filling water for power plants		5,500	1,293[3/]
Total amount		**8,610**	**3,185**

Notes : [1/] The amount of waste water generated is equal to 90 percent of the amount of water used.
[2/] The amount of waste water generated is equal to 80 percent of the amount of water used.
[3/] The waste water volume that occurred was at 23.5 percent of the volume of water used.
(The costs of the design of the power plant at U-Tapao International Airport, B.Grimm Power Public Company Limited, 2020)

Source: Project feasibility study master planning project U-Tapao International Airport Development Project and Surrounding Areas Rayong, 2018

Table 2.6-5 Predicted water consumption and waste water in U-Tapao International Airport Area in Phase 2 (2038)

Area	Building area (square meters)	Water consumption (cubic meters/day)	Waste water volume (cubic meters/day)
Commercial – Hotel	50,000	200	180[1/]
Commercial – Retail Store	14,930	60	54[1/]
Commercial - Office (10 square meters/person)	108,570	869	782[1/]
Commercial – Meeting Room	5,430	22	20[1/]
Terminal (38 million people)	264,100	2,603	2,082[2/]
Aviation support section	37,000	148	133[1/]
Cargo/Logistics	153,100	612	551[1/]
Aircraft Maintenance Center	30,850	123	111[1/]
Other Aircraft/Training Service center	116,670	467	420[1/]
Water refill for cooling system, group of buildings type		2,443	-
Filling water for power plants		5,500	1,293[3/]
Total amount		**13,046**	**5,625**

Notes : [1/] The amount of waste water generated is equal to 90 percent of the amount of water used.
[2/] The amount of waste water generated is equal to 80 percent of the amount of water used.
[3/] The waste water volume that occurred was at 23.5 percent of the volume of water used.
(The costs of the design of the power plant at U-Tapao International Airport, B.Grimm Power Public Company Limited, 2020)

Source: Project feasibility study master planning project U-Tapao International Airport Development Project and Surrounding Areas Rayong, 2018

Table 2.6-6 Predicted water consumption and waste water in the U-Tapao International Airport area in Phase 3 (2048)

Area	Building area (square meters)	Water consumption (scubic meters/day)	Waste water volume (cubic meters/day)
Commercial – Hotel	50,000	200	180[1/]
Commercial – Retail Store	27,500	110	99[1/]
Commercial - Office (10 square meters/person)	200,000	1,600	1,440[1/]
Commercial – Meeting Room	10,000	40	36[1/]
Terminal (70 million people)	469,000	4,795	3,836[2/]
Aviation support section	60,000	240	216[1/]
Cargo/Logistics	287,000	1,148	1,033[1/]
Aircraft Maintenance Center	100,000	400	360[1/]
Other Aircraft/Training Service center	200,000	800	720[1/]
Water for Group Cooling		4,500	-
Water refill for cooling system, group of buildings type		5,500	1,293[3/]
Total amount		**19,333**	**9,212**

Notes : [1/] The amount of waste water generated is equal to 90 percent of the amount of water used.
[2/] The amount of waste water generated is equal to 80 percent of the amount of water used.
[3/] The waste water volume that occurred was at 23.5 percent of the volume of water used.
(The costs of the design of the power plant at U-Tapao International Airport, B.Grim Power Public Company Limited, 2020)

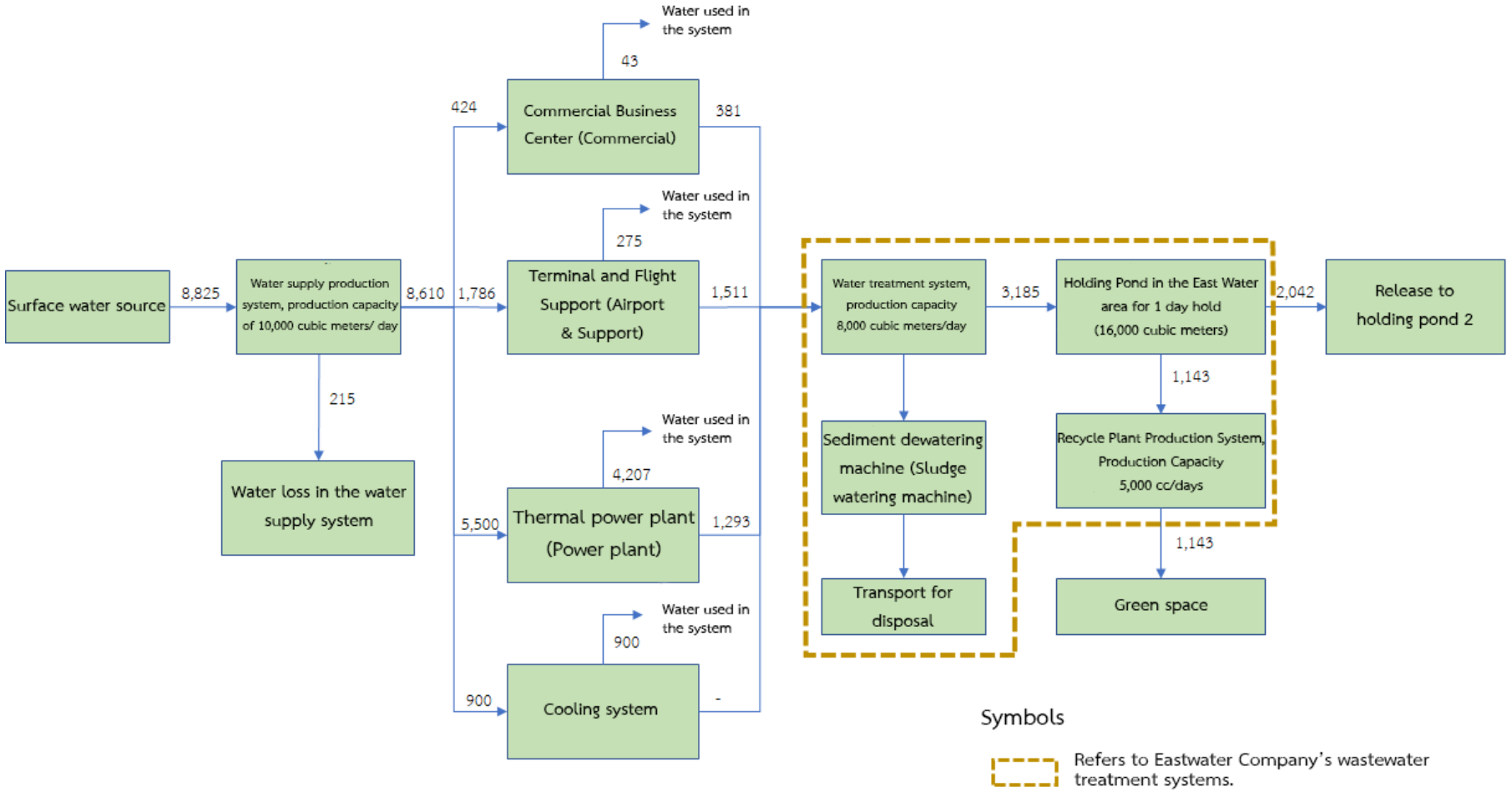
Source: Project feasibility study master planning project U-Tapao International Airport Development Project and Surrounding Areas Rayong, 2081

2.6.6.3 Central waste water treatment system

Central waste water treatment plant located in the supporting area of U-Tapao Airport outside of the International Airport, U-Tapao Extension, which the waste water treatmentsystemwill be operatedby Eastern Water Resources Development and Management Public Company Limited or East Water designed by Paragon Engineering Company Limited which layoutof the waste water treatment system is shown in **Figure 2.6-3** The amount of waste water generated from the terminals, when the maximum passenger volume is 70 million per year, approximately waste water 3,836 cubic meters per day (which account for 51 percent of total waste water volume) based on waste water volume projections, considered in the areas that have developed the expansion of U-Tapao International Airport(Project feasibility study master planning project U-Tapao International Airport Development Project and Surrounding Areas Rayong, 2018). The waste water occurred was calculated from 80-90 percent of water used which the waste water volume occurred included the internal use of each building and the commercial area. It was found that the total amount of waste water generated in 2028, 2038 and 2048 was 3,185, 5,625 and 9,212 cubic meters per day,

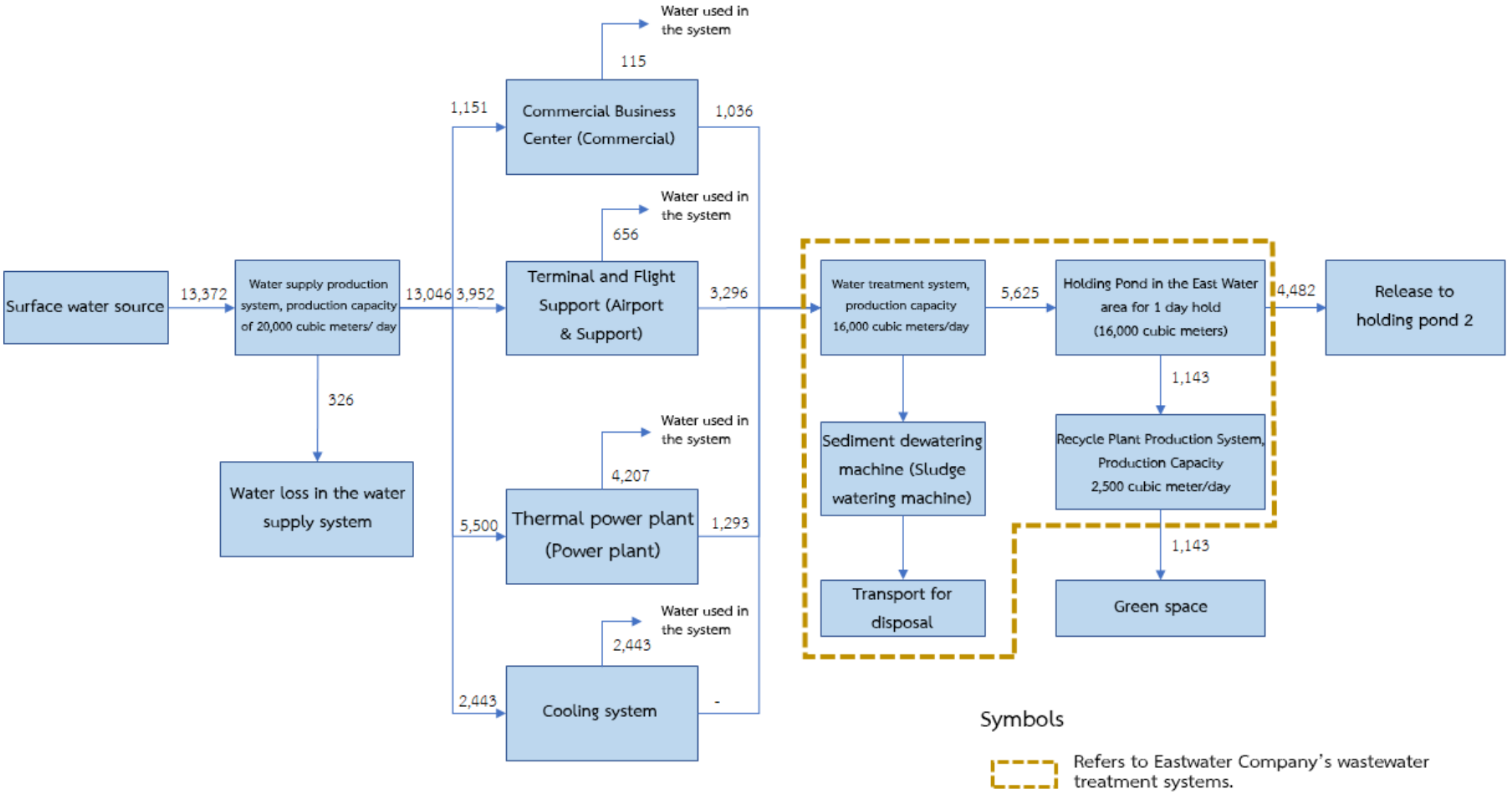
respectively. The amount of waste water generated from the number of passengers in 2028 2038 and 2048 equal to 767, 2,082 and 3,836 cubic meters per day or 24 percent, 37 percent and 41 percent of the total waste water volume, respectively, as detailed in **Table 2.6-**4 to **Table 2.6-**6 in which Eastwater Company, Limited has designed a treatmentsystem of size 16,000 cubic meters per day, which can provide adequate support for waste water treatment

By partially treated effluent re-used some to reduce the amount of waste water discharged into the final water tank of the project by the quality of the aforementioned waste water to be recycled can be used in green areas within the aviation business / business area (Airport City) mainly, which has an area of approximately 258,400 square meters. or 1.615 Rai when using the water demand rate for the lawn area is equal to 0.75 liters per day, based on the volume of water used in the reference plant (ETp) in April (Source: Direk Thongaram, 1981), and referring to the average monthly volume of water evaporation in Rayong is the average of 30 years (1961 - 1990), The Department of Meteorology, 1991. Therefore, water must be used to clean the lawn 1,143,420 cubic meters per day or about 1,143 cubic meters per day, water balance chart in phase 1 (2028), phase 2 (2038), and phase 3 (2048) referring to the volume of water demand from development activities based on Master Plan, Feasibility Study Project U-Tapao International Airport Development Project and Surrounding Areas Rayong, 2018 as shown in **Figure 2.6-4** to **Figure 2.6-6.**



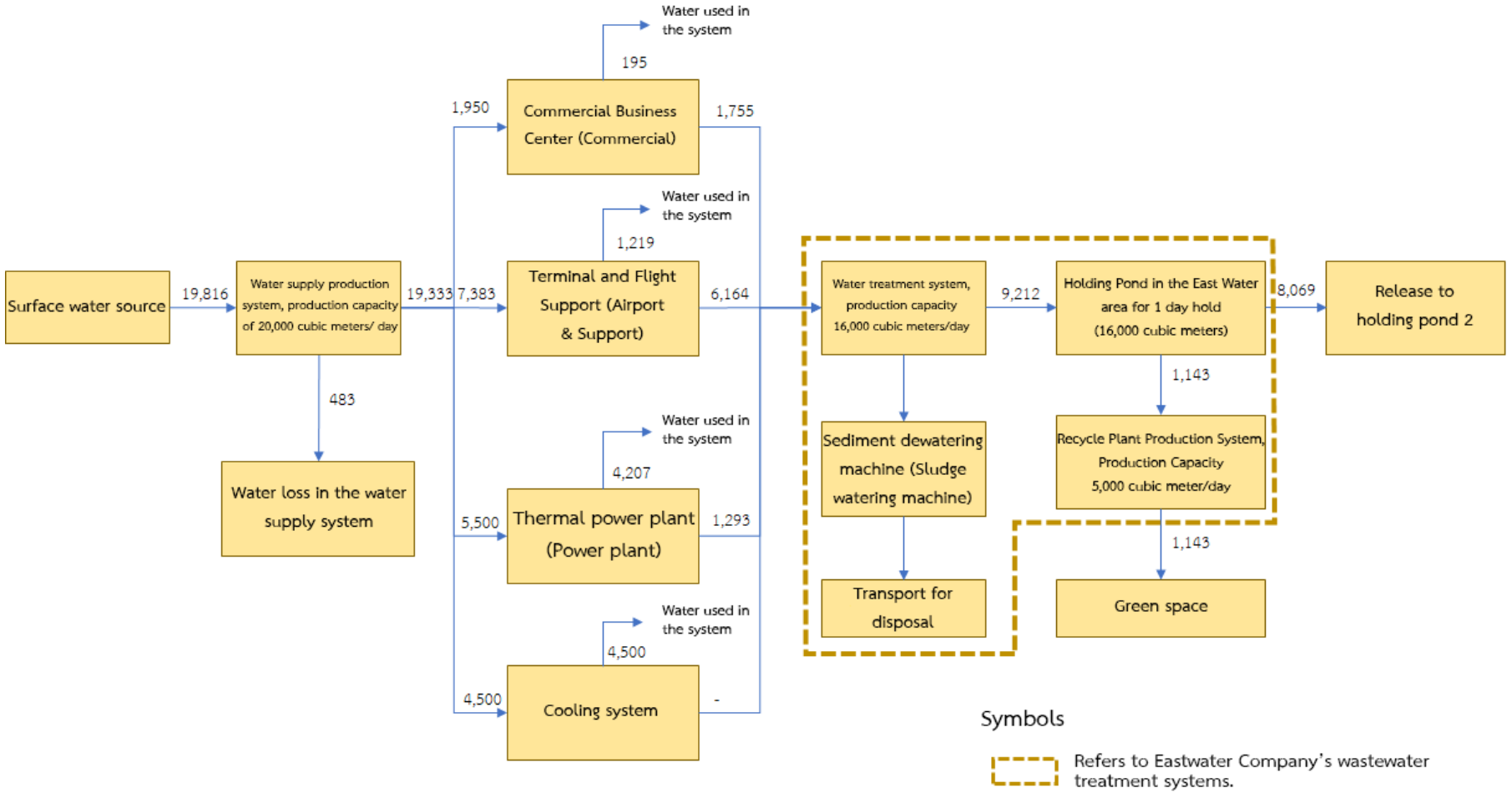
Source: The Eastern Economic Corridor Policy Office, 2021

Figure 2.6-4 Water balance chart in U-Tapao International Airport Area, Phase 1



Source: The Eastern Economic Corridor Policy Office, 2021

Figure 2.6-5 **Water balance chart in U-Tapao International Airport Area Phase 2**



Source: The Eastern Economic Corridor Policy Office, 2021

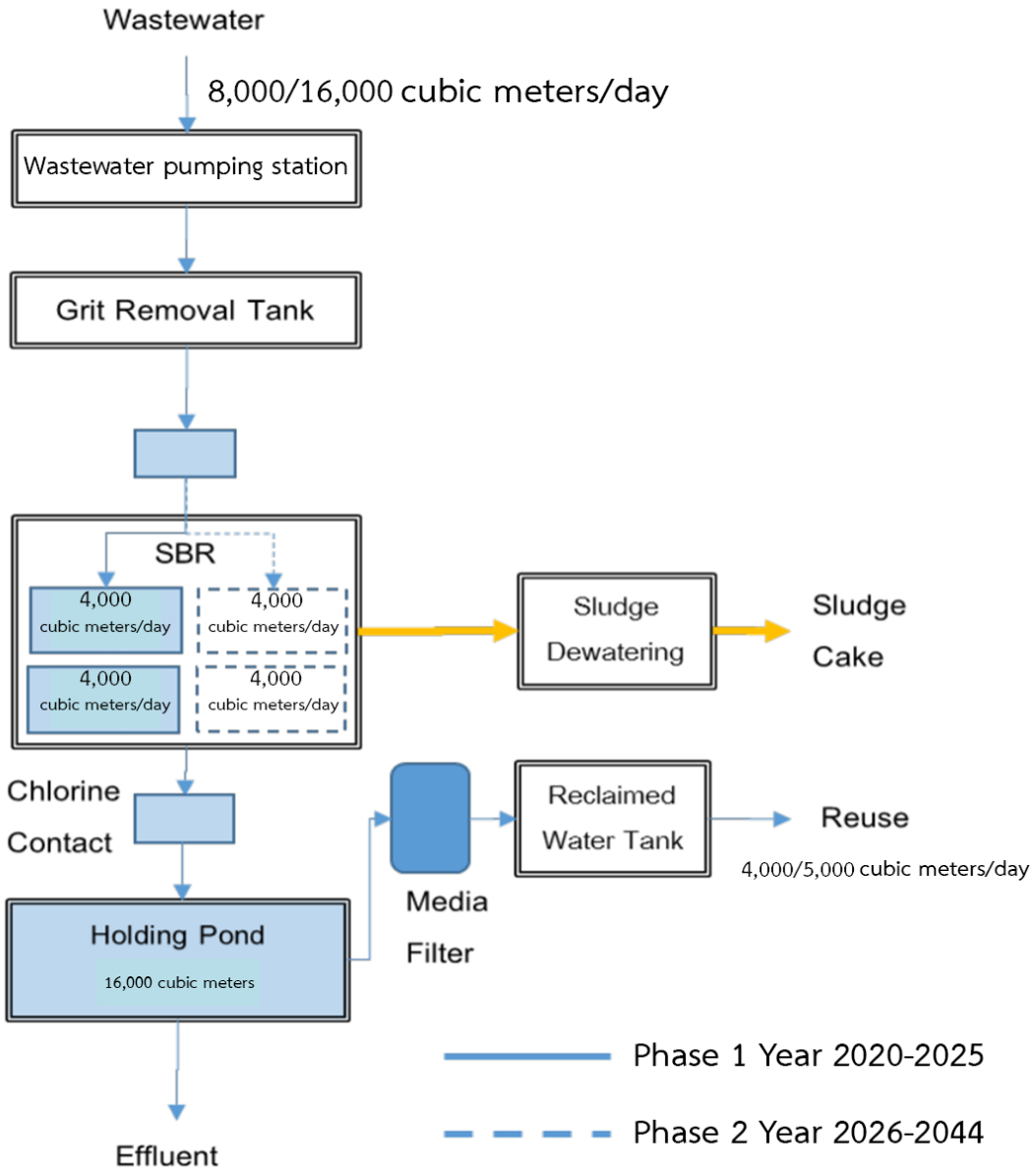
Figure 2.6-6 Water balance chart in U-Tapao International Airport Area Phase 3

There is still not much of the initial waste water volume as it is the construction phase 2020-2025) and it will increase in 2026 after the Terminal 3 is activated. Therefore, the construction of the waste water treatment system must be in accordance with this period, as summarized below.

Phase 1: 2020 – 2025: Waste water treatment systems	= 8,000 cubic meters per day
Stage 2 : 2026 – 2044: Additional waste water treatment system	= 8,000 cubic meters per day
Total size of waste water treatment system	= 16,000 cubic meters per day

The waste water treatment system is a Sequencing Batch Reactor (SBR) with an aerator tank and a sedimentation tank. It also has the same tank and a short hydraulic flow adjusted to meet the functions of the SBR, making it easy to use a small space, save money, and low cost. And once waste water is entered into the waste water treatment, there is water quality control of waste water that passed, standard of treatment, sewerage control according to the Announcement of the Ministry of Natural Resources and Environment.

The operational system design is divided into 2 phases, i.e. Phase 1, water treatment system, production capacity of 8,000 cubic meters per day, and Phase 2, waste water treatment system, additional 8,000 cubic meters per day, totaling 16,000 cubic meters per day. The SBR waste water treatment system is shown in **Figure 2.6-7**



Source: East Water Company, Limited, 2019

Figure 2.6 7 Working Principles of Sequenc ing Batch Reactor (SBR)

Drainage through the waste water treatment system will measure the values of COBI and BOD with a continuous water quality monitor (COD/BOD Online). Standard treated waste water will be treated as recycled water for reuse by watering the trees in the green area (garden area) within the project area.

In the event that the treated waste water from the SBR tank does not meet standard values, it will send to rest in the emergency tank to prevent the non-standard water from falling out of the project area. Then, pump water back for treatment until the effluent water quality meets the standard.

Excess sediment arising from waste water treatment process is pumped to the Sludge Holding Tank, which will be filled with air to prevent odor. The sediment is pumped to combine

with polymers before sending to the extruder unit until the sludge has approximately 80% moisture or 20% DS. The sludge will be Cake and contains high organic components and no hazardous substances. Due to the specified water quality ofwaste water that can be used as a fertiliser for non-flowering plants in the project. But it must be stabilized first by composting it to make fertilizer or using it as a soil conditioner or hiring a private company to manage waste (In the process of procuring a private sector to operate) to be disposed of outside the area. by requesting permission to manage unused materials according to the Announcement of the Ministry of Industry Regarding the disposal of sewage or unused materials.

Receiving waste water from the extended treatment of U-Tapao Airport project, East Water Company Limited, has specified that all activities in the area must be waste water treatment or have to be managed in accordance with the quality of the industrial estate before releasing to the central waste water treatment system of Eastwater Company. The central waste water treatment system can support 16,000 cubic meters per day of waste water. Details of water quality measurement before releasing to the sea are shown in **Table 2.6-7**

Table 2.6-7 Waste water quality before entering the central waste water treatment system and waste water quality before releasing into the sea

Sequence	items	Unit of	waste water drains into waste water treatment systems*	Water drains before releasing into the sea**
1	pH		5.5-9.0	5.5-9.0
2	Temperature	degrees Celsius (°C)	<45	<40
3	Color	ADMI	600	300
4	Odor	-	Not offensive	
5	Total dissolved solids (TDS)	milligrams per liter	<3,000	<3,000
6	Total suspended solids (TSS)	milligrams per liter	<200	<50
7	BOD	milligrams per liter	<500	<20
8	COD	milligrams per liter	<750	<120
9	Sulfide	milligrams per liter	<1	<1
10	Cyanide	milligrams per liter	<0.2	<0.2
11	Fat oil and grease	milligrams per liter	<10	<5
12	Formaldehyde	milligrams per liter	<1	<1
13	Phenols	milligrams per liter	<1	<1

Table 2.6-7 Waste water quality before entering the central waste water treatment system and waste water quality before releasing into the sea

Sequence	items	Unit of	waste water drains into waste water treatment systems*	Water drains before releasing into the sea**
14	Free chlorine	milligrams per liter	<1	<1
15	Pesticide		Must not be detected	Must not be detected
16	TKN	milligrams per liter	<100	<100
17	Fluoride	milligrams per liter	<5	-
18	Surfactant	milligrams per liter	<30	-
19	Heavy Metal			
	Zinc	milligrams per liter	5	5
	- Chromium hexavalent (Cr^{6+})	milligrams per liter	0.25	0.25
	- Chromium Trivalent (Cr^{3+})	milligrams per liter	0.75	0.75
	Arsenic	milligrams per liter	0.25	0.25
	Copper	milligrams per liter	2	2
	Mercury	milligrams per liter	0.005	0.005
	Cadmium	milligrams per liter	0.03	0.03
	Barium	milligrams per liter	1	1
	Selenium	milligrams per liter	0.02	0.02
	Lead	milligrams per liter	0.2	0.2
	Nickel	milligrams per liter	1	1
	Manganease	milligrams per liter	5	5
	Silver	milligrams per liter	1	-
	Total Iron	milligrams per liter	10	-

Table 2.6-7 Waste water quality before entering the central waste water treatment system and waste water quality before releasing into the sea

Sequence	items	Unit of	waste water drains into waste water treatment systems*	Water drains before releasing into the sea**

Notes : * The table attached to the announcement of the Industrial Estate of Thailand No. 76/2560 on General Standards for Draining Waste water into waste water Treatment System of Industrial Estate

** Based on the announcement of the Ministry of Natural Resources and Environment, Re: Set standards to control waste water from industrial plant, Industrial estate and indutrial area dated 29 March 2016

Source: East Water Company, Limited, 2020.

Eastwater Company has a consultation letter with the Office of Natural Resources and Environmental Policy and Planning (ONEP) regarding the preparation of an environmental impact assessment report of the waste water treatment system and was informed that waste water to be treated has the characteristics and properties of sewage or unused materials that are hazardous wastes, which do not fall under the announcement of the Ministry of Industry, Re: Disposal of Sewage or Unused Materials (2005). Details are shown in **Annex 2-6.** Thus, the East Water waste water Treatment Project is not eligible for the preparation of the Environmental Impact Assessment Report.

A preliminary plan for conducting a phase 1 water supply and waste water treatment system project is shown in **Table 2.6-8**

Table 2.6-8 Basic Plan for Implementing a Phase 1 Water supply and waste water Treatment System Project, Public Water Supply and waste water Treatment Project U-Tapao International Airport

Basic project plan, water supply and wastewater treatment system, phase 1, water and wastewater treatment project of U-Tapao International Airport

Sequence	Description	Duration (Months)	Period of Operation (Months)																			
1		18	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	1.1 Procuring for contractors to conduct construction projects	2																				
	1.2 Engineering Design	2																				
	1.3 Authorization for the Related Agencies	3																				
	1.4 Construction area preparation work	3			Surrounding the fence	Adjust area																
	1.5 Raw water system work (raw water pipe installation, installation of pumping systems)	5																				
	1.6 Main equipment and machinery procurement work of the system	5																				
	1.7 3 days construction work for water supply reserved tank	10																				
	1.8 Other construction works (driving pipes, digging ponds, foundations, buildings, tall tanks, and etc.)	6																				
	1.9 Main electrical work	6			High voltage electrical work																	
	1.10 Installation work of machinery, machines, measurement tools, and control systems	6									Electrical work with low voltage											
	1.11 Systems Testing and System Run Testing	1																				
	1.12 Water supply production system and water distribution																					
2	Construction of wastewater treatment systems	20																		★		
	2.1 Procuring for contractors to conduct construction projects	2																				
	2.2 Engineering Design	2																				
	2.3 Authorization for the Related Agencies	3																				
	2.4 Construction area preparation work	3			Surrounding the fence	Adjust area																
	2.5 Main equipment and machinery procurement work of the system	6																				
	2.6 Other construction works (driving pipes, digging ponds, foundations, buildings, tall tanks, and etc.)	8																				
	2.7 Main electrical work	4							High voltage electrical work				Electrical work with low voltage									
	2.8 Installation work of machinery, machines, measurement tools, and control systems	5																				
	2.9 Start up system test and running system test	3																				
	2.10 The system is ready to use																				★	

Source: East Water Company, 2020 revised by project to hire consultants to support the Eastern Special Development Zone Policy Office to manage and direct contracts for the U-Tapao Airport Development Project and the Eastern Aviation City, 2021

2.6.6.4 Aviation Fuel Service System

EECO arranged area for the aviation fuel service system to support the construction area of the fuel tank, approximately 19 Rai. Currently, the fuel service system of the aircraft is under the selection of operators.The results of the study of planning project for the study of appropriateness, project to develop U-Tapao International Airport and surrounding areas in Rayong(AE Com Consulting (Thailand) Co., Ltd., 2018) The area size required for the development of the fuel depot of U-Tapao International Airport was evaluated based on the forecast number of flights on days that there is a heavy traffic volume for development in various phases, the estimated area size for the depot is determined by the total fuel storage volume required in the airport. Details are shown in **Table 2.6-9** Preferred area

Table 2.6□9 Preferred areasize for fuel depot

Airport Fuel Depot	Unit	Phase 1 Year 2028	Phase 2 Year 2038	Phase 3 Year 2048
Air traffic during rush periods (Aircraft and Freight Aircraft)	Flights	209	480	744
The proportion of outbound flights on heavy traffic days		50%	50%	50%
Amount of fuel required per flight	Liters/flights	20,000	30,000	40,000
Approximate daily fuel volume refill	Cubic Meters	2,090	7,200	14,880
Fuel storage period	Days	10	10	10
Total desired amount of stored fuel	**Cubic Meters**	**20,900**	**72,000**	**148,800**
Land size proportions per building area		0.48	0.48	0.48
Preferred area size	**Hectare**	**1**	**3.5**	**7.1**

Source: Project feasibility study master planning project U-Tapao International Airport Development Project and Surrounding Areas, Rayong, December 2018

2.6.6.5 waste transfer station

The Waste Transfer Station will be a new construction outside the project area, located on the east side of U-Tapao International Airport with an area of approximately 16,000 square meters, comprising of loading docks, maintenance buildings, office buildings, weighing buildings, parking and car wash areas, waste segregation process facilities, entrance roads and buffer areas, including waste water treatment systems. Private sector is responsible for arranging for transportation of waste to outside project area and not in combination with the waste management of Naval Aviation Division. The waste from said agency will be taken to the waste segregation department of the concessions from the Royal Thai Navy, which will be responsible for segregating at the area of Khao Ta Bak km.8, which is about 6 kilometres from U-Tapao International Airport

Predicting the amount of solid waste according to the maximum capacity for the flight of the project, which can accommodate up to 70 million persons, is considered based on the area that has developed the expansion of U-Tapao International Airport and the commercial according

to the master plan (Project feasibility study master planning project U-Tapao International Airport Development Project and Surrounding Areas, Rayong, 2018). The rate of solid waste generation depends on the population in each building and the function of each building. It is found that the total amount of solid waste generated in 2048 is approximately 101 tons per day. Details are shown in **Table 2.6-**10 **to Table 2.6-**12.

Table 2.6-10 Forecast Solid Waste Volume in U-Tapao International Airport Phase 1 Area

Area	Building area (square meters)	The rate of solid waste generation		Solid waste volume	
		Quantity	Unit	Kg/ days	Tons/day
Commercial – Hotel	18,420	0.017	kg/cubic meters/day	313	0.31
Commercial – Retail Store	5,500	0.017	kg/cubic meters/day	94	0.09
Commercial - Office (10 square meters/person)	40,000	0.220	kg/people/day	880	0.88
Commercial – Meeting Room	2,000	0.017	kg/cubic meters/day	34	0.03
Terminal (14 million people)	469,000	0.440	kg/people/day	16,877	16.88
Aviation support section	15,000	0.017	kg/cubic meters/day	255	0.26
Cargo/Logistics	50,250	0.017	kg/cubic meters/day	854	0.85
Aircraft Maintenance Center	24,900	0.017	kg/cubic meters/day	423	0.42
Other Aircraft/Training Service center	116,670	0.017	kg/cubic meters/day	1,983	1.98
Water refill for group of building cooling systems				-	-
Water refill for power plants				-	-
Total amount					**21.71**

Source: Project feasibility study master planning project U-Tapao International Airport Development Project and Surrounding Areas, Rayong, 2018

Table 2.6-11 Predicting the volume of solid waste in the U-Tapao International Airport area in Phase 2

Area	Building area (square meters)	The rate of solid waste generation		Solid waste volume	
		Quantity	Unit	kg/day	tons/day
Commercial – Hotel	50,000	0.017	kg/cubic meters/day	850	0.85

Commercial – Retail Store	14,930	0.017	kg/cubic meters/day	254	0.25
Commercial - Office (10 square meters/person)	108,570	0.220	kg/people/day	2,389	2.39
Commercial – Meeting Room	5,430	0.017	kg/cubic meters/day	92	0.09
Terminal (38 million people)	469,000	0.440	kg/people/day	45,808	45.81
Aviation support section	37,000	0.017	kg/cubic meters/day	629	0.63
Cargo/Logistics	153,100	0.017	kg/cubic meters/day	2,603	2.60
Aircraft Maintenance Center	30,850	0.017	kg/cubic meters/day	524	0.52
Other Aircraft/Training Service center	116,670	0.017	kg/cubic meters/day	1,983	1.98
Filling water for group of building cooling systems				-	-
Filling water for power plants				-	-
Total amount					**55.13**

Source: Project feasibility study master planning project U-Tapao International Airport Development Project and Surrounding Areas, Rayong, 2018

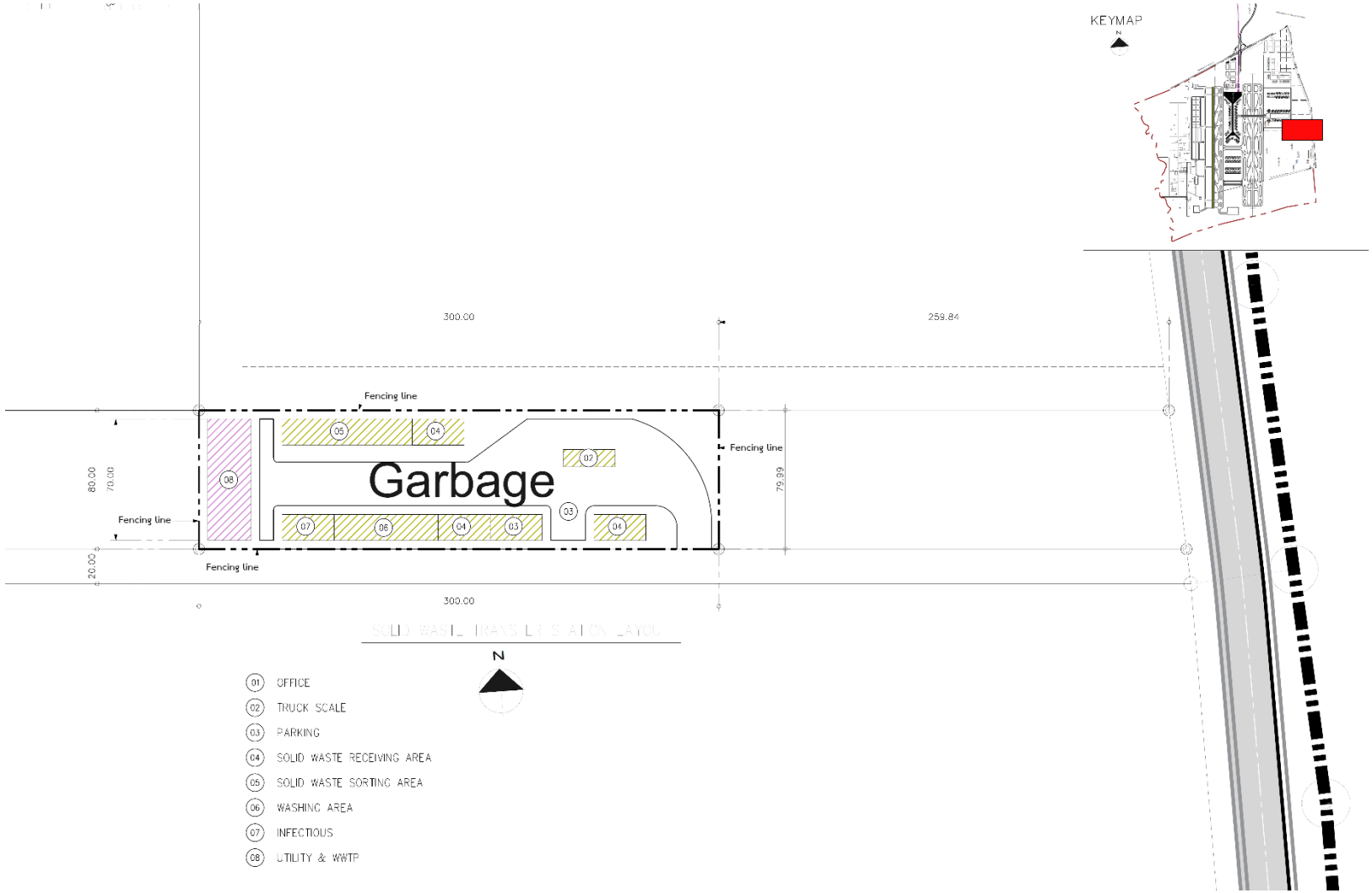
Table 2.6-12 Predicting the volume of solid waste in the U-Tapao International Airport area in Phase 3.

Area	Building area (square meters)	The rate of solid waste generation		Solid waste volume	
		Quantity of	Unit	kg/day	tons/day
Commercial – Hotel	50,000	0.017	kg/cubic meters/day	850	0.85
Commercial – Retail Store	27,500	0.017	kg/cubic meters/day	468	0.47
Commercial - Office (10 square meters/person)	200,000	0.220	kg/people/day	4,400	4.40
Commercial – Meeting Room	10,000	0.017	kg/cubic meters/day	170	0.17
Terminal (70 million people)	469,000	0.440	kg/people/day	84,384	84.38
Aviation support section	60,000	0.017	kg/cubic meters/day	1,020	1.02
Cargo/Logistics	287,000	0.017	kg/cubic meters/day	4,879	4.88
Aircraft Maintenance Center	100,000	0.017	kg/cubic meters/day	1,700	1.70
Other Aircraft/Training Service center	200,000	0.017	kg/cubic meters/day	3,400	3.40
Filling water for group of building cooling systems				-	-
Filling water for power plants				-	-
Total amount					**101.27**

Source: Project feasibility study master planning project U-Tapao International Airport Development Project and Surrounding Areas, Rayong, 2018

In the area of the waste disposal station, there will be an arrangement of collecting waste water from the contamination of the waste substance, including all waste water that occurs at the transfer station, treatment the primary waste water treatment system in the waste disposal station area, and then deliver the waste water to the total waste water treatment system on the project, located at the south side of the waste disposal station. The project has set the design of the waste disposal station in accordance with the Announcement of the Pollution Control Department regarding the criteria to consider the appropriateness of the area, the design and construction of the waste disposal station, and production in the year of 2017.

The waste disposal station and the layout information are shown in **Figure 2.6-8**



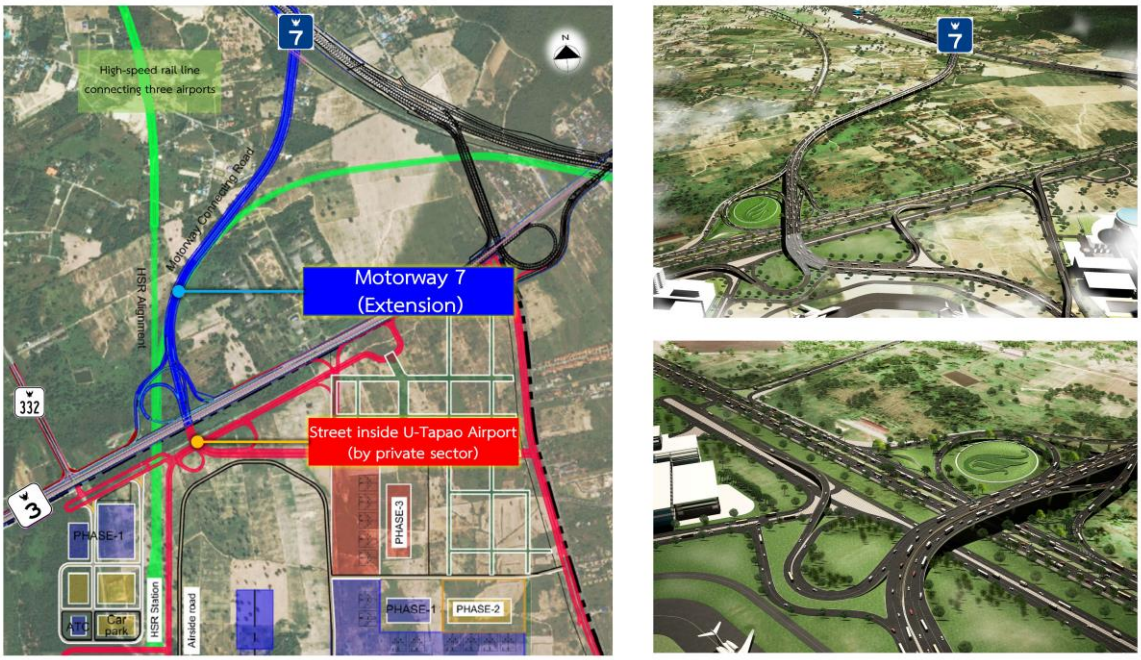
Source: The Eastern Economic Corridor Policy Office, 2021

Figure 2.6 8 Layout of the Waste Transfer Station Area

2.6.6.6 Transport network around the project area

Main road network surrounding the project area consists of Highway No.7(Bangkok-Ban Chang Line Pattaya-Map Ta Phut), Highway No. 3, Highway No. 331 Highway No.,332 Highway, and Highway No.3126 with details and concepts of traffic connections between the project area and the road transportation network, divided into 2 directions as follows:

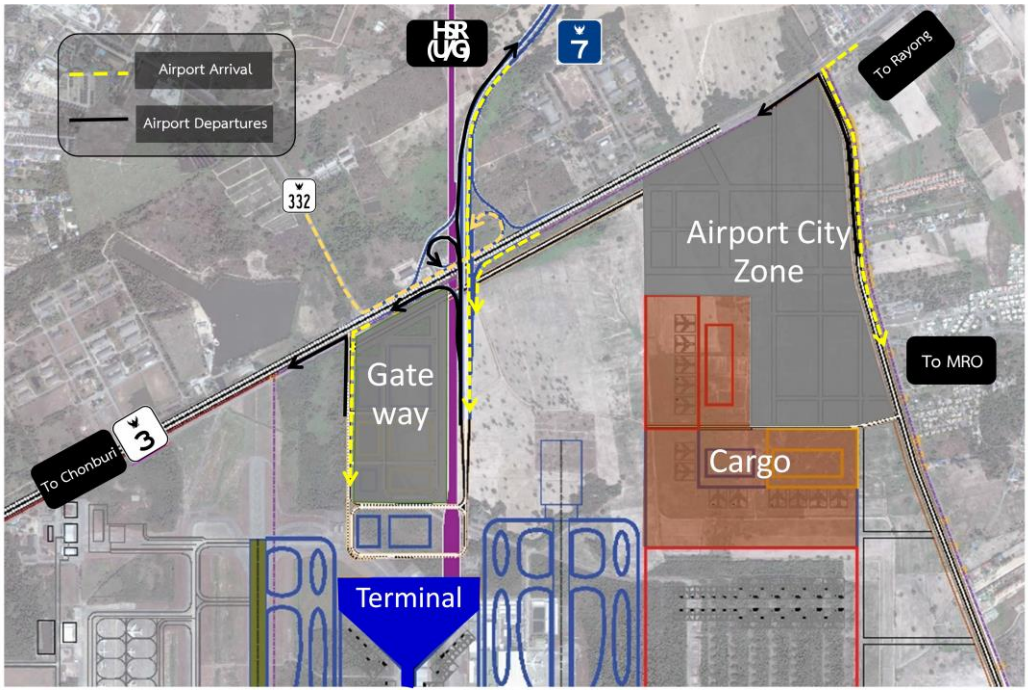
1) Intercity Highway No.7, extension connecting to U-Tapao Airport, is an additional construction of Intercity Highway No.7 to enable direct connection to U-Tapao Airport as shown in **Figure 2.6-** *9* The public sector, with the Department of Highways responsible for the design and construction of the area outside of U-Tapao Airport and private sector, will be responsible for the design and construction of the area of U-Tapao Airport (which the division of responsibility scope is the same guideline used for the development of Suvarnabhumi Airport). Private sector has already been coordinated with the Department of Highways to determine the connection points between the areas inside and outside the airport.



Source: Project to hire consultants to support the Eastern Economic Corridor Policy Office to manage and supervise contracts U-Tapao Airport and Eastern Aviation City Development Project for fiscal year 2021

Figure 2.6 9 Intercity Highway No. 7 Connecting Extension to U-Tapao Airport

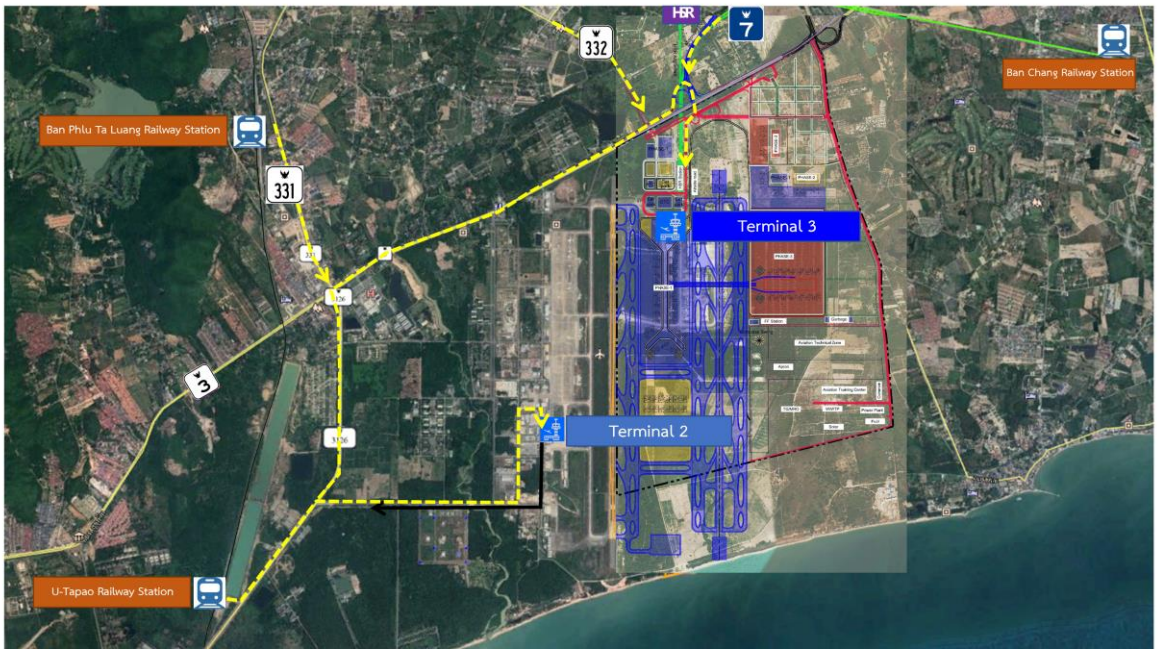
2) The travel link to the project from the north is a travel that originates mainly from the area of Pattaya, Chonburi, or from other regions. The concept of developing a connection network to support traffic in this part will plan to connect to entry and exit the project using Highway No. 3 (Sukhumvit Road), and Intercity Highway No.7. When the airport is operated, passengers will be able to take the route to the new terminal (Terminal 3), so there is no traffic congestion between the local traffic and the traffic of airport passengers. Furthermore, local traffic can travel connecting to the project by Highway No.332 which connects to Sukhumvit Road and to the airport by using the elevated road to the front of Terminal 3with details as shown in **Figure 2.6-**10.



Source: Project to hire consultants to support the Eastern Economic Corridor Policy Office to manage and supervise contracts U-Tapao Airport Development Project and Eastern Aviation City for fiscal year, 2021

Figure 2.6-10 The concept of connecting travel into the project from the north

3) The travel link to the project from the south is from the south area which is Sattahip area and Juk Samet Port. The idea is to plan to connect to the project via Highway No.3126. The main road currently supports the current terminal (Terminal 2). However, in the future when the terminal is open, the entry to the project via Highway No.3 (Sukhumvit road) will use elevated road to the terminal directly. Details are shown in **Figure 2.6-11**



Source: Project to hire consultants to support the Eastern Economic Corridor Policy Office to manage and supervise contracts U-Tapao Airport Development Project and Eastern Aviation City for fiscal year, 2021

Figure 2.6-11 The concept of connecting travel into the project from the south

2.7 Aviation Safety Zones

Ministry of Transport has announced aviation safety zones of U-Tapoa International Airport in 1995 to consider the air safety standards of the International Civil Aviation Organization (ICAO) because it is a U-Tapao International Airport with a length of more than 1,800 meters, the airport is classified in the Aerodrome Code 4. It has been announced that nearby Rayong-Utapao International Airport in area of Huai Yai Subdistrict, Bang Lamung District, Bang Sarae Subdistrict, Phlu Ta Luang Subdistrict, Sattahip District, Chonburi Samnak Thon Subdistrict, Phala Subdistrict, Ban Chang Subdistrict, Ban Chang District, Rayong as aviation safety zones announced in Government Gazette on 30 March 1995 **(Appendix 2-7)** as Announcement of the Ministry of Transport Re: Determination of Areas Nearby Rayong-U-Tapao International Airport in the area of Bang Lamung District, Sattahip District, Chonburi and Ban Chang District, Rayong as an Aviation Safety Zone in 1995, details shown in **Figure 2.7-**1and has the composition shown in **Figure 2.7-2** are summarized as follows:

The preparation of the aviation safety zone of runway 2 will be in accordance with the requirements of the Civil Aviation Authority of Thailand 14th edition of the Airport Standards, Chapter 4, Obstacles, Article 273 stated that

"Inner Horizontal Surface" means the horizontal plane surface above the airport and surrounding area of the airport.

"Conical Surface" means the surface is incline and extending from the edge of the inner line surface.

"Approach Surface" means an inclined plane or a combination of planes, which are in advance of the runway threshold, with the slopes inclined down to the runway threshold.

"Transitional Surface" means the complex surface which is in the area along the side of the safety area around the runway (Runway Strip) and some sides of the path surface, with sloping up and extending until converge with the inner line of surface.

"inner Transitional surface" means a surface similar to an inclined surface, but closer to the runway.

"Take-off lamp surface" means that the plane or other designated surface is beyond the runway ending or the area is free of obstruction.

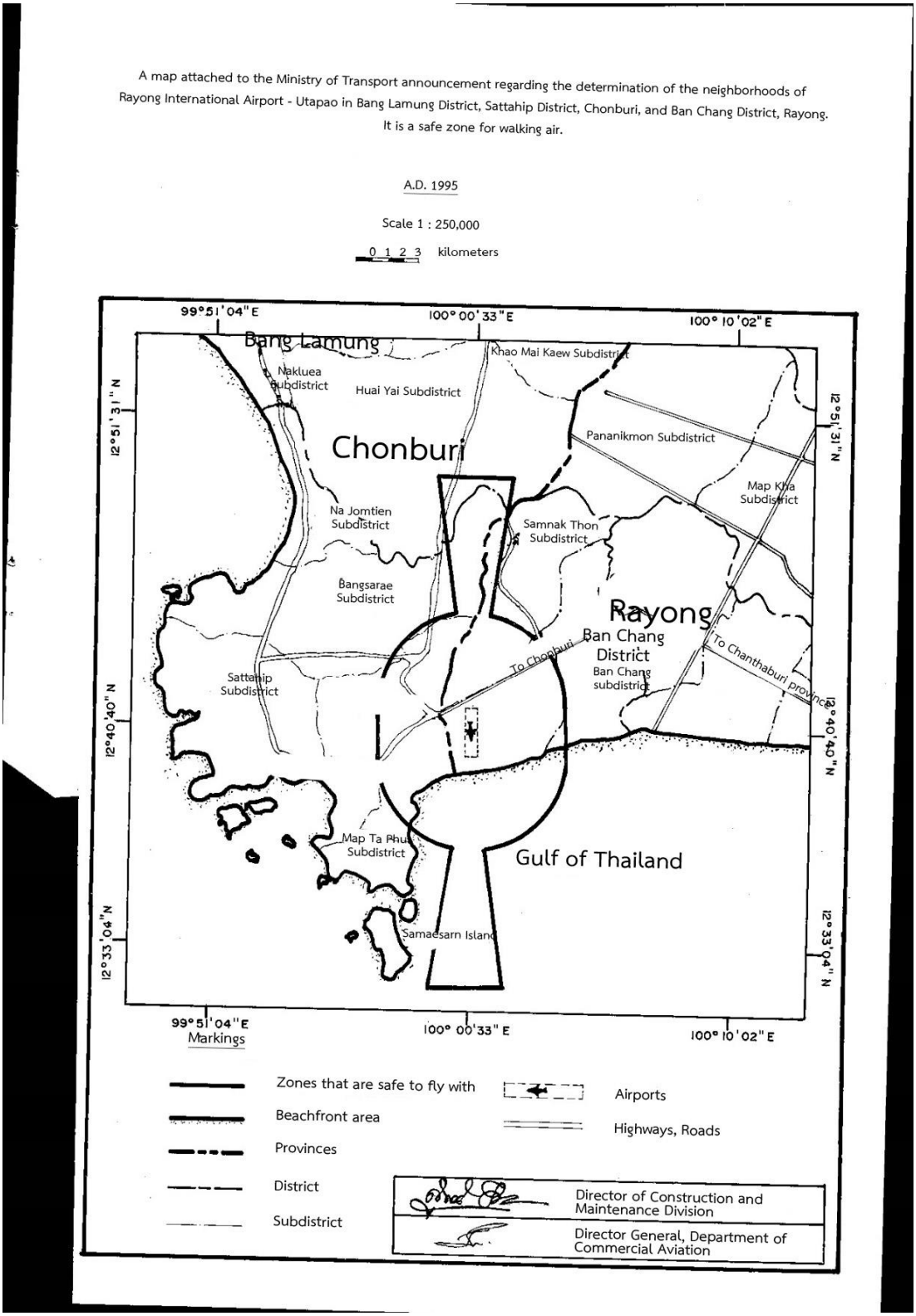
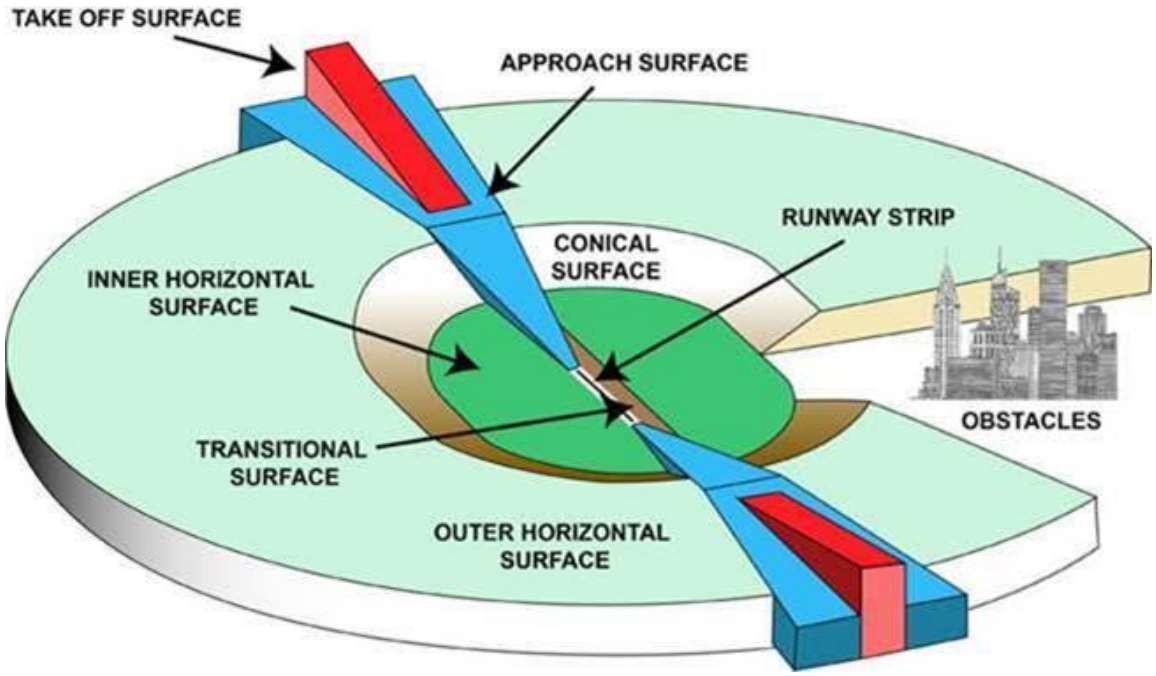


Figure 2.7□1 Aviation Safety Zones of Rayong-U-Tapao International Airport according to the Ministry of Transport, 1995

The distance between the preparation of the barrier-limiting surface is according to **Table 2.7-1**. Dimensions and the level of the surface limiting obstruction to the downflow runway. The project runway is precision runway code 4 (runway length is more than1,800 meters) with a runway threshold level of 18L = 27.511 meters (Mean Sea Level) and runway threshold 36R = 7.803 meters



Source: https://www.airportgurus.com/successful-experiences/bugesera/ Searched on 13 October 2021

Figure 2.7-2 Components within the aviation safety zone

(Mean Sea Level). When preparing an obstruction-limiting surface, it is shown in **Table 2.7-1** and **Figure 2.7-3. Additional** details regarding the dimensions and slopes of the surface restrict obstruction of the downflow runway are shown in **Appendix 2-8**, Volume 14, Section 4, Obstacles.

Table 2.7-1 Dimension and slope of the surface limit obstruction to the downflow runway

Page 85
Vol. 136 Special section 156 D Government Gazette 19 Jun 2019

Table 14 Dimension and surface clarity limit obstruction to landing runways

Type of runway										
	The landing runway without using the meter Consists of flying on				Non-precision runway			Precision runway		
								Type One	Second category and thirdly	
	Numeric code				Numeric code			Numeric code	Numeric code	
Surface and dimension[A]	1	2	3	4	1,2	3	4	1,2	3,4	3,4
(3)	(3)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Conical surface										
Sloping	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Height	35 meters	55 meters	75 meters	100 meters	60 meters	75 meters	100 meters	60 meters	100 meters	100 meters
Inner Tier Surface										
Height	45 meters	45 meters	45 meters	45 meters	45 meters	45 meters	45 meters	45 meters	45 meters	45 meters
Radius	2,000 meters	2,500 meters	4,000 meters	4,000 meters	3,500 meters	4,000 meters	4,000 meters	3,500 meters	4,000 meters	4,000 meters
Inner lining surface										
Width	-	-	-	-	-	-	-	90 meters	120 metersE	120 metersE
Distance from the runway head	-	-	-	-	-	-	-	60 meters	60 meters	60 meters
Length	-	-	-	-	-	-	-	900 meters	900 meters	900 meters
Slope level	-	-	-	-	-	-	-	2.5%	2%	2%
Sacrifice surface										
Length of inner edge	60 meters	80 meters	150 meters	150 meters	150 meters	280 meters	280 meters	140 meters	280 meters	280 meters
Distance from the runway head	30 meters	60 meters	60 meters	60 meters	60 meters	60 meters	60 meters	60 meters	60 meters	60 meters
Spread rate (on each side)	**10%**	**10%**	**10%**	**10%**	**15%**	**15%**	**15%**	**15%**	**15%**	**15%**
First part										
Length	1,600 meters	2,500 meters	3,000 meters	3,000 meters	2,500 meters	3,000 meters	3,000 meters	3,000 meters	3,000 meters	3,000 meters
Slope level	5%	4%	3.33%	2.5%	3.33%	2%	2%	2.5%	2%	2%
Second Part										
Length	-	-	-	-	-	3,600 metersB	3,600 metersB	1,200 meters	3,600 metersB	3,600 metersB
Slope level	-	-	-	-	-	2.5%	2.5%	3%	2.5%	2.5%
Second Segment Section										
Length	-	-	-	-	-	8,400 metersB	8,400 metersB	-	8,400 metersB	8,400 metersB
Total length	-	-	-	-	-	15,000 meters	15,000 meters	15,000 meters	15,000 meters	15,000 meters
Sloped surface										
Slope level	20%	20%	14.3%	14.3%	20%	14.3%	14.3%	14.3%	14.3%	14.3%
Inner inclined surface										
	-	-	-	-	-	-	-	40%	33.3%	33.3%
Balked landing surface										
Length of inner edge	-	-	-	-	-	-	-	90 meters	120 metersE	120 metersE
Distance from the runway head	-	-	-	-	-	-	-		1,800 metersD	1,800 metersD
Spread rate (on each side)	-	-	-	-	-	-	-	10%	10%	10%
Slope level	-	-	-	-	-	-	-	4%	3.33%	3.33%

ก. All dimensions are measured in the horizontal, unless otherwise specified.
ข. The length is variable (see article 296 or article 302).
ค. Distance to end of safe area around the runway
ง. or distance from the destination of the run, whichever is less.
จ. When the letter code is F, increase the width to one hundred and forty-five meters.

Source: The Civil Aviation Authority of Thailand, 2021

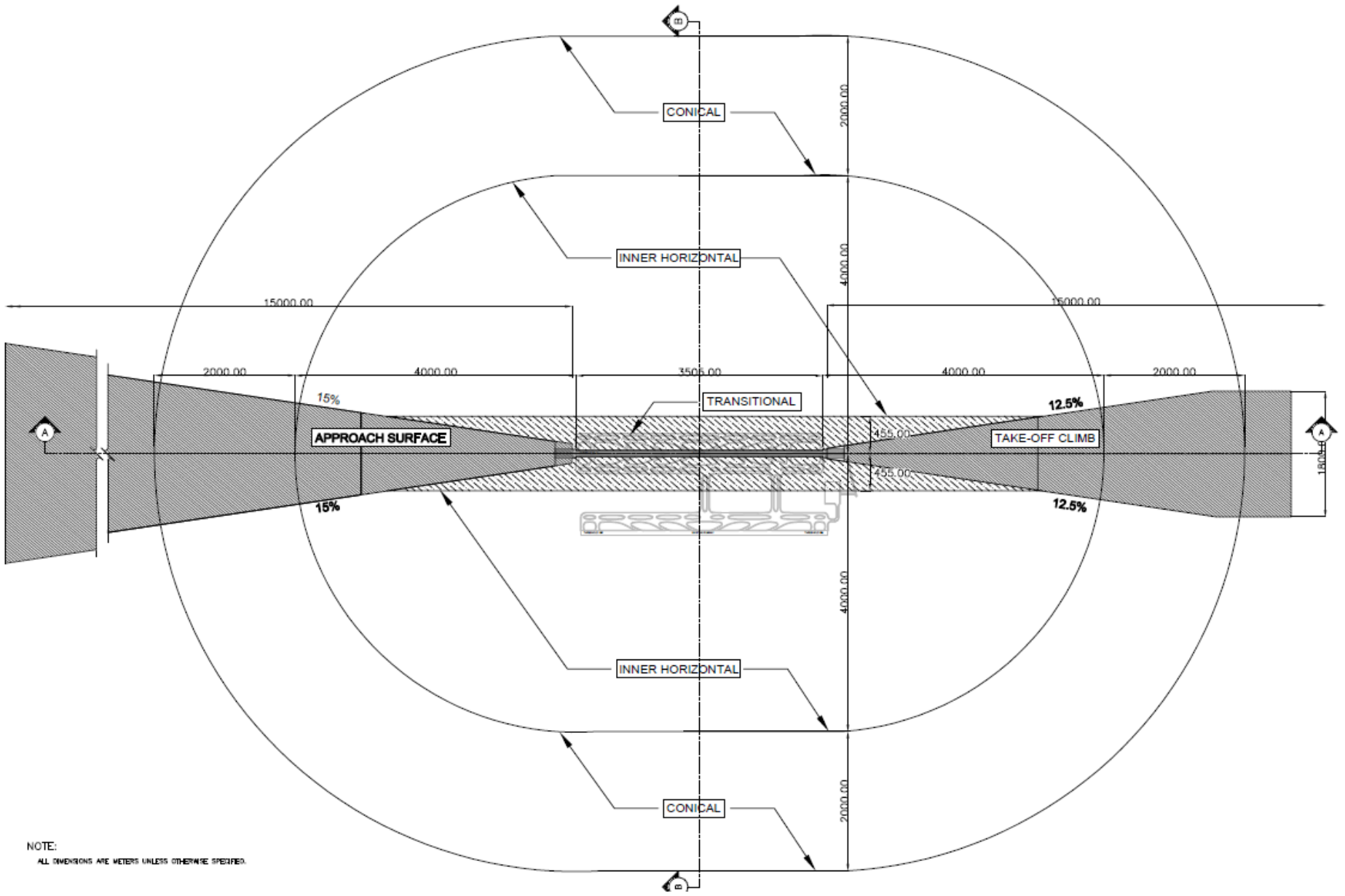


Figure 2.7 3 Dimension and slope of the surface limit obstruction

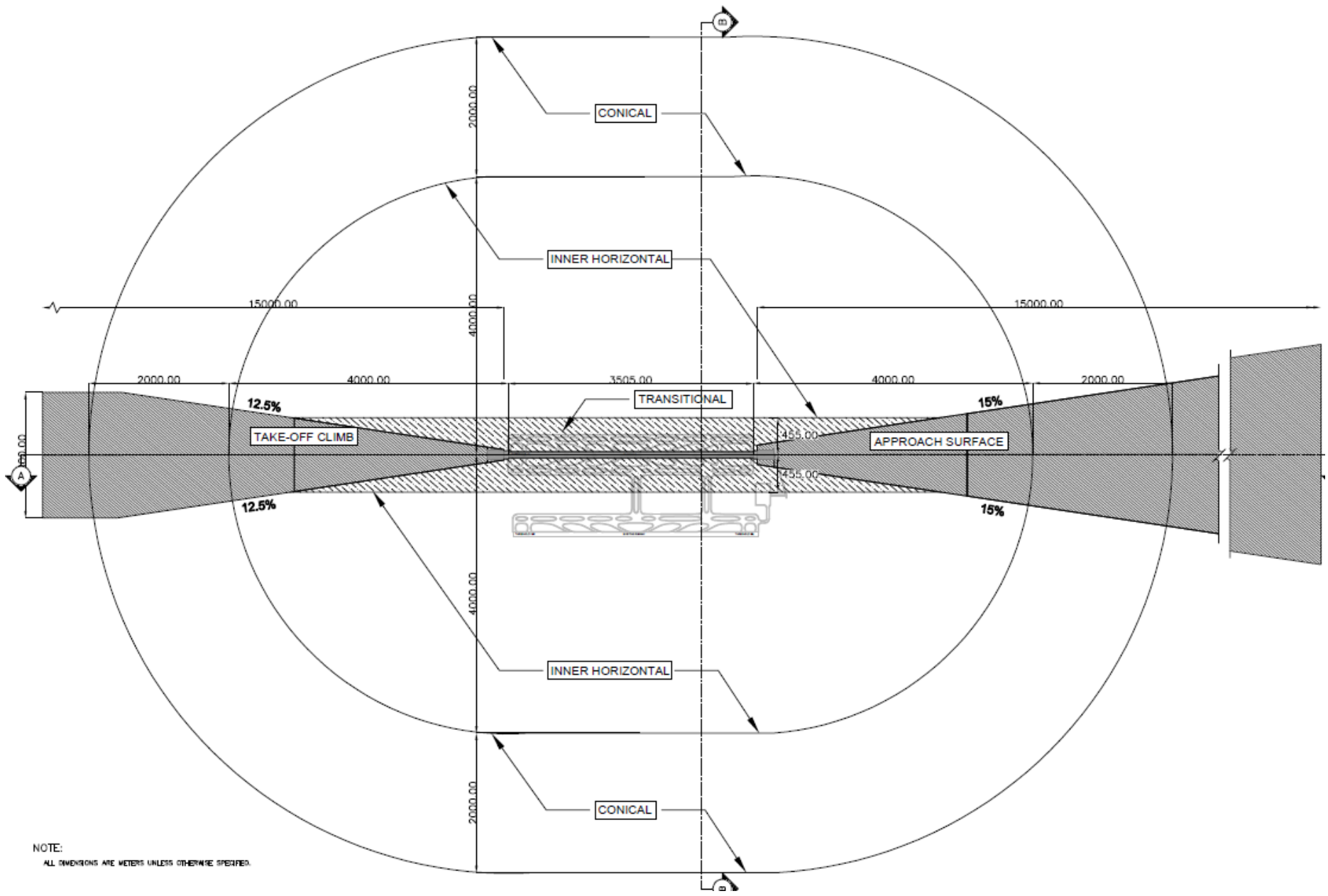
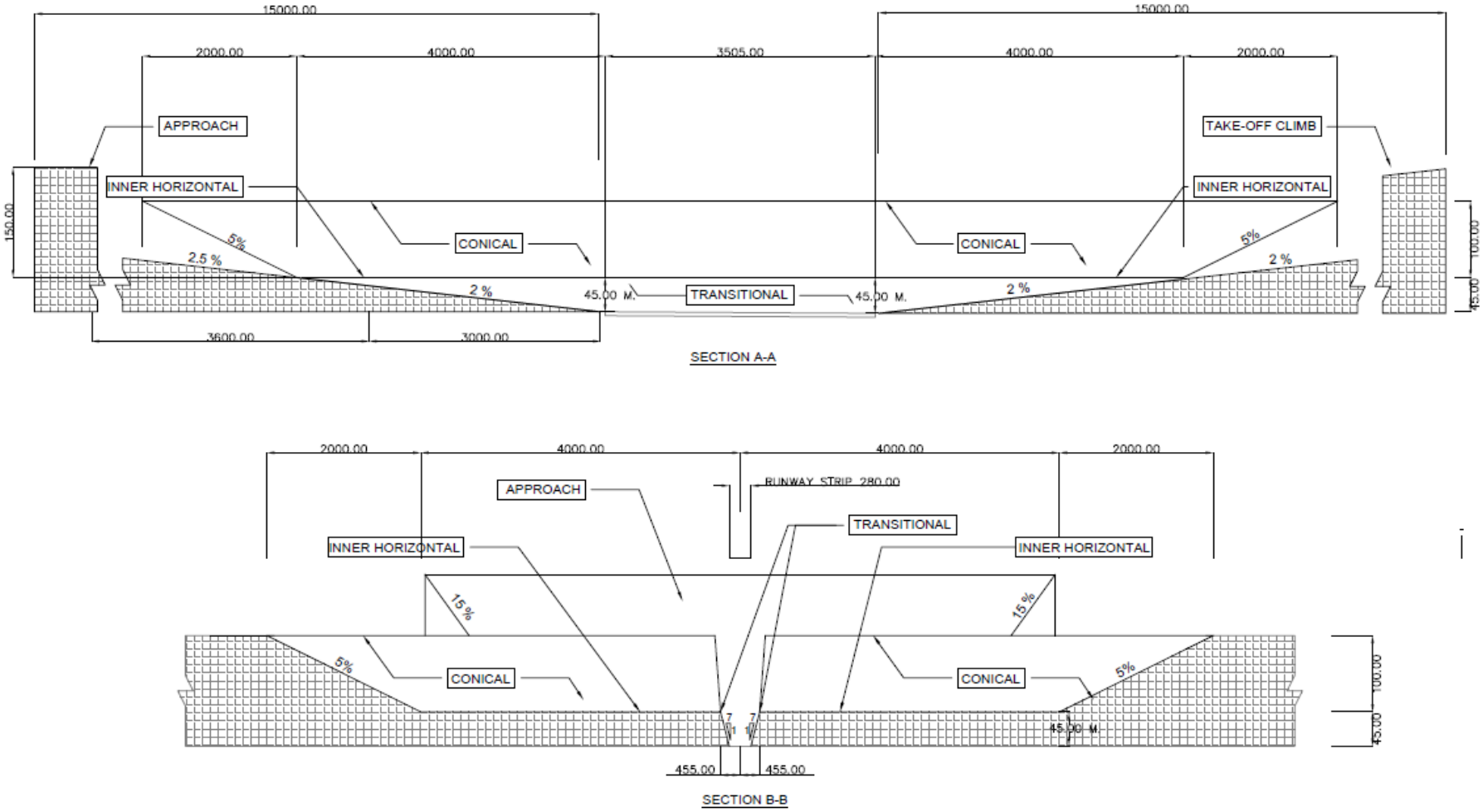


Figure 2.7 -3 Dimension and slope of the surface limit obstruction

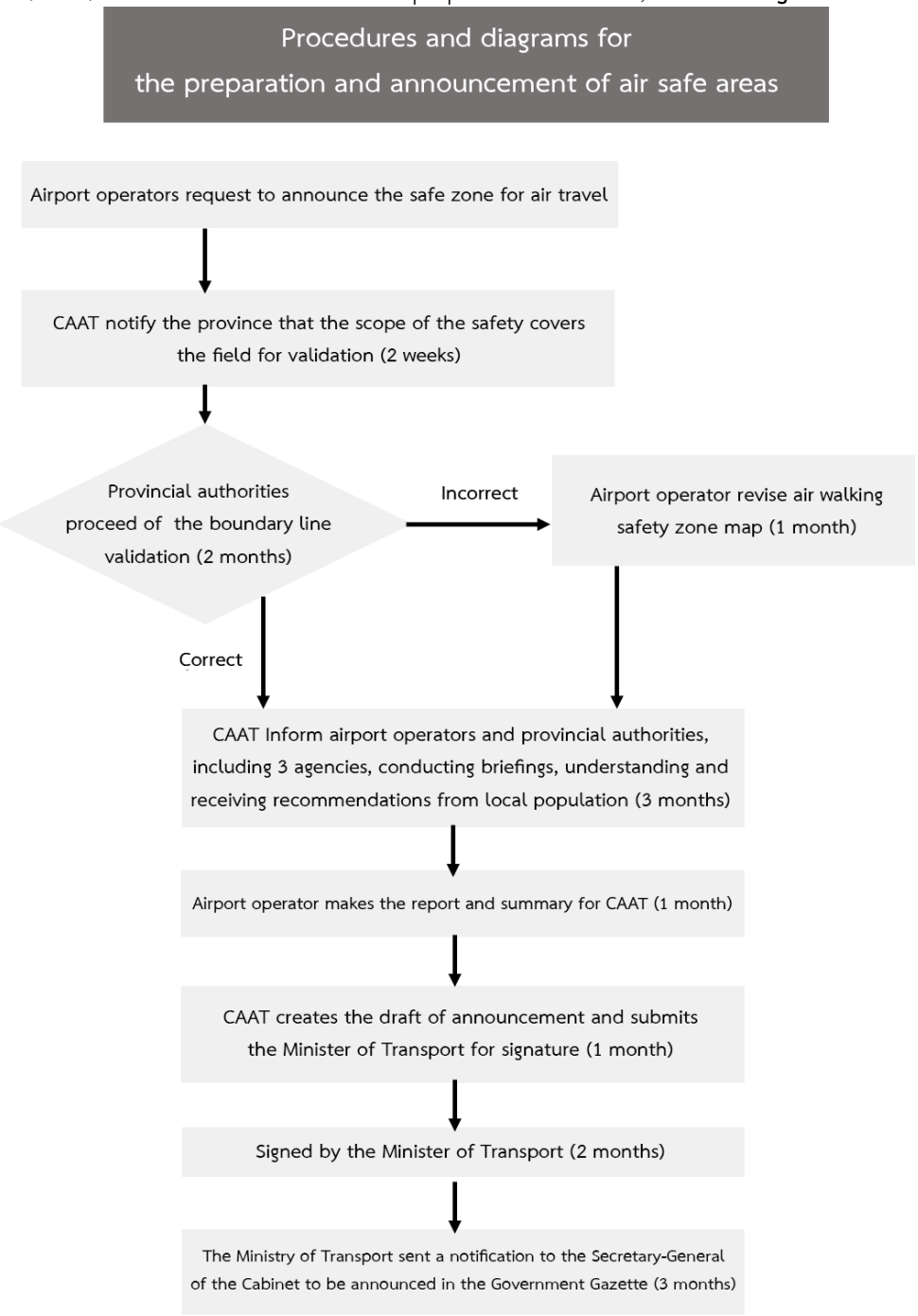
Source: Consultant on the design of the construction project of the runway and driveway 2, U-Tapao International Airport, Ban Chang District, Rayong, 2021



Source: Consultant on the design of the construction project of the runway and driveway 2, U-Tapao International Airport, Ban Chang District, Rayong, 2020.

Figure 2.7-3 Dimension and slope of the surface limit obstruction

When there is runway 2, there must be aviation safety zone announcement to cover runway 2 to protect against the danger of structures or trees, at the high altitude which shall be dangerous to aircraft accessed. In particular, the Low Visibility range must be announced in all airports of member states (State Party) of ICAO worldwide, which must be in accordance with the standards set forth in the Appendix to the Chicago Convention No.14. Aerodromes. In this regard, the project shall consider the basic draft for the aviation safety zone when there is runway 2 reference in Requirements of the Civil Aviation Authority of Thailand (CAAT) which the flow chart for the preparation of details, shown in **Figure 2.7-4**



Source: The Civil Aviation Authority of Thailand, 2021

Figure 2.7-4 Flow Chart for establishing aviation safety zones

Runway 2 is located 1,140 meters away from the east side of Runway 1. A map comparing the aviation safety zone of Runway 1 and Runway 2 can be considered by comparing the original aviation safety zone in 1995 with the aviation safety zone when using 2 runways which will be announced to use in the future, details are shown in **Figure 2.7-5** and **Figure 2.7-6**

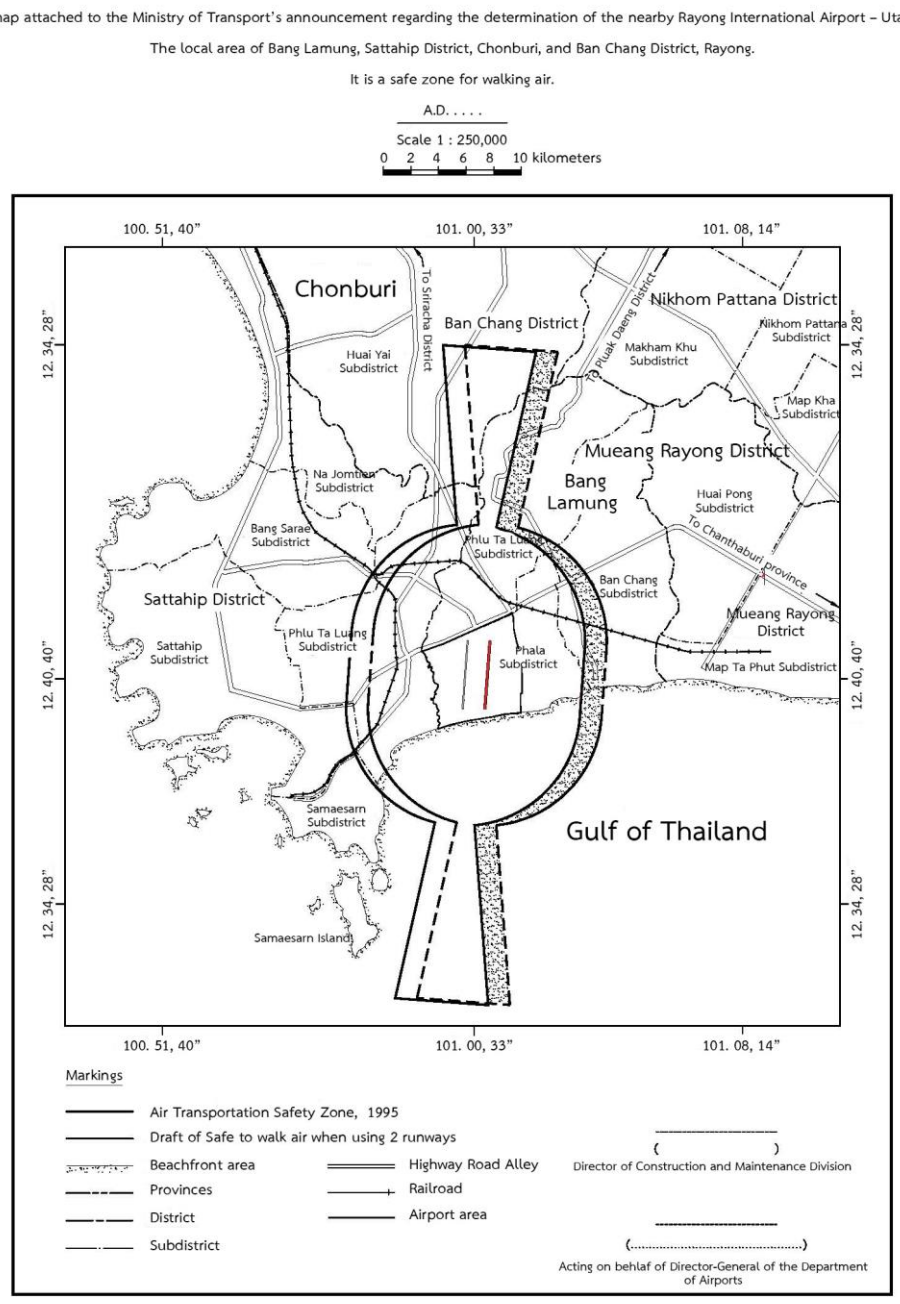
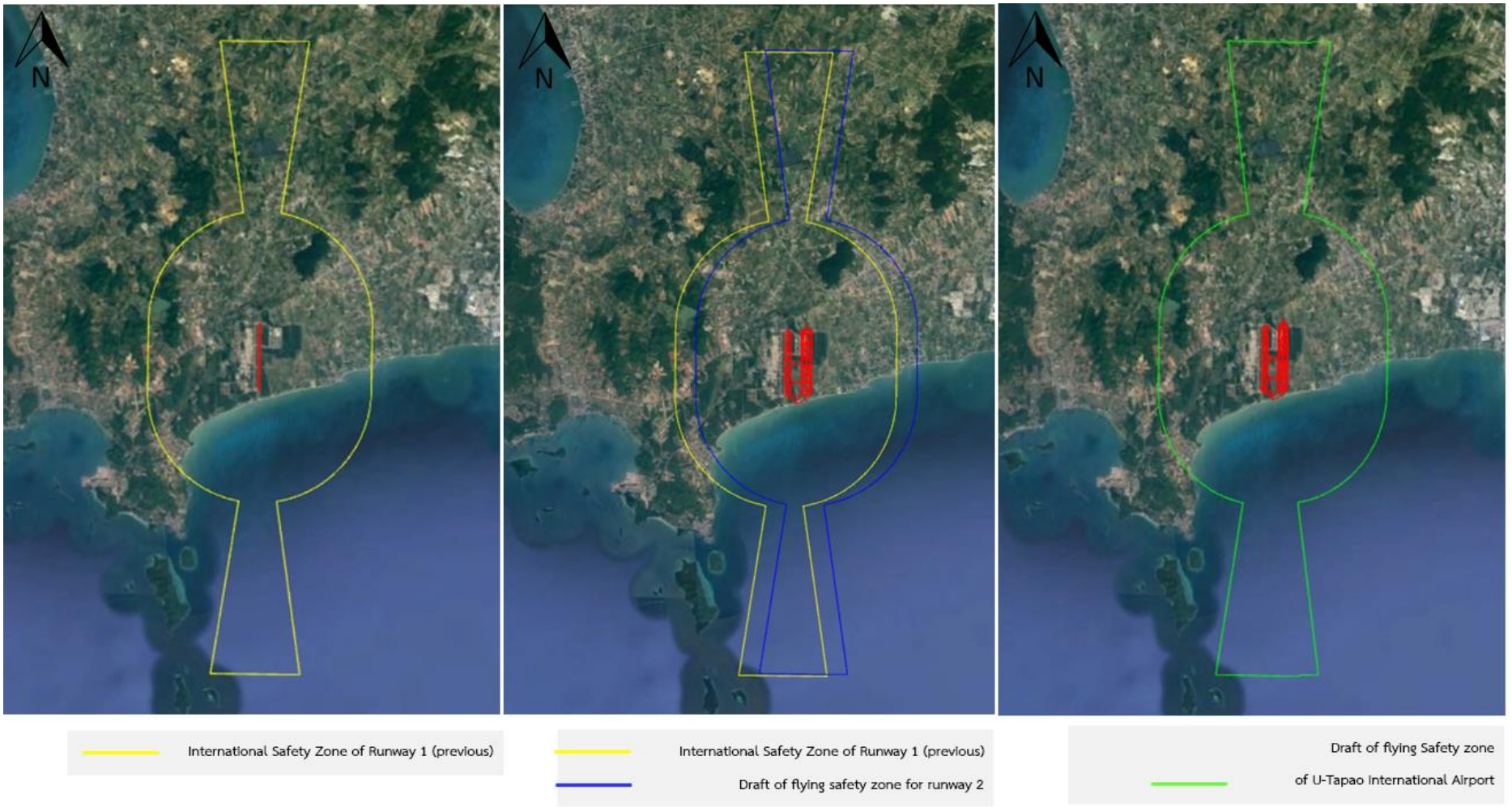


Figure 2.7-5 Layout Comparison of Aviation Safety Zone

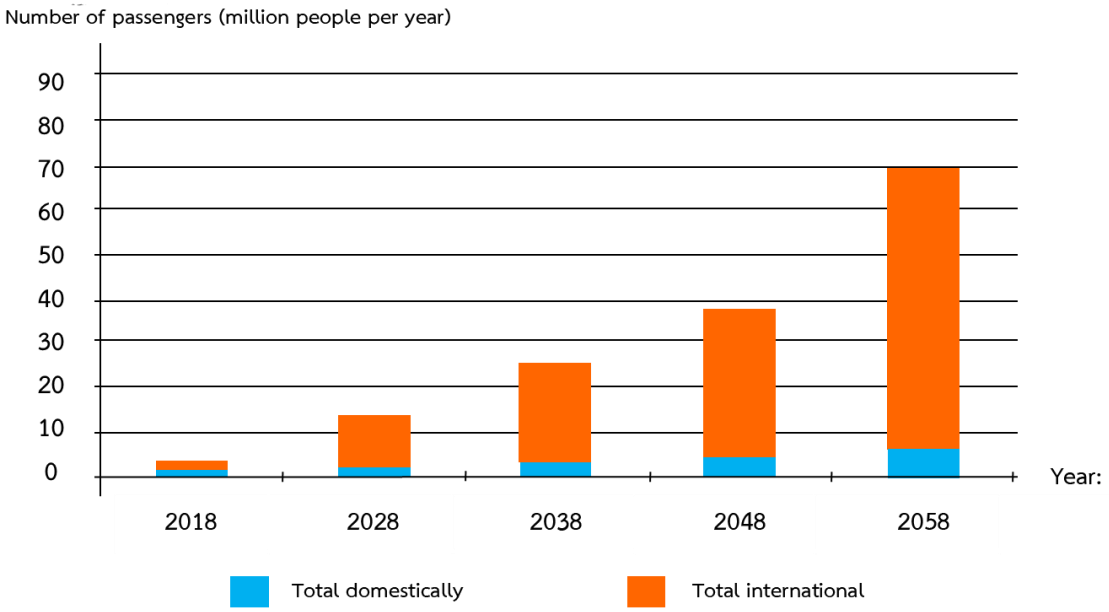


Source: Consultant on the design of the construction project of the runway and driveway 2 at U-Tapao International Airport, Ban Chang District, Rayong, 2020.

Figure 2.7-6 Comparison Map of Runway 1 and Runway 2 Aviation Safety Zone

2.8 Predicted future air traffic volume

According to the master plan of U-Tapao International Airport (December 2018), the total annual passenger volume prediction of U-Tapao International Airport, in the case of Agressive Scenario), were found that in the year of 2028, 2038 and 2048, the passenger volumes were 14, 38 and 70 million passengers per year, respectively, shown in **Figure 2.8-1**



Source: Adapted from A complete report on the feasibility study project master planning project U-Tapao Airport Development Project and surrounding areas, Rayong (December 2018)

Figure 2.8-1 Predicion of total annual passenger volume at U-Tapao International Airport, in case of Aggressive Scenario.

In this regard, the flight and flight fleet mix volume of U-Tapao International Airport are predicted to support the expected passenger volume and flight volumein 2028 and 2038 and 2048. Details are as follows:

2.8.1 Aircraft forecast

The aircraft model estimates that to be in service at U-Tapao International Airport in the future (2028, 2038 and 2048) were adapted from the complete report on the feasibility study project master planning project U-Tapao Airport Development Project and surrounding areas, Rayong (December 2018). Details are shown in **Table 2.8-1**. Since the future aircraft technology will be mostly commercial aircraft type, Code C and E aircraft types, which aircraft type Code D and F will be less. According to the prediction data of the master plan, it was found that Code D aircraft models had relatively high proportions. In the example, the aircraft projections were found that Code D aircraft models were forecasted at 21% in 2048. Therefore, the consulting group adjusted the proportions of air planes, Code D were reduced to only 1% and brought the remaining proportions inthe aircrafts Code E, which previously has 16% to be adjusted to 36%, details shown in **Table 2.8-2**.

Table 2.8-1 Forecasts of aircraft in service at U-Tapao International Airport

Aircraft Movement	Year 2028			Year 2038			Year 2048		
	Flights Domestic	International flights	Freight flights	Flights Domestic	International flights	Freight flights	Domestic flights	International flights	Freight flights
Code C	100	80	50	90	60	30	80	50	20
Code D	-	5	50	10	15	50	20	20	40
Code E	-	15	-	-	25	15	-	30	30
Code F	-	-	-	-	-	5	-	-	10
Total Code	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Table 2.8-2 Aircraft forecasts at U-Tapao International Airport in the year 2048

Aircraft Movement	Domestic flights	International flights	Flights Cargo	Predicted Aircraft Type	Predicted Aircraft Type (Re-adjusted)
Code C	122,000	76,250	3,840	62%	62%
Code D	30,500	30,500	7,680	21%	1%
Code E	-	45,750	5,760	16%	36%
Code F	-	-	1,920	1%	1%
Total Code	**152,500**	**152,500**	**19,200**	**100%**	**100%**

The aircraft models that will be operated in the future are in Code C, D, E, and F aircraft, divided by the size of the Aircraft Wingspan and Outer Main Gear Wheel Span, as detailed in **Table 2.8-3** and summarized the proportions of aircraft in the base year (2018) and forecast aircraft service at U-Tapao International Airport in the future (2028, 2038 and 2048) as shown in **Table 2.8-4**

Table 2.8-3 Aircraft Code Specifications by the size of Aircraft Wingspan and Outer Main Gear Wheel Spain

Aircraft Type Aircraft Code	Wingspan	Outer Main Gear Wheel Span	Typical Aeroplane
C	24 m but < 36 m	6 m but < 9 m	BOEING 737-700/AIRBUS A-320/ EMBRAER ERJ 190-100
D	36 m but < 52 m	9 m but < 14 m	B767/AIRBUS A-310
E	52 m but < 65 m	9 m but < 14 m	B777/B787 Series/A330
F	65 m but < 80 m	14 m but < 16 m	BOEING 747-8/AIRBUS A-380-800

Source: ICAO Annex 14 Aerodrome Reference Code

Table 2.8-4 Forecasts of aircraft that will serve at U-Tapao International Airport in the future

Aircraft Type Aircraft Code	Percentage of proportion of aircraft models				
	Base year (2018)		Predicted Year		
	Summer	Winter	Year 2028	Year 2038	Year 2048
Code A	0.008216	0.004728	-	-	-
Code B	0.662940	0.576758	-	-	-
Code C	56.904392	57.035702	57	58	62
Code D	1.237157	1.306366	1	1	1
Code E	38.446822	38.248619	39	38	36
Code F	2.740480	2.827834	3	3	1
Total amount	**100**	**100**	**100**	**100**	**100**

Source: Adjusted from the complete report of the project feasibility study master planning project, U-Tapao Airport Development Project and surrounding areas, Rayong (December 2018)

2.8.2 Number of flights forecast

The forecast number of flight with higher growth rate than the base case (Aggressive Forecast) when the project will be developed in 2028 and 2038 and 2048 which supported 80,600 flights per year, 200,000 flights per year, and 324,200 flights per year, respectively. Details are shown in **Table 2.8-5**

Table 2.8-5 Baseline Forecast and Agressive Forecast

Forecast Number of flights (flights per year)	Year: 2028		Year: 2038		Year: 2048	
	Baseline forecast (Baseline)	Aggressive forecast (Aggressive)	Baseline forecast (Baseline)	Aggressive forecast (Aggressive)	Baseline forecast (Baseline)	Aggressive forecast (Aggressive)
1. Domestic and international flights	69,900	78,000	156,300	189,000	241,100	305,000
2. Freight flight	2,400	2,600	9,000	11,000	15,000	19,200
3. Total forecast flights	72,300	80,600	165,300	200,000	256,100	324,200

Source: A complete report on the feasibility study project master planning project U-Tapao Airport Development Project and surrounding areas, Rayong (December 2018)

2.9 Details of construction activities of the project

Summary of construction activities that will take place in the project area consisting of 1) construction work on runway2 2) construction work on parallel roads 3) construction work on tunnel under runways 4) construction work on apron and pit 5) construction on Terminal 3 6) construction work on cargo builiding 7) contruction on aviation control unit 8) construction on building on ground transportation center 9) construction on parking buildings 10) construction on fire building 11) construction work on road 12) contruction on office/retail buildings 13) construction on aviation support area 14) construction on high speed train station (underground) details as shown in **Figure 2.3-1** Project area**.** Summary of construction activities are as in**Table 2.9-1.**

Table 2.9 1 Summary of construction activitiesin project area (in orange frame area)

Sequence No.	Construction elements	Construction activities
1	**Runway 2**	
		Area adjustment and stump excavation work
		Stump excavation and level adjustment work
		Soil Improvement Work
		Road soil work
		Surface work
		Safe area around runway 2 work
		Drainage structure work
		Traffic marking work
2	**Tunnel under Runway and driveway 2**	
		Area adjustment and stump excavation work
		Piling work
		Excavation work
		Tunnel Structure and Drainage Structure work
		Mechanical and Electrical Work
		Soil filling and bridge work
		Architecture inside a tunnel
3	**M driveway and N driveway**	
		Area adjustment and stump excavation work
		Stump excavation and level adjustment work
		Soil Improvement Work
		Road soil work
		Surface work
		Safe area work around M and N driveway work
		Drainage structure work
		Traffic marking work
4	**Rapid Exit Taxiways**	
		Stump excavation and level adjustment work
		Soil Improvement Work

Table 2.9□1 Summary of construction activitiesin project area (in orange frame area)

Sequence No.	Construction elements	Construction activities
		Road soil work
		Surface work
		Safety area work around rapid exit taxiways
		Drainage structure work
		Traffic marking work
5	L driveway and P driveway	
		Area adjustment and stump excavation work
		Stump excavation and level adjustment work
		Soil Improvement Work
		Road soil work
		Surface work
		Safe area around driveway L and P work
		Drainage structure work
		Traffic marking work
6	J and K driveway and rapid exit taxiway to runway 1	
		Area adjustment and stump excavation work
		Stump excavation and level adjustment work
		Soil Improvement Work
		Road soil work
		Surface work
		Safe area around driveway J and K work
		Drainage structure work
		Traffic marking work
7	Apron and pit	
		Excavation and area adjustment work
		Soil improvement work
		Soil filling work
		Floor structure work
		Surface work
8	Terminal 3	
		Excavation and area adjustment work
		Foundation-based work
		Structure work
		Architecture and system work
9	Cargo building	
		Excavation and area adjustment work
		Foundation-based work
		Structure work
		Architecture and system work

Table 2.9□1 Summary of construction activitiesin project area (in orange frame area)

Sequence No.	Construction elements	Construction activities
10	Aviation Control Unit	
		Excavation and area adjustment work
		Foundation-based work
		Structure work
		Architecture and system work
11	Ground transportation center	
		Excavation and area adjustment work
		Foundation-based work
		Structure work
		Architecture and system work
12	Parking building	
		Excavation and area adjustment work
		Foundation-based work
		Structure work
		Architecture and system work
13	Fire Building	
		Excavation and area adjustment work
		Foundation-based work
		Structure work
		Architecture and system work
14	Roads	
		Excavation and area adjustment work
		Foundation-based work
		Elevated structure work
		Soil filling work
		Floor Structure Work
		Surface work
		Traffic sign marking on road surface work (painting traffic lines)
		Electrical work
15	Office/Retail building	
		Excavation and area adjustment work
		Foundation-based work
		Structure work
		Architecture and system work
16	Aviation support area	
		Excavation and area adjustment work
		Foundation-based work
		Structure work
		Architecture and system work

Table 2.9-1 Summary of construction activitiesin project area (in orange frame area)

Sequence No.	Construction elements	Construction activities
17	High speed train station (underground)	
		Excavation and area adjustment work
		Pile construction work
		Excavation, pouring rough concrete and extraction of piles
		Station structure work
		Systems and architecture work in the station

Source: Consultant on the design of the construction project of runway and driveway 2 at U-Tapao International Airport, Ban Chang District, Rayong, 2021

2.9.1 The development of runway 2 with tunnel under runway and parallel driveway.

Runway 2 is 3,505 meters long (equivalent to the current runway) and is located 1,140 meters away from the current runway. The geographical coordinates of each side of runway 2 of U-Tapao International Airport are shown in **Table 2.9-2**

Table 2.9-2 Geographical coordinates of each threshold of runway 2 at U-Tapao International Airport

Position	Threshold Geographical coordinates		Z Above Mean Sea Level
	X	Y	
Threshold of the north runway	719009.537	1404296.678	+27.5
Threshold of the south runway	718753.152	1400801.067	+7.8

Note : Refer to the basic UTM system WGS 1984.

Source: Consultant designed the construction project for runway and driveway 2, U-Tapao International Airport, Ban Chang District, Rayong, 2020.

In construction of runway 2, tunnel under runway was constructed to support the vehicles transporting airside service vehicles by using cars for transport and service between the main terminal and the sattelite terminal, which is in the airside area needs to use the tunnel route to avoid crossing, runway and driveway, which must be carried out at the same time as construction of runway 2.

The tunnel has a width of 53.60 meters, consisting of 6 sub lanes. Each lane is divided by 0.80 meters of thick reinforced concrete walls.

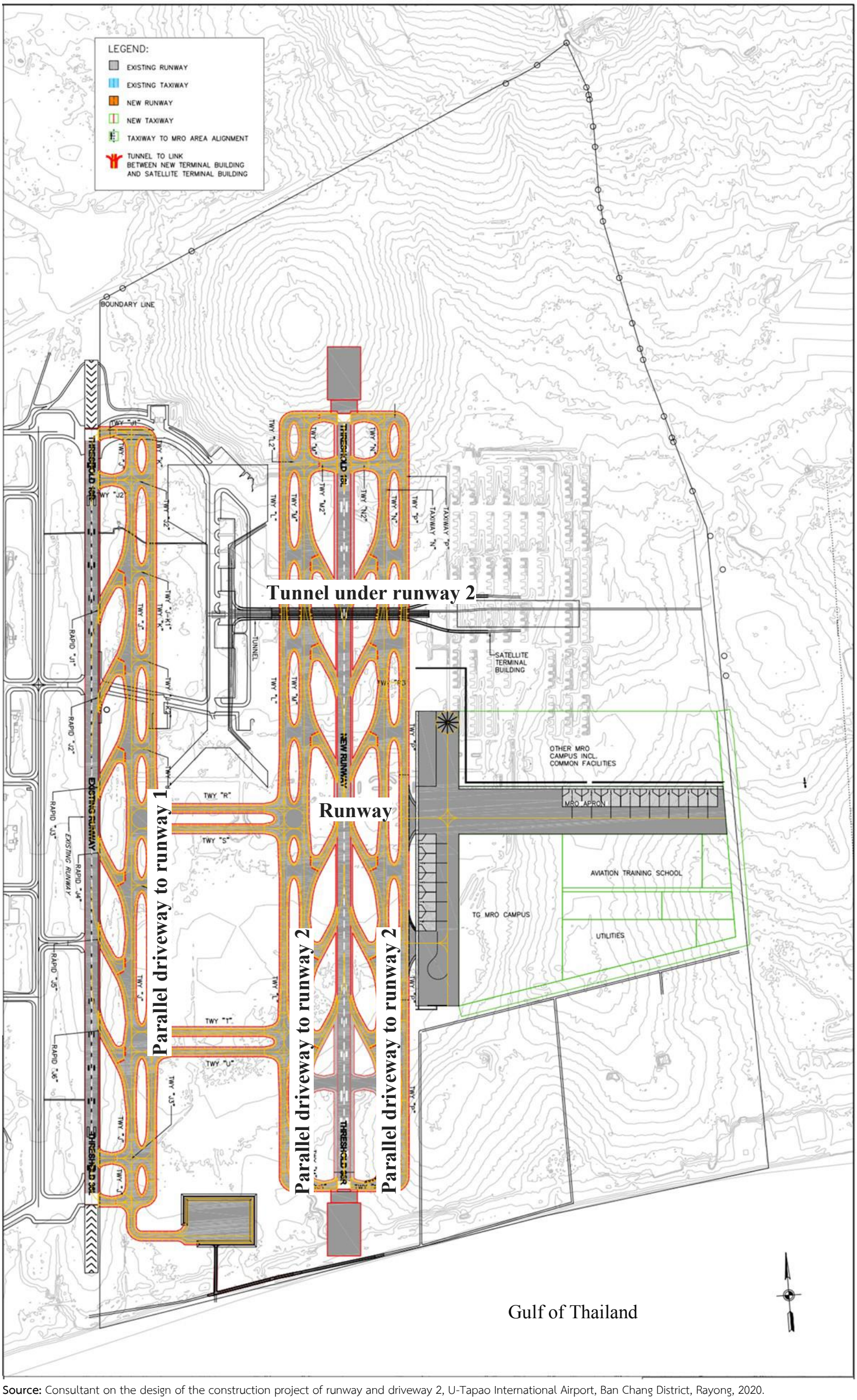
The parallel driveway is placed in parallel with runway 2(left 2 lines and right 2 lines) and in parallel on runway 1 (located on the right side of runway 1). The code F is at a width of 23 meters.

Runway 2 position witha tunnel under the runway and parallel driveway are shown in **Figure 2.9-1**

With the characteristics of the terrain in which the 2nd runway will be constructed and driven, with a tunnel under the runway, which is high hill in the north and slopes down to the south and seems as waterway, requiring to adjust to new level in order to achieve a level consistent with the level of runway and driveway, as well as an incline not exceeding 1.5% according to Standard of the International Civil Aviation Organization (ICAO).

Construction management: Initially, the project will build a temporary drainage trough and change water from the original waterway to the sea, as shown in **Figure 2.9-2**. At the same time, the permanent drainage canal will be constructed to as a concrete canal next to the Taxiway P.

After construction of the permanent waterways next to Taxiway P is complete**, water** will be returned to the said waterways as shown in **Figure 2.9-**3. In the original drainage trough in the area to construct Satellite Terminal, airport administrators will continue to develop in the future when that area is to be constructed.



Source: Consultant on the design of the construction project of runway and driveway 2, U-Tapao International Airport, Ban Chang District, Rayong, 2020.

Figure 2.9□1 runway position display witha tunnel under the runway and parallel driveway

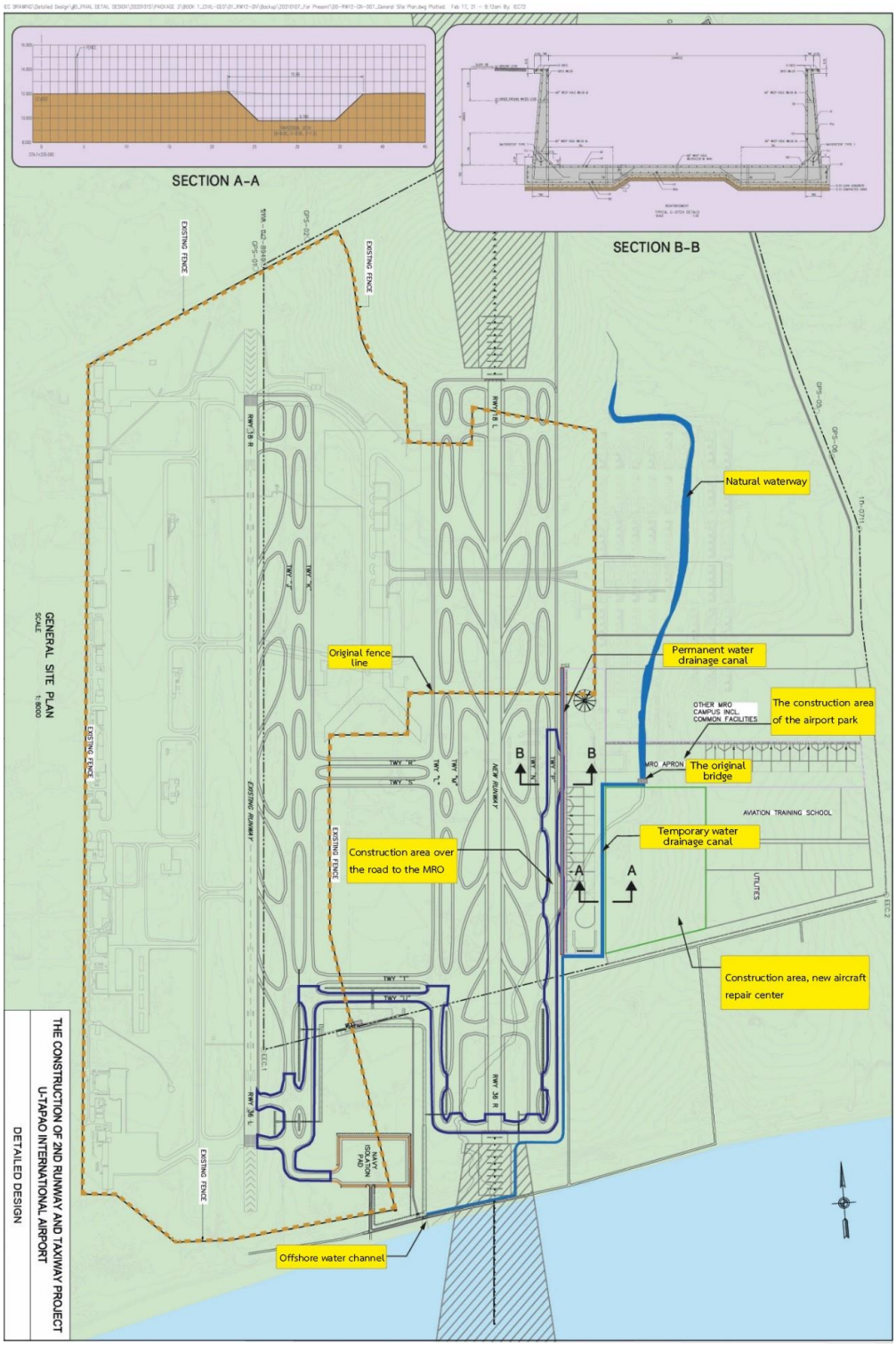


Figure 2.9 2 Drainage system in the area of soil filling work to adjust the area for the construction of the driveway connecting runway 1 Visiting the new aircraft repair center and apron

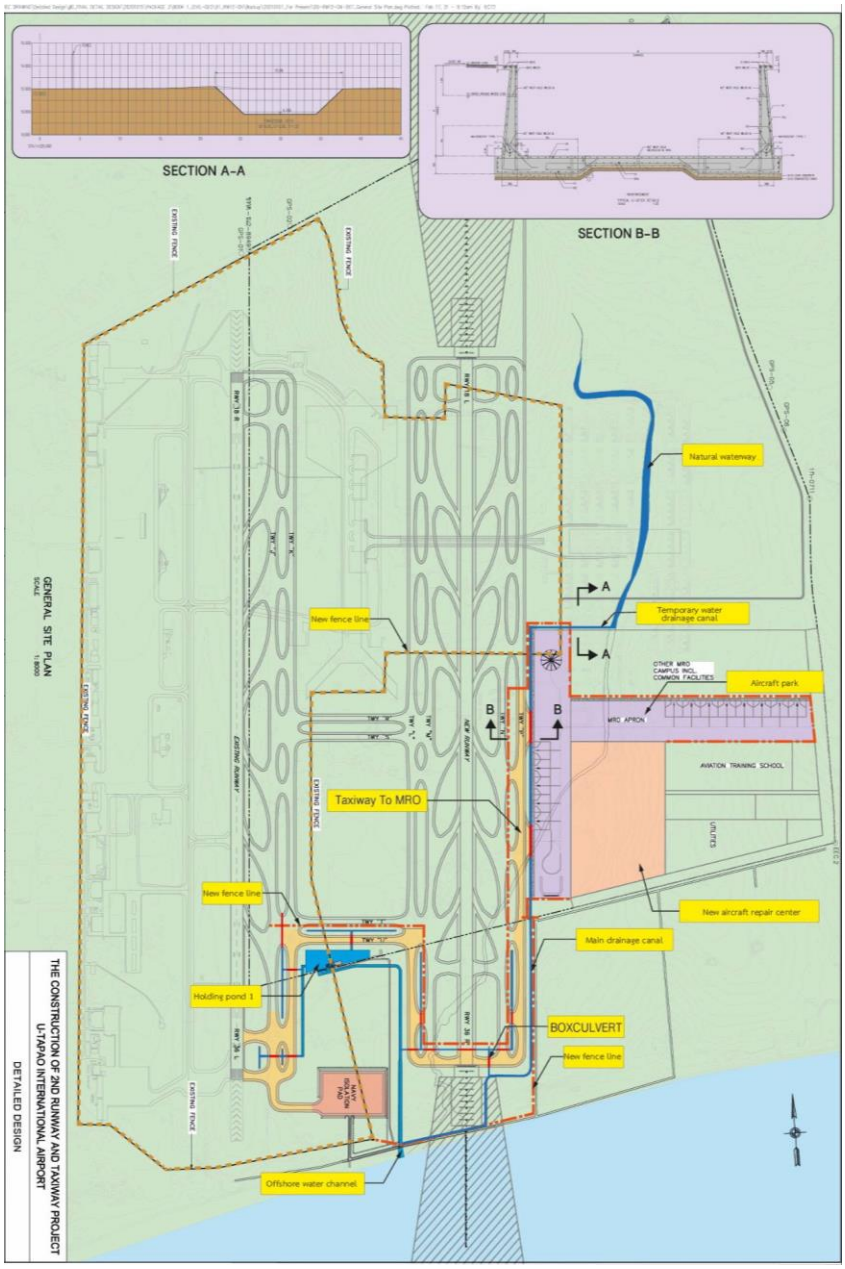


Figure 2.9 3 Main drainage system after construction of the driveway connected to runway 1 to the new aircraft repair center(before construction of runway 2) is complete.

2.9.2 Runway construction

2.9.2.1 *Runway Design Standards*

Runway design is divided into 2 main parts: the first part is the Runway Geometry Design. The second part is Runway Pavement Design. Each part is referenced according to the design standard as follows:

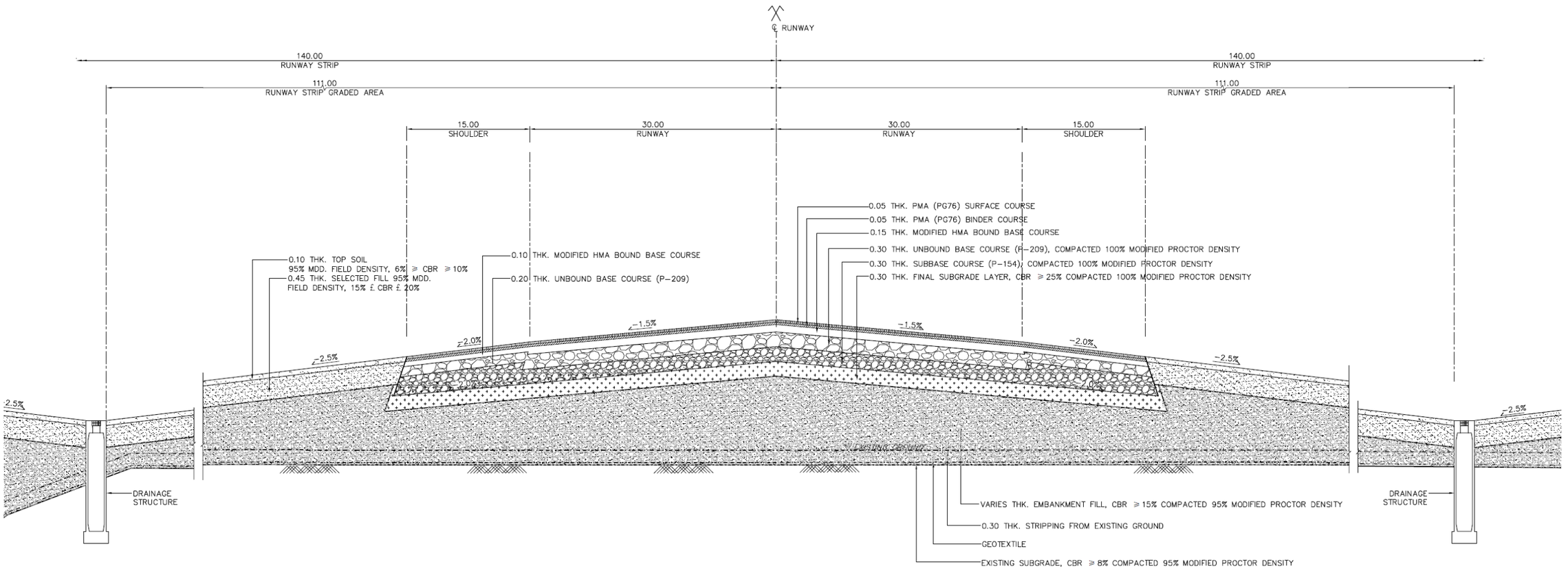
1) Runway Geometry Design: Designed in accordance with the design standard of ICAO (Appendix 14) and CAAT (Aerodrome standard for CAAT n°14 requirements). The length of the runway is 3,505 meters, Code F, the width of 60-meters runway. The shoulders of each side are 15 meters long, the slopes of the runway by the difference between the

maximum along the center of the runway should not exceed 1%. The runway should not have a long slope not over than 1.25% except for the first and last ranges, the length of the slope should not exceed 0.8%, including changes in curve surface slopes, will not exceed 0.1% per 30 meters.

2) Runway Pavement Design: Use theU.S. Federal Aviation Administration (FAA) design method as per the Advisory Circular 150/5320 - 6F : Airport Pavement Design and Evaluation and use FAA Rigid and Flexible Iterative Elastic Layer Design (FAARFIELD) Software Computer Version 1.4 helps in designing.

2.9.2.2 *Runway Structure*

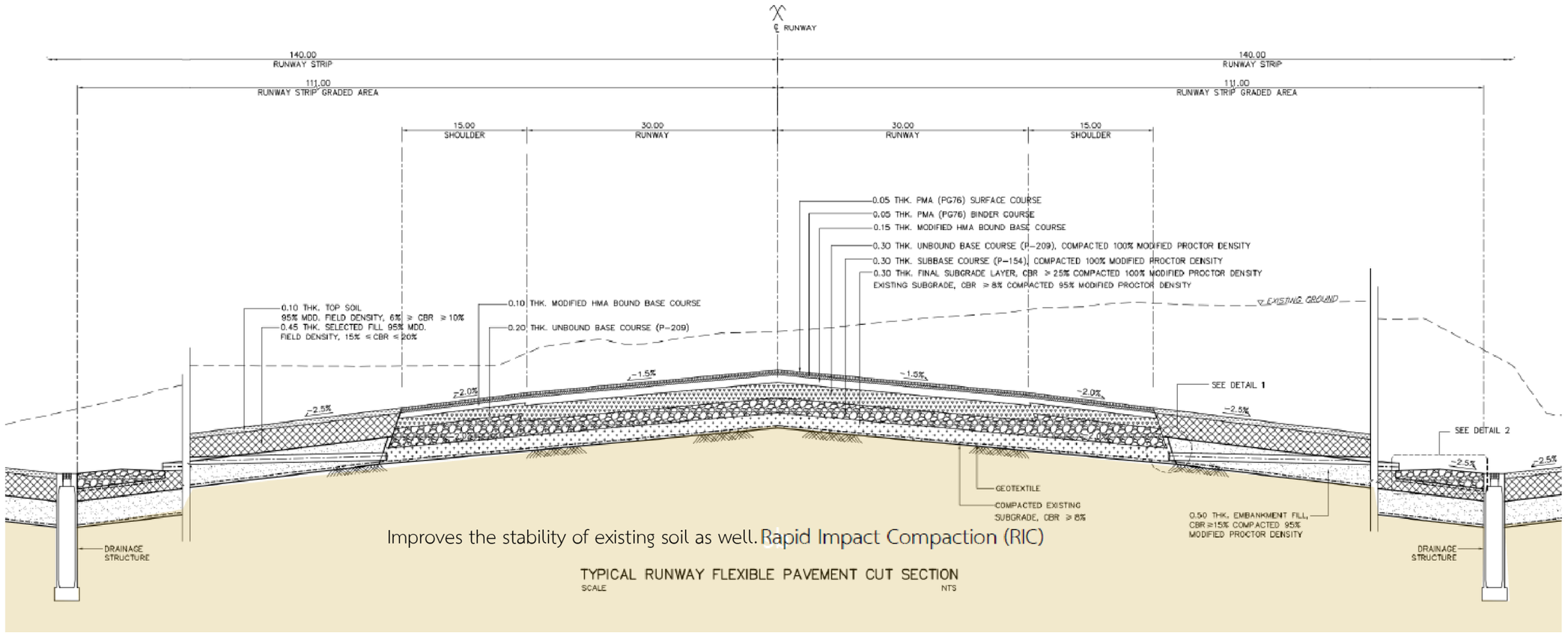
The runway structure is designed as Flexible Pavementfor filling work, shown in **Figure 2.9-4** and cutting work are shown in **Figure 2.9-5** along the length of runway, with asphaltic concrete being an important surface materials. Differential Settlement between the filling and the cutting route is designed to improve soil quality by 5 meters, both in the field of excavation and the work. There is a minimum density of 95% of the compaction obtained from the modified test method by Rapid Impact Reaction (RIC) which strike with steel weights weighing 12 tons to create vibrations in the soil layer and compact the soil layer deep down to 5 meters to have a firmness according to the criteria of pavement design according to the FAA therefore, there is a subsidence as the layer structure is described as follows.



TYPICAL RUNWAY FLEXIBLE PAVEMENT FILL SECTION
SCALE NTS

Source: Consultant on the design of the construction project of runway and driveway 2, U-Tapao International Airport, Ban Chang District, Rayong, 2020

Figure 2.9-4 General cross section of runway structure in filling work area



Improves the stability of existing soil as well. Rapid Impact Compaction (RIC)

TYPICAL RUNWAY FLEXIBLE PAVEMENT CUT SECTION
SCALE NTS

Source: Consultant on the design of the construction project of the runway and the 2nd taxiway at U-Tapao International Airport, Ban Chang District, Rayong, 2020.

Figure 2.9 5 General cross section of runway structure in excavation area

1) Flexible Pavement using asphaltic concrete comprising of:

1.1) The 60-meters-wide runway structure; the materials from the bottom-to-top surface consist of

- The original Compacted Existing Subgrade densely compressed with 95% Field Density Modified Proctor Reaction Test achieves a CBR of no less than 8%.
- Non-synthetic materials (Geotextile) placed on the original ground surface, densely compressed.
  Compacted Selected Subgrade Embankment Fill with thickness changes according to the previous soil level and the surface level value designed with 95% Field Density Modified Proctor Compaction Test yields CBR of no less than 8%.
- For the Final Subgrade Material, the thickness of 30 centimeters, 100% densely compressed. Field Density Modified Proctor Reaction Test with the CBR is no less than 10%.
- Uncrushed Aggregate Subbase Course (materials P-154 according to FAA standard) with a thickness of 30 centimeters
- Crushed Aggregate Base Course (materials P-209 according to FAA standard) with a thickness of 30 centimeters.
- Floor materials of HMA Bound Base Course (materials P-401 according to FAA standard) with a thickness of 15 centimeters.
- Floor materials of HMA Binder Course (materials P-401 according to FAA standard) with thickness 5 centimeters.
- HMA Wearing Course (P-401 based on FAA standard) with a thickness of 5 centimeters.

1.2) The shoulder structure of the runway is 15 meters wide, from the edge of the runway. Materials from the bottom to the top of the runway include:

- The original Compacted Existing Subgrade densely compressed with 95% Field Density Modified Proctor Reaction Test achieves a CBR of no less than 8%.
- Non-synthetic materials (Geotextile) placed on the original ground surface, densely compressed.
- Compacted Selected Subgrade Embankment Fill, with thickness changes according to the previous soil level and the surface level value designed with 95% Field Density Modified Proctor Compaction Test yields CBR of no less than 8%.
- Crushed Aggregate Base Course (materials P-209 according to FAA standard) with thickness of 20 centimeters.
- Floor materials of HMA Binder Course (materials P-401 according to FAA standard) with thickness 5 centimeters.
- Top floor materials of HMA Wearing Course (Materials P-401 based on FAA standard) with a thickness of 5 centimeters.

1.3) Graded Area of Runway Strip with each side width of 65 meters from shoulder, consists of:

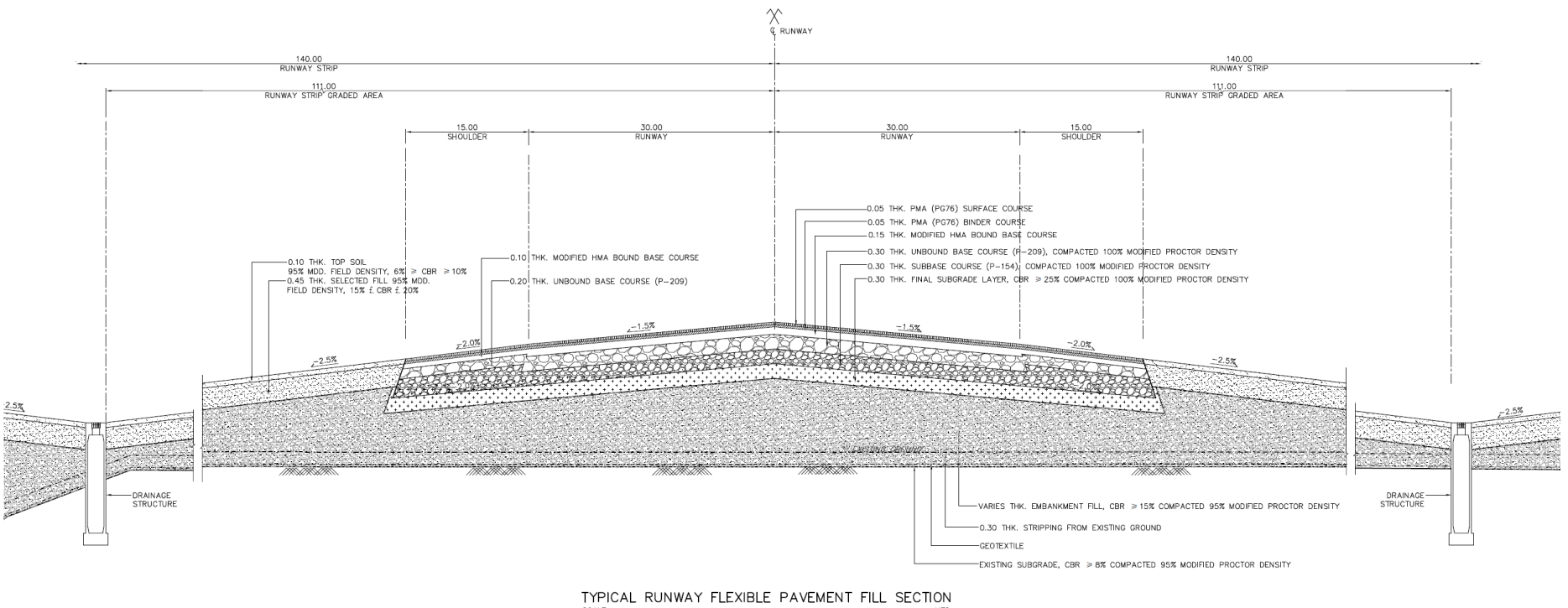
- The original Compacted Existing Subgrade densely compressed with 95% Field Density Modified Proctor Reaction Test achieves a CBR of no less than 8%.
- Compacted Subgrade Embankment Fill, with thickness changes according to the original soil level and the designed surface level with 95% Field Density Modified Proctor Compaction Test yields CBR no less than 8%.
- Selected Fill materials with 95% Field Density Modified Proctor Compaction Test to achieve CBR of no less than 20% with the thickness 45 centimeters.
- For Top soil and Grassing materials, the 95% Field Density Standard Proctor Compaction Test, the CBR was no less than 6%, but no more than 10% with 10 centimeters thickness.

Notes : 95% Field Density CBR 8% was (soil with field density equal to 95% of the density obtained from the Modified Proctor Test and CBR value greater than or equal to 85%)

The design has been periodically drilled in the approach of running and driving to check ground conditions. The inspection results show that the soil layer is sand by which upper floors is loose to moderate sand layer and deep down is the compacted sand layer and some area found granite layer at a depth of more than 15 meters. Therefore, it was designed to dig out the top soil layer that has weeds out first. Then there is a technique to improve soil tightness suitable for sandy soil, called Rapid Impact Compaction (RIC), which is a 12-ton steel drum hammer to create vibration in the soil layer and compact the deeper soil layer up to 5 meters, causing the soil layer to reach a depth of 5 meters, transforming into a dense layer of sand which is suitable as a structural layer of runway and driveway. Such soil improvement methods are commonly used in foreign countries for improving sandy soils for airport construction.

The Runway area has a slope of 1.2%, and the land extension with only 2% grade soil. There might be a problem with standing water, and the detail of using the Drainage Layer materials underneath the Pavement as shown in **Figure 2.9-6** and **Figure 2.9-7**

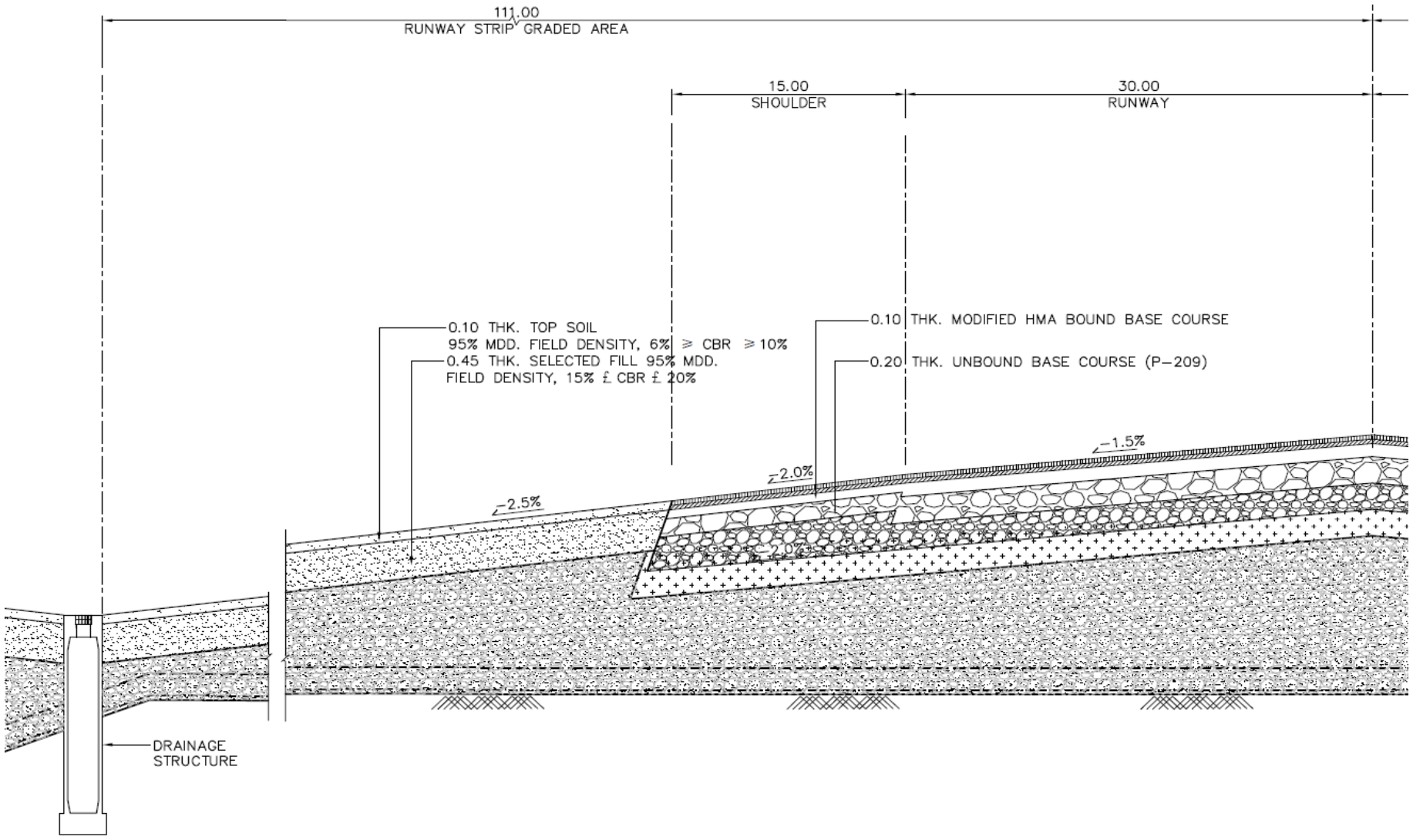
Runway 2 has been designed by having the 1.5% (Maximum Value as Per ICAO Annex 14) in the area of the surface, 2% in the area of the shoulder, and 2.5% in the slopes at the edge of the road, also known as a runway strip, with a top soil materials layer of 10 cm thickness. Below this layer is the rough thick soil layer of 45 cm (selected fill layer, CBR >15%) that water can quickly permeate or flow through, similar to the fairway of the golf course. Therefore, rainwater from the surface of the ramp or from the bottom of the floor can flow into the drainage system, which is a 2 meter wide square pipe easily.



TYPICAL RUNWAY FLEXIBLE PAVEMENT FILL SECTION
SCALE NTS

Source: Consultant on the design of the construction project of runway and driveway 2 at U-Tapao International Airport, Ban Chang District, Rayong, 2020.

Figure 2.9 6 General Cross Section of Runway 2



Source: Consultant on the design of the construction project of runway and driveway 2 at U-Tapao International Airport, Ban Chang District, Rayong, 2020.

Figure 2.9 7 Cross Slope of Runway 2 and Materials Layer

2.9.2.3 *The process of runway construction*

The construction of road surface and shoulder has the following construction steps:

1) Runway surface construction

1.1) Compacted Existing Subgrade

- In the case of areas where soil quality needs to be improved, the engineering soil quality must be improved by Ground Improvement by Rapid Impact Compaction first.
- In the case of land filling, the soil surface must be excavated to a depth of not less than 30 centimeters.
- In the event of excavating, dig to the level specified by the survey team, based on the level of the construction track surface, which is approximately 60 meters wide.
- Use Bulldozer, Backhoe, Loader, and Truck to excavate and move soil.
- Adjust the slope correctly according to the construction using Graderand Backhoe.
- Use steel-wheeled crushers and watercars to crush to obtain the correct level, width, slope, and press-milled value as required.
- At this stage, the quality inspection will proceed in 2 parts as follows:
  - Randomized compaction test.
  - Random survey of coordinates (Scope Level)

1.2) Compacted Selected Subgrade Embankment Fill

As a support layer for the Final Subgrade, the thickness of this layer changes according to the original soil level, and depends on the long surface level, compacted to yieldCBR of no less than 8%, with:

- Placing Geotextile on Compacted Existing Sub-grade.
- Use a Dump Truck to transport materials for fill.
- Use Bulldozer, Grader and Backhoe to customize the slopes according to the construction style.
- Use a steel-wheeled crusher or a spiny-wheel according to the materials being used, and a watercar to compress for obtaining the correct level, width, inclined, and press-milled values as required.
- At this stage, the quality inspection will proceed in 2 parts as follows:
  - Randomized compaction test.
  - Random survey of coordinates (Scope Level)

1.3) Final Subgrade Material, thickness 30 centimeters by

- Used a truck to move materials for a filling.
- Use Bulldozer Grader and Backhoe to adjust the slopes correctly according to the construction style.

- Use the steel wheel crusher to compress for obtaining the correct level of width, bias, and crusher.
- At this phase, the quality inspection will be carried out in 2 parts as follows:
  - Randomized compaction test.
  - Random survey of pavement coordinates (Scope level)

1.4) Uncrushed Aggregate Subbase Course (materials P-154 according to FAA standard) with a thickness of 30 centimeters

- Use a truck to pick up the materials by installing it at a thickness of 30 centimeters, only on the road surface.
- Use Bulldozer Grader and Backhoe to adjust the slopes correctly according to the construction style.
- Use the steel cart to compress for obtaining the correct level of width, inclined values, and the press-milled value as require.
- At this phase, the quality inspection will be carried out in 2 parts as follows:
  - Randomized compaction test.
  - Random survey of pavement coordinates (Scope level)

1.5) Coarse aggregate materials (Crushed stone) Crushed Aggregate Base Course (materials P-209 according to FAA standard) with a thickness of 30 centimeters

- Use a truck to move the materials for filling by installing it at a thickness of 30 centimeters, only on the road surface.
- Use Bulldozer Grader and Backhoe to adjust the slopes correctly according to the construction style.
- Use the steel cart to grind the compressed machine to obtain the correct level of width, inclined values, and the press-milled value as require.
- At this phase, the inspection will be carried out in 2 parts as follows:
  - Randomized compaction test.
  - Random survey of pavement coordinates (Scope level)

1.6) Floor ofHMA Bound Base Course (P-401), 15cm thickness

- Use a truck to move materials and use a Paver to place Hot-Mix Asphalt in a 15centimeter location.
- Used wheel compactor
- Use Grader to adjust the slope correctly according to the construction style.
- At this phase, the quality inspection of work will be performed randomly by surveying the range of pavement(scope level).

1.7) Floor ofHMA Binder Course (P-401) 5 cm thickness

- Use a truck to move materials and use a Paver to place Hot-Mix Asphaltin a 5 cm thickness.
- Used wheel compactor
- Use Grader to adjust the slope correctly according to the construction style.

- At this phase, the quality inspection of work will be performed randomly by surveying the pavement range (scope level).

1.8) FloorHMA Wearing Course layer (P-401), 5 cm thickness

- Use a trailer to move materials and use a Paverto place Hot-Mix Asphalt installed at a thickness of 5 centimeters.
- used wheel compactor
- Use Grader to adjust the slope correctly according to the construction style.
- At this phase, the quality inspection of work will be performed randomly by surveying the pavement range (scope level).

2) Construction of the shoulder and running path

2.1) Compacted Existing Subgrade

- In the case of areas where soil quality needs to be improved, the engineering soil quality must be improved by Ground Improvement by Rapid Impact Compaction first
- In the case of land filling, the soil surface must be excavated to a depth of not less than 30 centimeters.
- In the event of digging, dig to the level specified by the survey team, based on the level of the construction track surface, the shoulder width of the runway is 15 meters from the edge of the run route.
- Use Bulldozer, Backhoe, Loader, and Truck to excavate and move soil.
- Adjust the slope correctly according to the construction using Graderand Backhoe.
- Use steel-wheeled crushers and watercars to crush to obtain the correct level, width, slope, and press-milled value as required.
- At this stage, the quality inspection will be carried out in 2 parts as follows:
  - Randomized compaction test.
  - Random survey of coordinates (Scope Level)

2.2) Compacted Selected Subgrade Embankment Fill to be thesupport layer of Final Subgrade. This thickness changes to the original soil level and depends on the horizontal surface level, and it can be ground to achieve a CBR of no less than 8% by

- Placing Geotextile on Compacted Existing Subgrade.
- Used a truck to move materials for a filling.
- Use Bulldozer Grader and Backhoe to adjust the slopes correctly according to the construction style.
- Use a steel-wheeled crusher or a spiny-wheel according to the materials being used, and a watercar to compress for obtaining the correct level, width, inclined, and press-milled values as required.
- At this phase, the quality inspection will be carried out in 2 parts as follows:

- Randomized compaction test.
- Random survey of coordinates (Scope Level)

2.3) Final Subgrade Material, thickness 30 centimeters by

- Used a truck to move materials for a filling.
- Use Bulldozer Grader and Backhoe to adjust the slopes correctly according to the construction style.
- Use the steel wheel crusher to compress for obtaining the correct level of width, inclined and press-milled values as required.
- At this phase, the inspection will be carried out in 2 parts as follows:
  - Randomized compaction test.
  - Random survey of pavement coordinates (Scope level)

2.4) Uncrushed Aggregate Subbase Course (materials P-154 according to FAA standard) with a thickness of 40 centimeters

- Use a truck to move the materials for filling at the thickness of 40 centimeters.
- Use Bulldozer Grader and Backhoe to adjust the slopes correctly according to the construction style.
- Use the steel cart to compress for obtaining the correct level of width, inclined values, and the press-milled value as required.
- At this phase, the quality inspection will be carried out in 2 parts as follows:
  - Randomized compaction test.
  - Random survey of pavement coordinates (Scope level)

2.5) Coarse aggregate materials (Crushed stone) Crushed Aggregate Base Course (materials P-209 according to FAA standard) with a thickness of 20 centimeters

- Using a truck to move the materials for filling by installation at the thickness of20 centimeters
- Use Bulldozer Grader and Backhoe to adjust the slopes correctly according to the construction style.
- Use the steel cart to compress for obtaining the correct level of width, inclined values, and the press-milled value as required.
- At this phase, the quality inspection will be carried out in 2 parts as follows:
  - Randomized compaction test.
  - Random survey of pavement coordinates (Scope level)

2.6) FloorHMA Bound Base Course (P-401), 10 cm thickness

- Use a truck to move materials and use a Paver to placeHot-Mix Asphalt, installed at a thickness of 10 centimeters.
- Used wheel compactor
- Use Grader to adjust the slope correctly according to the construction style.
- At this stage, the quality inspection of work will be performed randomly by surveying the paveway range(scope level).

2.7) HMA Binder Course (P-401) 5 cm thickness

- Use a truck to move materials and use a Paver to place Hot-Mix Asphalt in a 5 cm thickness.
- used wheel compactor
- Use Grader to adjust the slope correctly according to the construction style.
- At this phase, the quality inspection of work will be performed randomly by surveying the pavement range (scope level).

2.8) FloorHMA Wearing Course(P-401), 5 cm thickness

- Use a truck to move materials and use a Paver with Hot-Mix Asphalt installed at a thickness of 5 centimeters.
- used wheel compactor
- Use Grader to adjust the slope correctly according to the construction style.
- At this phase, the quality inspection of work will be performed randomly by surveying the pavement range (scope level).

3) The construction of the Graded Area of Runway Strip is as follows:

3.1) Compacted Existing Subgrade

- dig deeper from ground surface at the level specified in the Form in the Grounding Area of Runway Strip, which is 65 meters wide, from the shoulder edge of the runway.
- Use Bulldozer Backhoe and the truck to dig and move the soil.
- Adjust the slope to the correct construction using Grader and Backhoe.
- Use steel-wheeled crushers and watercars to compress for obtaining the correct level of width, inclined, and press-milled value as require.
- At this stage, the quality inspection of the work will be performed randomly to test the compressed values.

3.2) For Compacted Subgrade Embankment Fill, the thickness changes according to the existing soil level and the surface level of the runway.

- Used a truck to move materials for a filling.
- Use the Bulldozer Grader and Backhoe to adjust the slopes correctly according to the construction style.
- Use a steel-wheeled or spiny-wheeled crusher according to the materials being used, and a watercar to press for obtaining the correct level of width, inclined, and press-milled value as require.
- At this phase, the quality inspection will be carried out in 2 parts as follows:
  - Randomized compaction test.
  - Random survey of pavement coordinates (Scope level)

3.3) Selected Fill materials with a thickness of 45 centimeters, by

- using a truck to move materials for a filling.

- Use Bulldozer Grader and Backhoe to adjust the slopes correctly according to the construction style.
- Use a steel-wheeled or spiny-wheeled crusher according to the materials being used, and a watercar to press for obtaining the correct level of width, inclined, and press-milled value as require.
- At this phase, the quality inspection will be carried out in 2 parts as follows:
  - Randomized compaction test.
  - Random survey of pavement coordinates (Scope level)

3.4) Top Soil and Grassing materials with a thickness of 10 centimeters in both surface and shoulder by

- Used a truck to move materials for a filling.
- Use Bulldozer Grader and Backhoe to adjust the slopes correctly according to the construction style.
- Use the steel cart to press for obtaining the correct level of width, inclined values, and press-milled value as require.
- At this phase, the inspection quality will be carried out in 2 parts as follows:
  - Randomized compaction test.
  - Random survey of pavement coordinates (Scope level)

Unequal subsidence of runway and driveway has been inspected and designed to have similar subsidences. The soil quality in the same soil level is improved by a depth of 5 meters, both in the excavator area and the filling work, to a depth of no less than 95% of the compaction obtained from the modifed method. By improving the soil quality called the Rapid Impact Compaction (RIC) which is hammered by a 12 tons-ton steel to produce vibrations on the soil surface and compress soil surface deep down at 5 meters to have the denseness according to the FAA criteria of surface design therefore, the road layer of runway and driveway has the same subsidence.

2.9.3 Construction of tunnel under the runway

According to the master plan,Feasibility Study and Development Project for U-Tapao International Airport and Surrounding Areas, Rayong Province (December 2018), the transportation system within the tunnel will beinstalled as an (Automated People Mover - APM) in phase 3 (2040-2043).

For the construction of underpass tunnel in runway 2, it is the digging and building tunnel structure, and channel called Block includinginstallation of electrical/mechanicals in the tunnel and drainage work areawaiting. The project has integrated the construction of tunnel in this report. By constructing tunnel under the runway 2 and driveway in the same contract as the construction of the runway 2 and other driveways which the contractor must construct simultaneously with runway 2 and other driveways construction after the construction of tunnel roofis completed which details are as follows:

2.9.3.1 *Standards for tunnel design under a runway*

For tunnel design, the project has been carried out in compliance with the requirements by referring to international standards in the following order:

- ICAO Annex 14
- FAA, AC 150/5300-13A, Airport Design
- Static and dynamic loads imposed by the heaviest aircraft expected to use the structures such as B777-300ER, A380-800F, A340-500/600, AN-225
- AASHTO (2017), The LRFD Tunnel Design and Construction Guide Specifications
- American Concrete Institute, Building Code Requirements for Reinforced Concrete (ACI 318-97)

2.9.3.2 *Procedures for the construction of tunnel under the runway*

A tunnel is constructed to connect the Passenger Terminal 3 with Satelite Terminal, comprising of 6-storey sub-tunnel.

A tunnel under the runway, is approximately 53.60 meters width, about 11 meters depth from the previous soil level, consists of 6 sub-channel as shown in **Figure 2.9-8** each of which has the following details:

- The leftmost and rightmost sub-channel are for 2 airside road channel . Each of the sub-channel has a width of 10 meters and a height of 5.50 meters.
- A sub-channel for public utility systems (Utilities Tunnel), such as water pipes and power lines system, with internal width of 6 meters and height of inside is 5.50 meters
- 2 sub-channel for the Baggage Handling System Tunnel, each with an internal width of 6 meters and an height of 5.50 meters
- 1 large channel for 1 passenger transferred truck (Automated People Mover, APM)

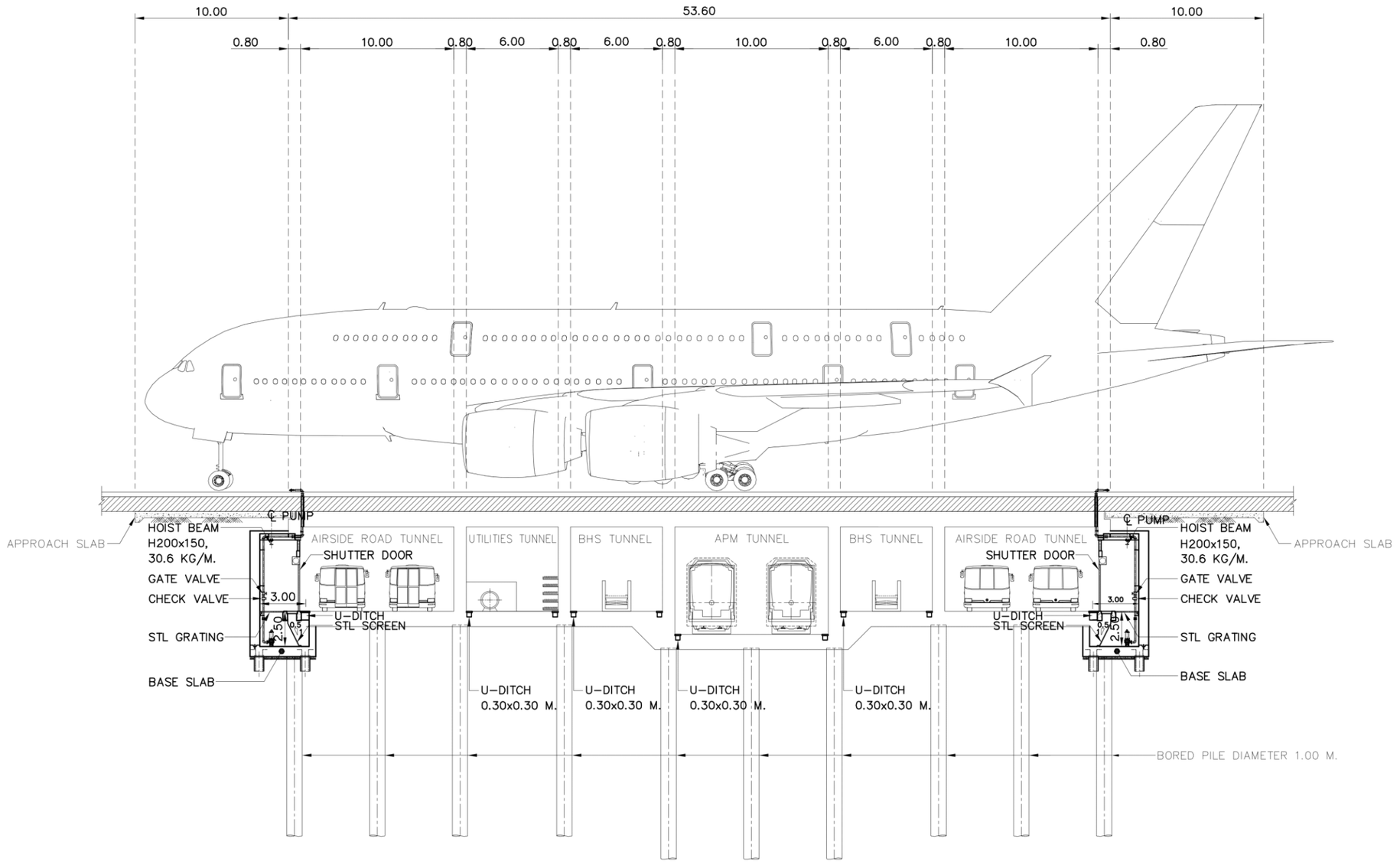
in which car tunnel will be up-and-down at the apron to connect the two aprons. Other tunnel will be connected to the ground level of the two buildings. The connection to the building will be carried out by concessions who will build the two buildings. Details are shown in **Figure 2.9-**9 to **Figure 2.9-12**

The structure of the tunnel is reinforced concrete structure placed on the tunnel pile under the surface of the runway about 5.5-6 meters which were constructed in an open-end construction and fill back, and don't use the Diaphragm Wall and the Pile Wall. In addition, the construction of the floor plate had been reduced to a different extent than the underpass (Approach Slab) placed on the roof of the tunnel on both sides. However, the soil type in the structure area was a layer of sand, settlement is a type of subsidence that occurs immediately during construction and when the construction is completed (Immediate Settlement) does not have a long-term dehydration subsidence like a clay layer. (Consolidation Settlement). The subsidence after construction will be a collapse and then restore (Elastic Settlement) due to the force acting from the weight of the aircraft alone which have very little difference. The different

subsidence checks were found to be very small compared to ICAO's criteria. The structure was designed to withstand the weight of the tunnel backfill and the weight of the aircraft passing through it.

As mentioned above, in the project area, the original layer of sand is not opaque. The groundwater can flow through the underside and above the tunnel roof. However, in order to reduce the impact of groundwater flow, the project has considered adding subdrain construction on the sides and underside of the tunnel to allow it to flow freely. It is not obstructed by the tunnel. It reduces the risk of soft soil from groundwater. In addition, the design has to consider having the Approach Slab to reduce the problem of the tunnel subsidence, or collapse of the compacted soil layer at tunnel side which may affect the difference of tunnel roof level.

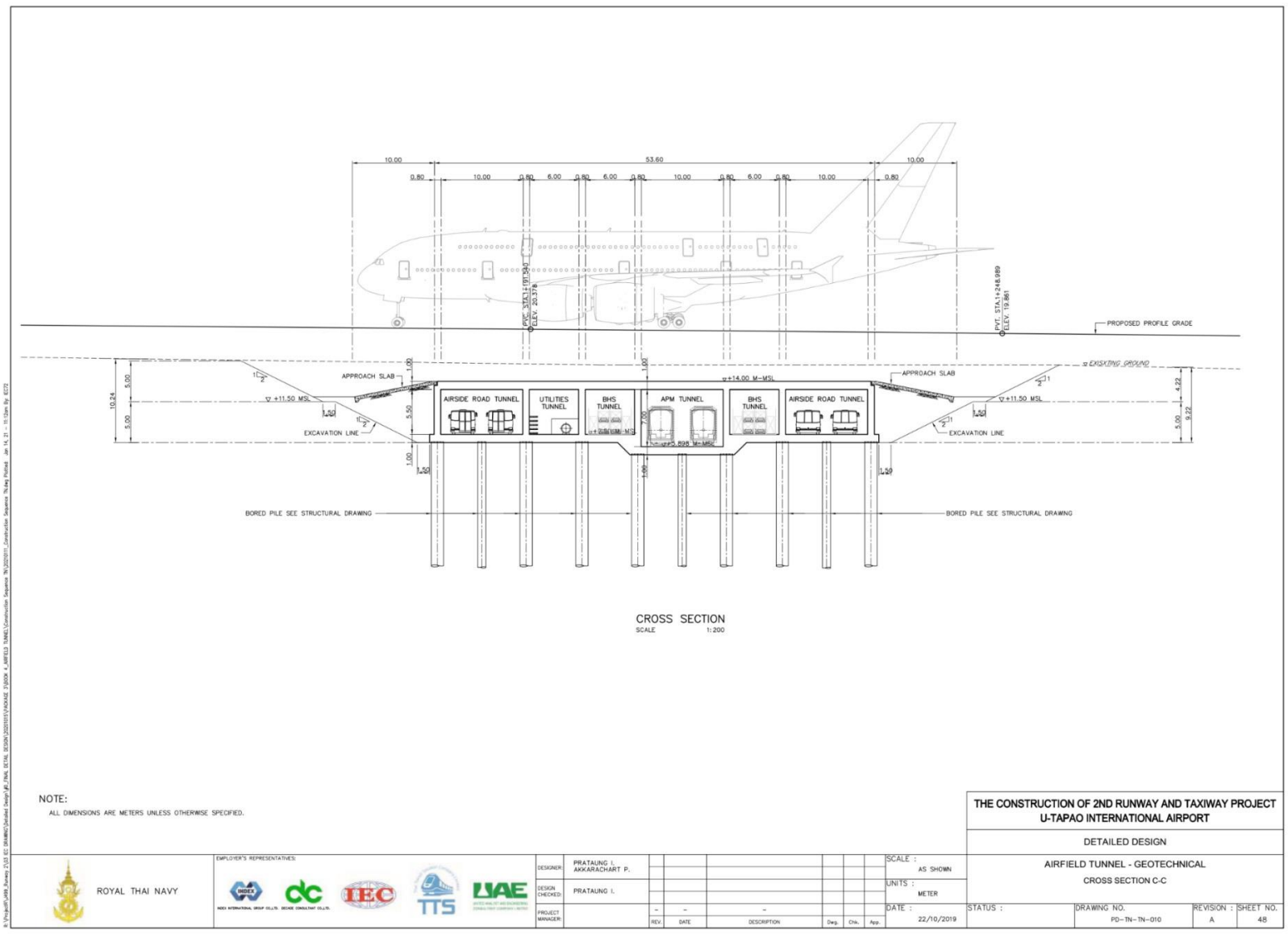
In order to reduce the problems of different subsidence of tunnel, the project has additionally reviewed the inspection measures of soil subsidence of the compact layer at tunnel side and tunnel roof during the period of construction and every 2 years after the tunnel is activated. The installation of the subsidence measurement instruments at the tunnel roof pavement and the side of tunnel roofs in the area of runway 2 and driveway for 4 locations, details as specified in the project measures table (EIA 1 Form).



SECTION B–B
SCALE 1:200

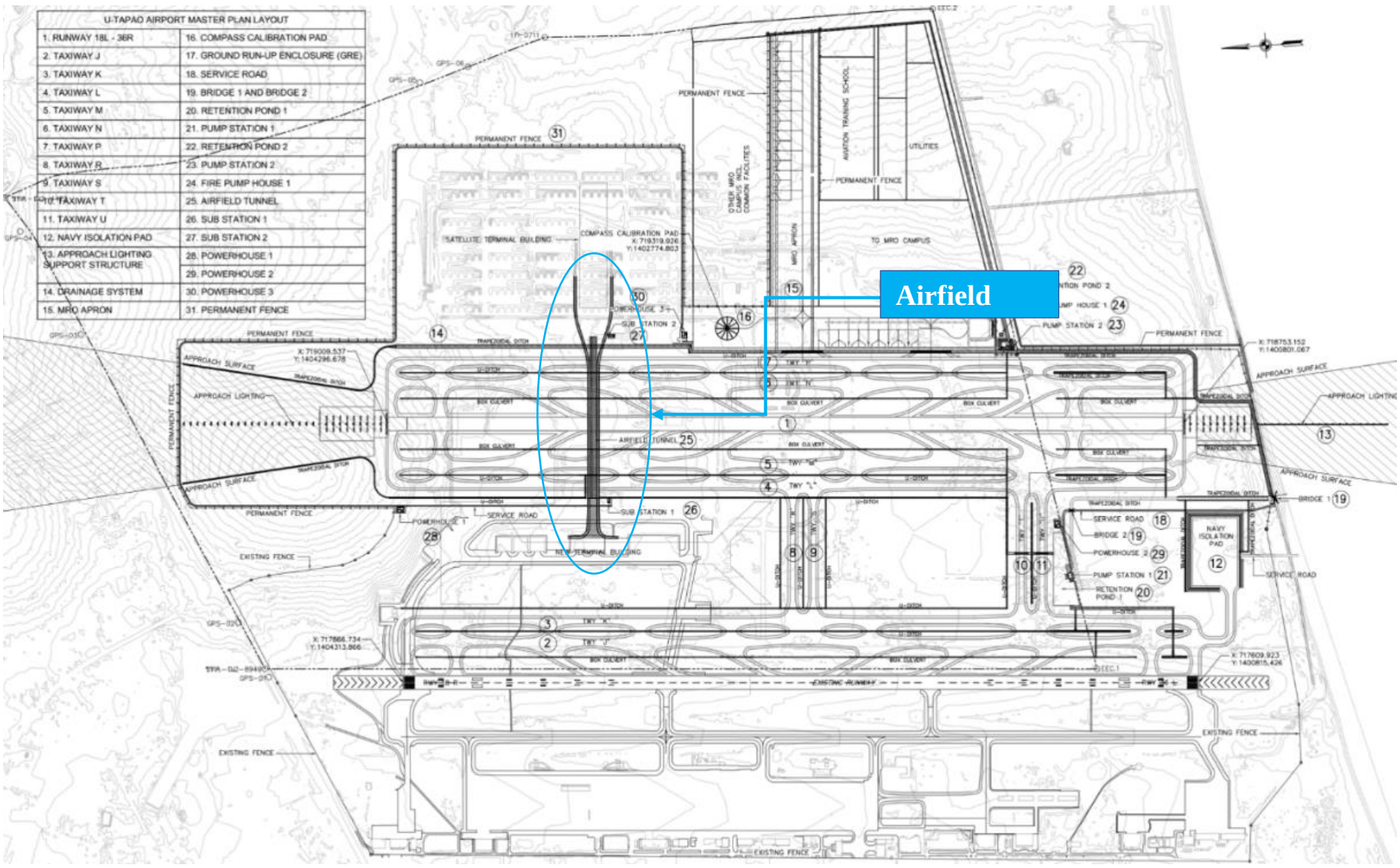
Source: Consultant on the design of the construction project of the runway and driveway 2, U-Tapao International Airport, Ban Chang District, Rayong, 2020.

Figure 2.9-8 Tunnel Cuts Under Runway 2



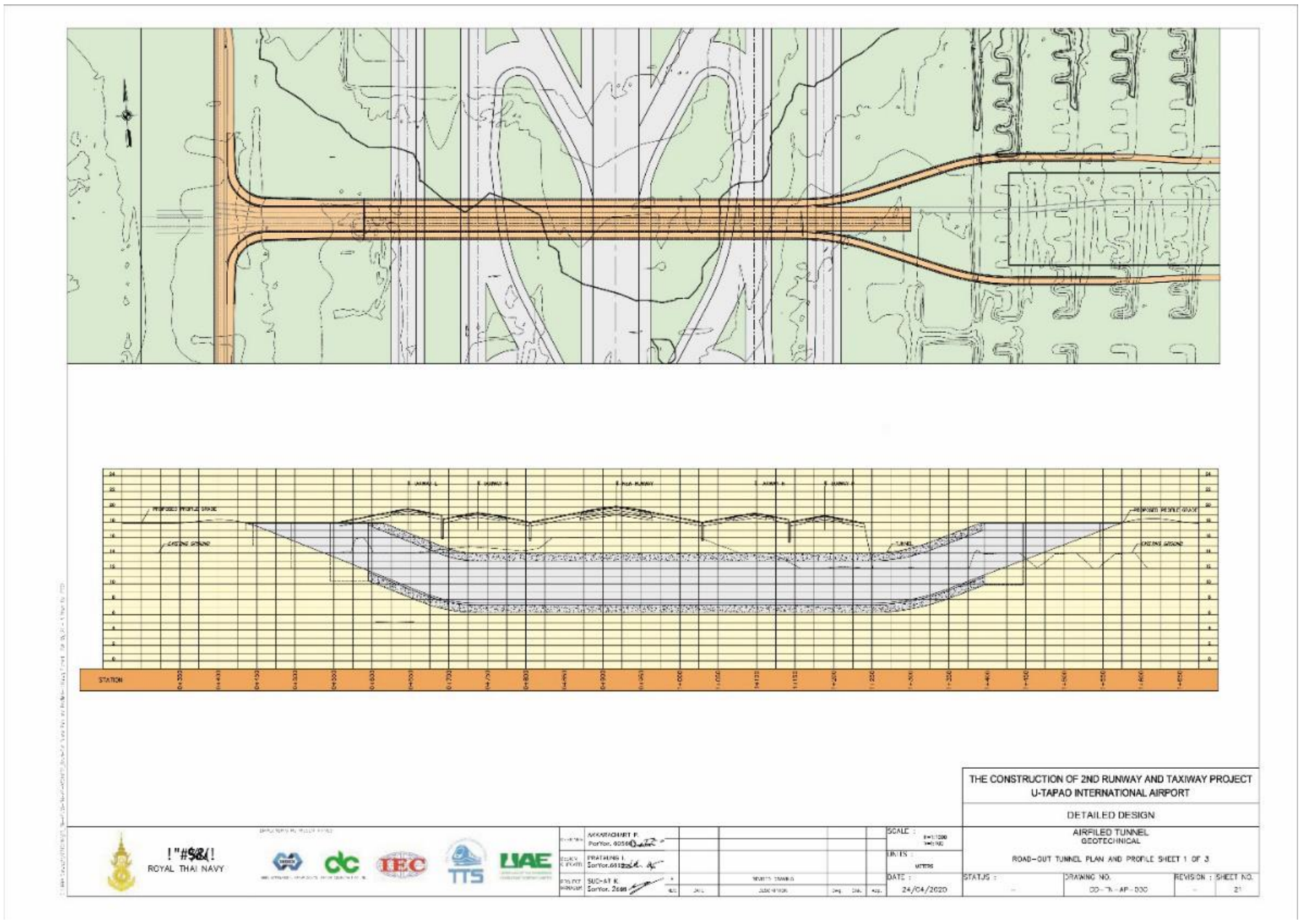
Source: Consultant on the design of the construction project of the runway and driveway 2, U-Tapao International Airport, Ban Chang District, Rayong, 2020.

Figure 2.9 9 Display of details of tunnel cuts through runway



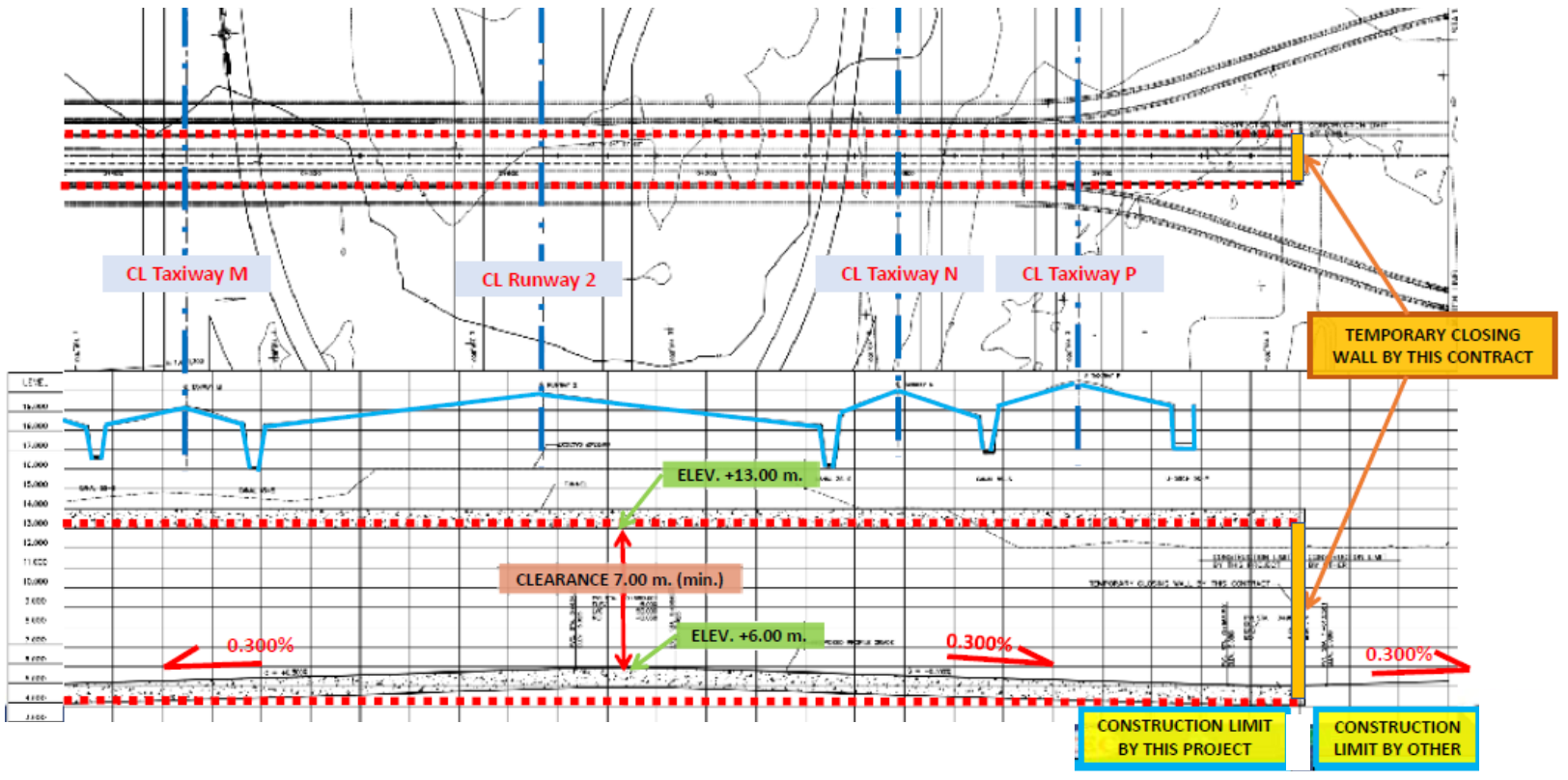
Source: Consultant on the design of the construction project of the runway and driveway 2, U-Tapao International Airport, Ban Chang District, Rayong, 2020.

Figure 2.9 10 Diagram showing the location and scope of tunnel will be initially constructed.



Source: Consultant on the design of the construction project of the runway and driveway 2, U-Tapao International Airport, Ban Chang District, Rayong, 2020.

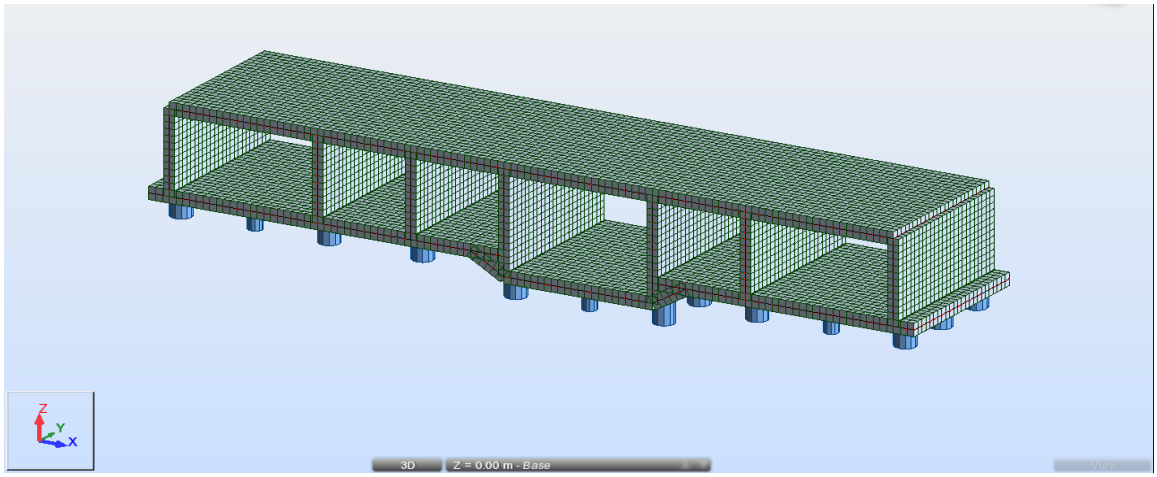
Figure 2.9 11 Long cross section of a tunnel placed under runway 2 and drive way L, M, N and P



Source: Consultant on the design of the construction project of the runway and driveway 2, U-Tapao International Airport, Ban Chang District, Rayong, 2020.

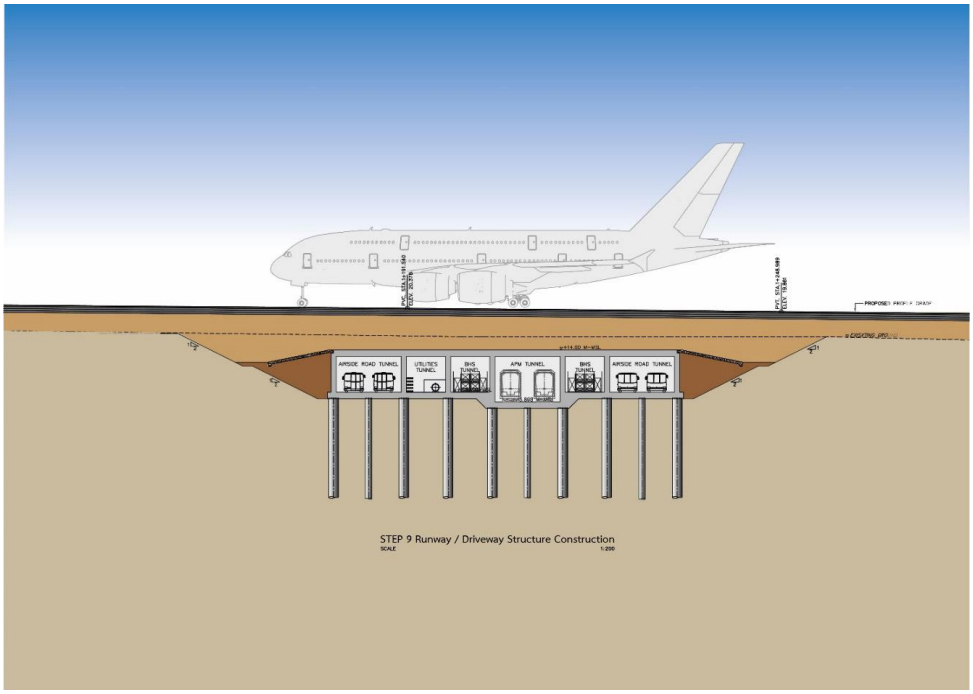
Figure 2.9 12 Long cross section of APM tunnel, baggage transportation tunnel and public utilities tunnel to be constructed in Phase 1

The structure of the tunnel is a concrete structure that is reinforced with steel on the drilled pile, shown in **Figure 2.9-13**. It is a construction of an open-construction structure and fill back, the construction of the floor plate had been reduced to a different extent than the underpass (Approach Slab) placed on the roof of the tunnel on both sides, as shown in **Figure 2.9-14**



Source: Consultant on the design of the construction project of the runway and driveway 2, U-Tapao International Airport, Ban Chang District, Rayong, 2020.

Figure 2.9-13 Tunnel Structure



Source: Consultant on the design of the construction project of the runway and driveway 2, U-Tapao International Airport, Ban Chang District, Rayong, 2020.

Figure 2.9-14 Tunnel Structure with Approach Slab

However, the soil in the structure area is sand layer. The subsidence will be immediately caused by the construction and upon completion of the construction (Immediate Settlement). It does not have long-term dehydration subsidence like clay layers. (Consolidation Settlement). The subsidence

after construction will be a collapse and then restore (Elastic Settlement) due to the force acting from the weight of the aircraft alone. which have very little difference.

The process of construction of runways and construction of tunnel under the runways has 9 stages, details of each stage, and illustrations shown in **Table 2.9-3**. For the stability of the well, use of polymers instead of bentonite solutions to reduce environmental impact.

Table 2.9□3 Procedures for the construction of runways and construction of tunnel under the runways, with illustrations

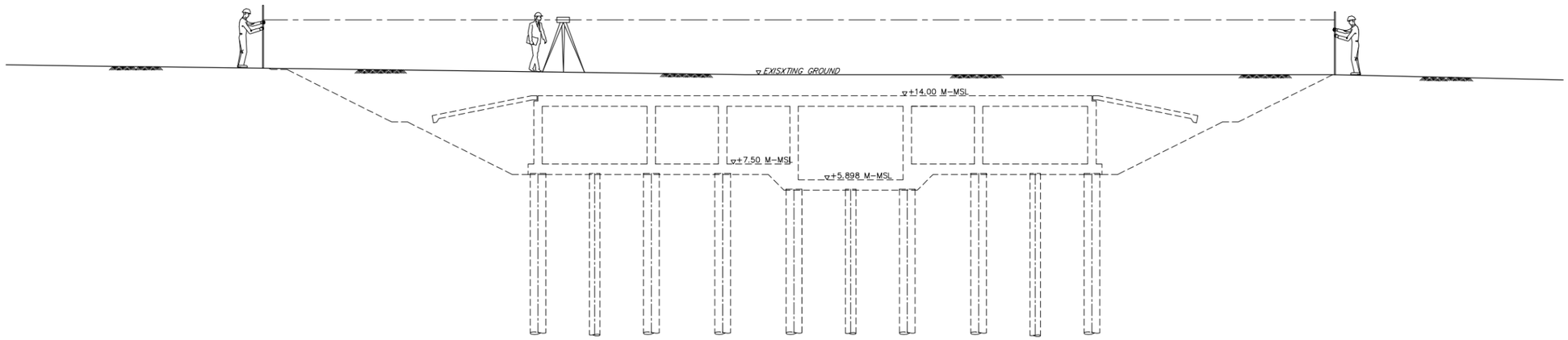
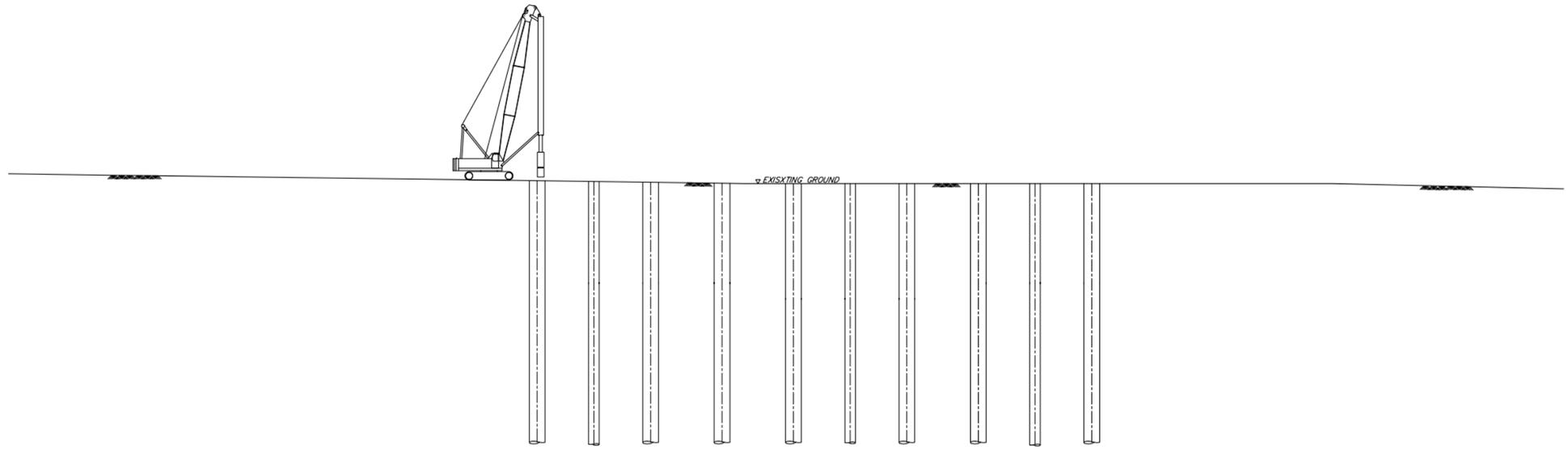
Construction procedures	Illustrations
Stage 1 Conduct a survey to define the area boundary of the workspace.	
Stage 2 Construction of a bored piles supporting the tunnel	

Table 2.9□3 Procedures for the construction of runways and construction of tunnel under the runways, with illustrations

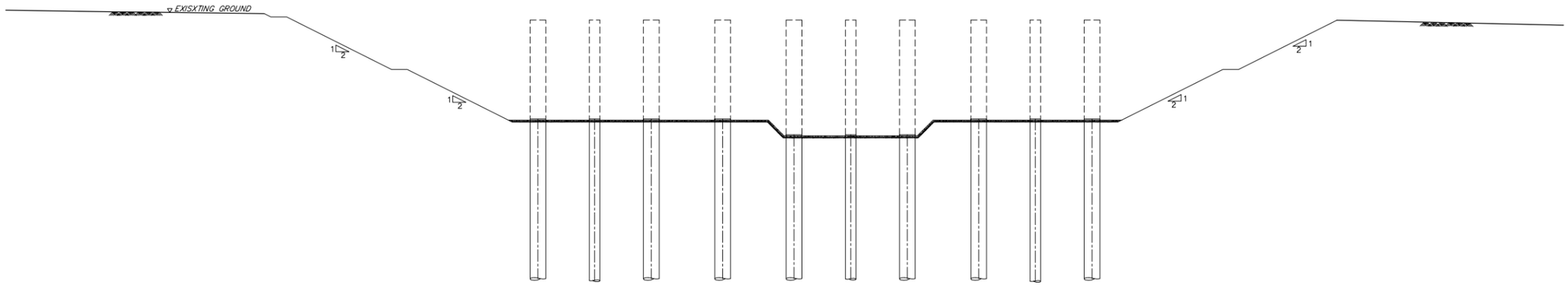
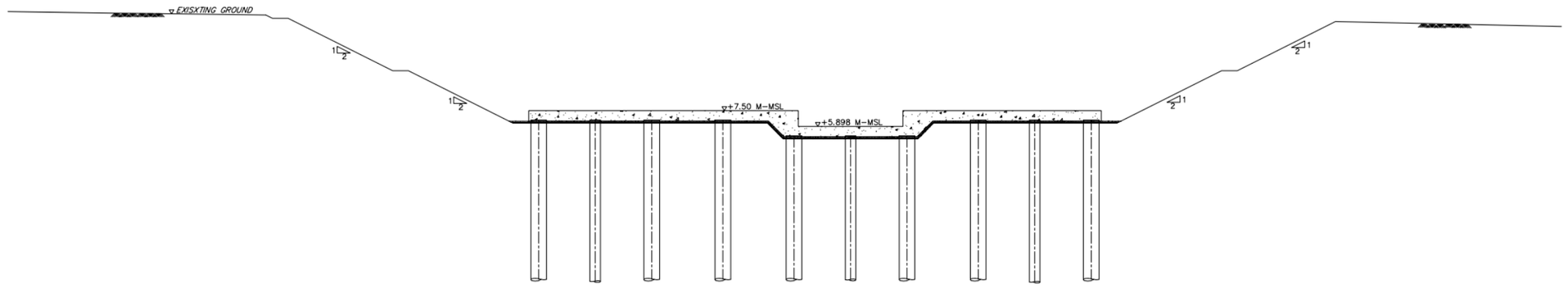
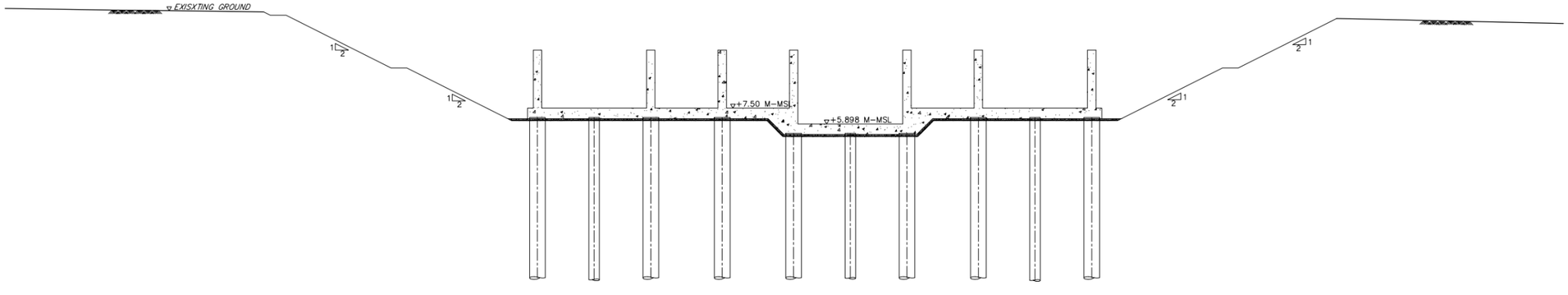
Construction procedures	Illustrations
Stage 3: dig to open soil surface and extract the foundation pile, make foundation sand, and pour concrete.	
Stage 4 Construction of the ground structure of the tunnel	
Stage 5 Construction of tunnel structure	

Table 2.9□3 Procedures for the construction of runways and construction of tunnel under the runways, with illustrations

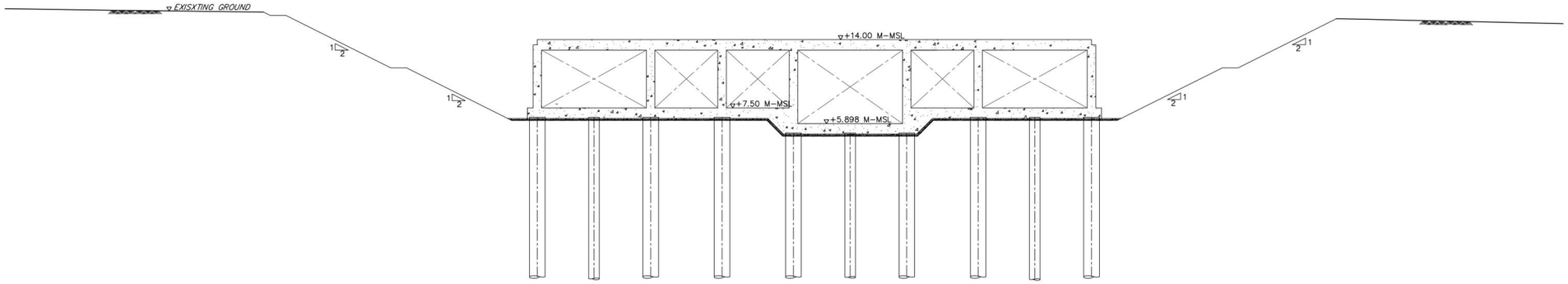
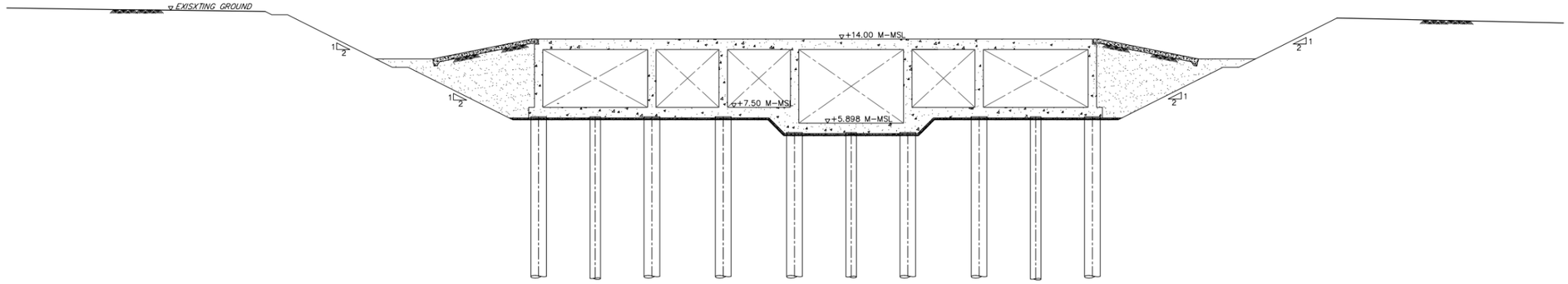
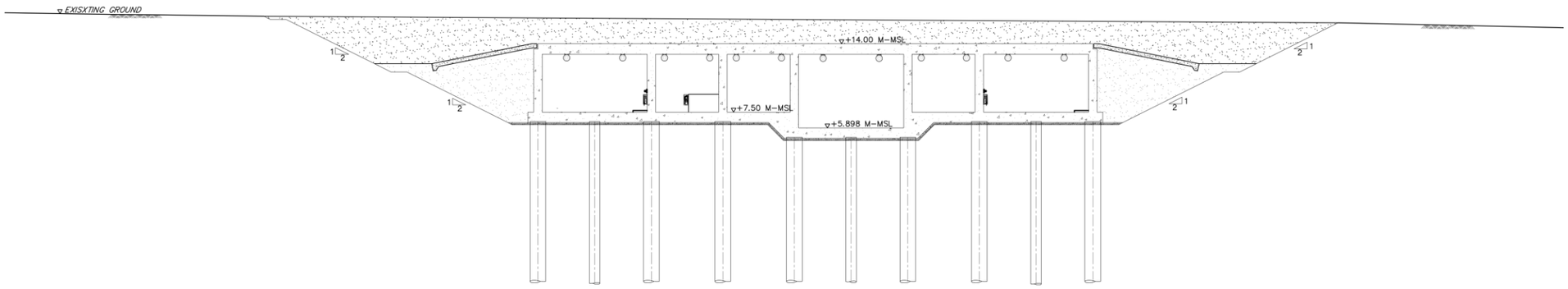
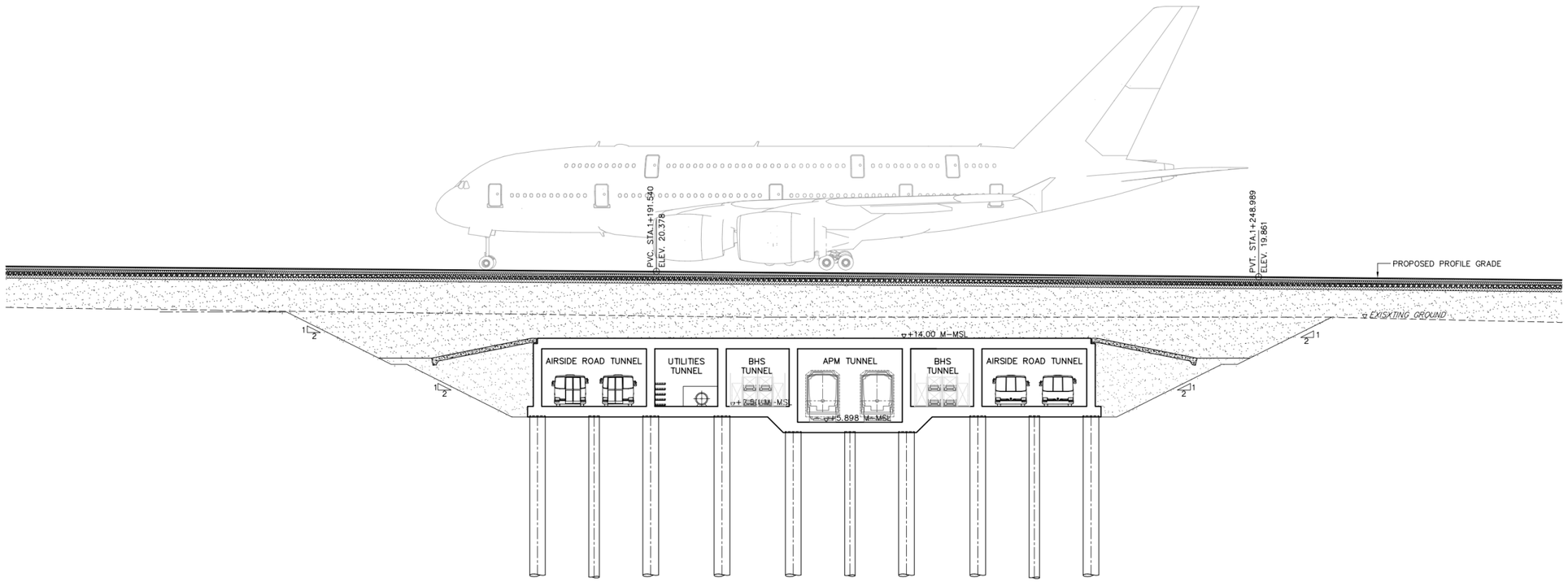
Construction procedures	Illustrations
<u>Stage 6</u> Construction of Tunnel Roof	
<u>Stage 7</u> Filling and compacting the soil side, working to improve the soil quality outside the tunnel with Rapid Impact Compaction (RIC) system, which is a 12-ton steel drum hammering to vibrate the soil layer and compact the soil layer down to 5 meters to the firmness according to the pavement layer design criteria according to FAA and then construct APPROACH SLAB	

Table 2.9□3 Procedures for the construction of runways and construction of tunnel under the runways, with illustrations

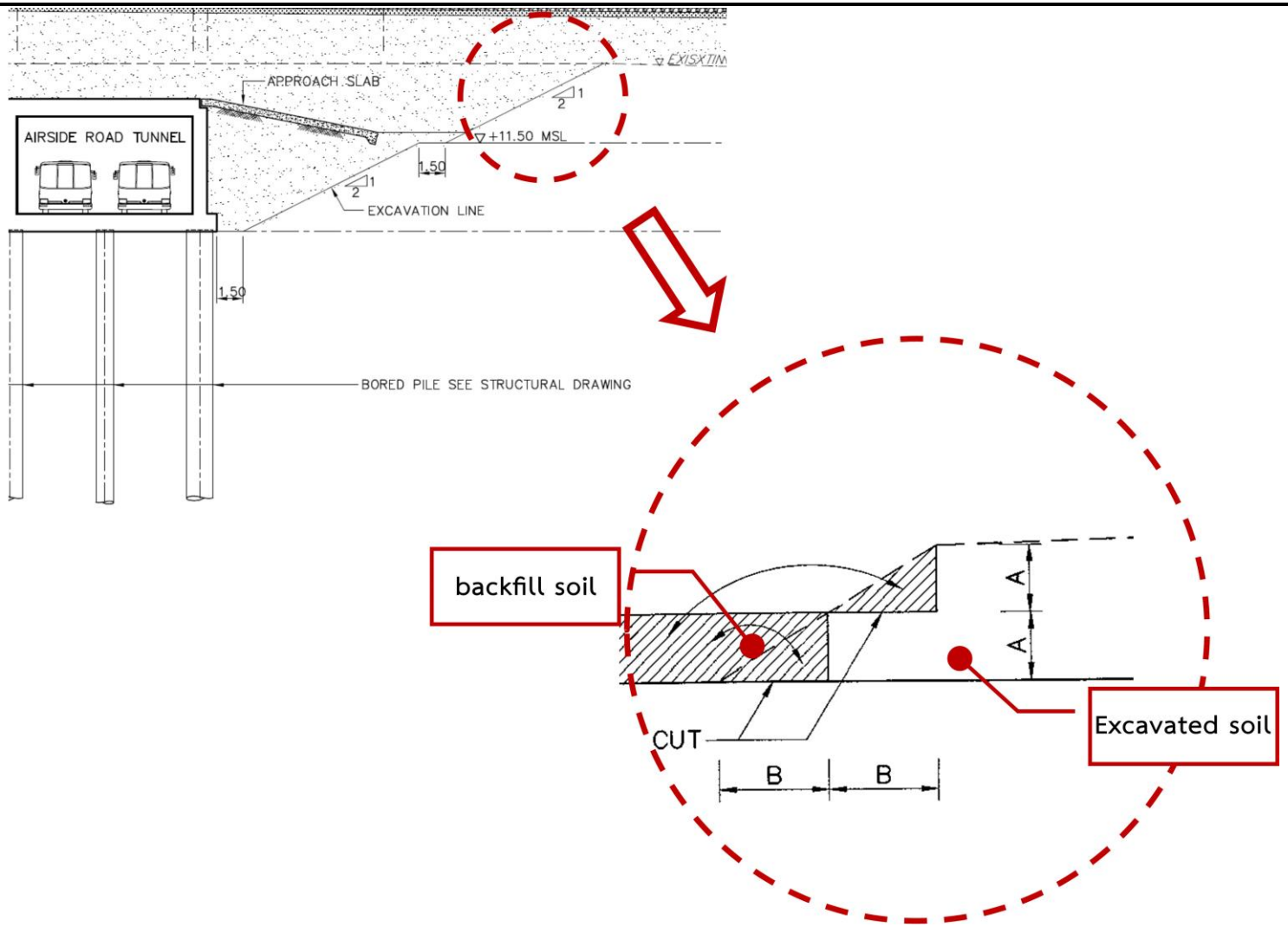
Construction procedures	Illustrations
<u>Stage 8</u> Filling and compacting the layered structure located on the north of the tunnel, and install system work in the tunnel.	
<u>Stage 9</u> Builds the surface structure of runways and driveways	

Source: Consultant on the design of the construction project of the runway and driveway 2, U-Tapao International Airport, Ban Chang District, Rayong, 2020.

In designing the excavation to build a tunnel, the level of excavation work is considered at the maximum depth of approximately 11.00 meters, it was determined for the protection against breaking down due to digging the ground to construct a tunnel by cutting the soil in the form of a ladder. The vertical slope per horizontal is 1 to 2 with a height not exceeding 5.00 meters per 1 slope step and the width of the step is 1.50 meters. Adjust the digging lance to be level (Bench) by specifying the distance between B and A are suitable for the machinery to be used for work. To allow the new compacted recoil to connect to the existing soil well, no slippage. Details are shown in **Figure 2.9-15.**

Investigation of the groundwater level in the area of the tunnel construction from the soil survey report found that the groundwater level was at approximately 2.00 meters (14.00 m-MSL), which is the same level as the top surface of the tunnel roof. By maintaining groundwater in the area of the tunnel construction below the minimum level of soil excavation, the construction contractor must maintain groundwater levels not to obstruct the construction until construction is complete. In this regard, maintenance of groundwater level can be carried out by using wells and temporary ditchs together with Sump Pit And Trench With Pump systems or groun water pumping systems to reduce water levels (Wellpoints).

For soil beside the outside wall of tunnel, when using the materials according to the specification and carrying out an engineering principle, the soil will be sufficiently tight to make the soil with California Bearing Ratio (CBR) values as require. This CBR value will be considered in wetland conditions. In addition, most of the soil condition in the tunnel area is a layer of sand, with good drainage properties.



Source: Consultant on the design of the construction project of the runway and driveway 2, U-Tapao International Airport, Ban Chang District, Rayong, 2020.

Figure 2.9 15 Bench concept for digging slopes with backfilled soil

2.9.4 Driveway construction

2.9.4.1 *Driveway design standards*

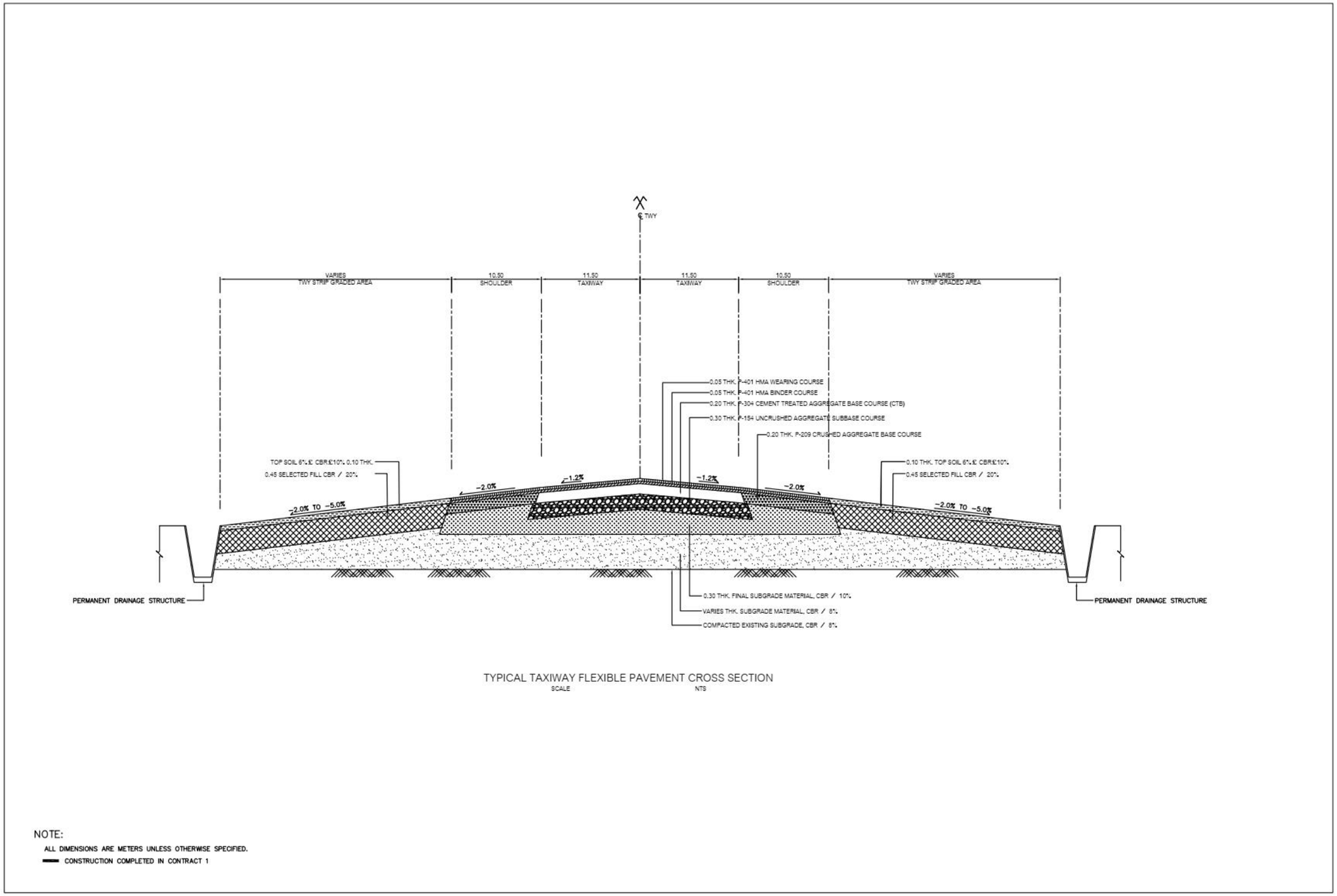
The drive way design is divided into 2 parts, namely the first part, Taxiway Geometry Design and the second part is Taxiway Pavement Design. Each part is referenced according to the design standards as follows:

1) Taxiway Geometry Design : Designed according to design standards of ICAO (Appendix 14) and CAAT (Aerodrome-based CAAT n°14 requirements). The driveway code F has a width of 23 meters and a wide shoulder of each side 10.5 meters, length of shoulder on each side not exceeding 1.5%, curved surface with a change rate not exceeding 1% per 30 meters, where Taxiways, Taxilanes and Associated fillets will be examined by the Software "AviPLAN" modelling the wheel path by the distances (4 meters) with the cockpit above the zero line of the taxiway. The Rapid Exit Taxiways is designed to have a radius of not less than 550 meters curve to slow down the speed of 93 kilometers/hour when the road is wet.

2) Taxiway Pavement Design: Use the US Federal Aviation Administration (FAA) design method as per the Advisory Circular 150/5320 - 6F : Airport Phavement Design and Evaluation and use FAA Rigid and Flexible Iterative Elastic Layer Design (FARFIELD) Software Computer Version 1.4 to help in design.

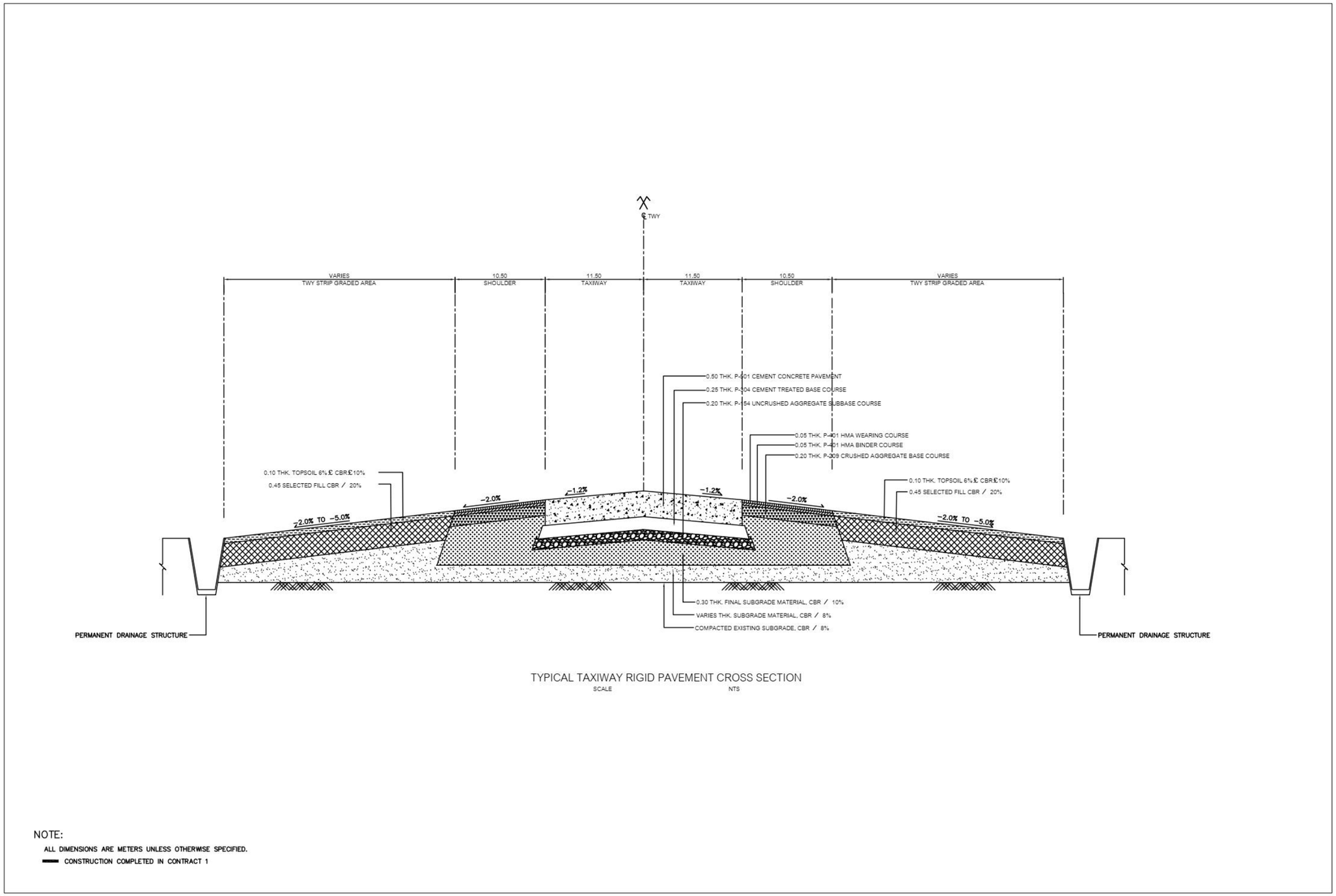
2.9.4.2 *Driveway floor structure*

Driveway floor structure designed in 2 categories, which the first is Flexible Pavement as shown in **Figure 2.9-**16 with asphaltic concrete as an important surface materials. It can be used in areas of straight driveway. The second type is a Rigid Pavementas shown in **Figure 2.9-**17



Source: Consultant on the design of the construction project of the runway and driveway 2, U-Tapao International Airport, Ban Chang District, Rayong, 2020.

Figure 2.9 16 Flexible Pavement using asphaltic concrete as a surface materials



Source: Consultant on the design of the construction project of the runway and driveway 2, U-Tapao International Airport, Ban Chang District, Rayong, 2020.

Figure 2.9 17 Rigid Pavement using concrete portland cement as a surface materials

Concrete portland cement is a surface materials used in the area of the driveway which is the sharp turn structure. Thefloor has the following details:

1) Flexible Pavement structure using concrete asphalt, comprising of:

1.1) The 23-meter drive surface structure, the materials from the bottom to the top, consists of

- The original Compacted Existing Subgrade densely compressed with 95% Field Density Modified Proctor Reaction Test achieves a CBR of no less than 8%.
- Non-synthetic materials (Geotextile) placed on the original ground surface, densely compressed.
- Compacted Selected Subgrade Embankment Fill which the thickness changes according to the original soil level and the surface level designed as densely compressed, with 95% Field Density Modified Proctor Reaction Test to achieve a CBR of not less than 8%.
- For the Final Subgrade Material, the thickness of 30 centimeters, 100% densely compressed. Field Density Modified Proctor Reaction Test with the CBR is no less than 10%.
- Uncrushed Aggregate Subbase Course (materials P-154 according to FAA standard) with a thickness of 30 centimeters
- The floor materials of Cement Treaded Aggregate Base Course (CTB) (materials P-304 according to FAA standard) with the thickness of 20 centimeters.
- Floor materials of HMA Binder Course (materials P-401 according to FAA standard) with thickness 5 centimeters
- The top surface of concrete asphalt materials HMA Wearing Course (P-401 based on FAA standard) with the thickness of 5 centimeters.

1.2) The driveway shoulder structure, 10.5 meters wide each side, from the edge of the driveway. The materials from the bottom to the top floor consists of

- The original Compacted Existing Subgrade densely compressed with 95% Field Density Modified Proctor Reaction Test achieves a CBR of no less than 8%.
- Non-synthetic materials (Geotextile) placed on the original ground surface, densely compressed.
- Compacted Selected Subgrade Embankment Fill with the thickness changes according to the original soil level and the surface level designed as densely compressed, with 95% of Field Density Modified Proctor Reaction Test to achieve a CBR of not less than 8%.
- The floor materials of Crushed Aggregate Base Course (materials P-209 according to FAA standard) with the thickness of 20 centimeters.
- Floor materials of HMA Binder Course (materials P-401 according to FAA standard) with thickness 5 centimeters

- The top surface of the concrete asphalt materials HMA Wearing Course (materials P-401 based on FAA standard). The thickness is 5 centimeters.

1.3) The structure in the area to adjust the level of safety around the driveway (Graded Area of Taxiway Strip) is 22.5 and 28 meters wide, depending on the distance from the shoulder edge of the driveway to the structure of each drainage, comprising of:

- The original Compacted Existing Subgrade densely compressed with 95% Field Density Modified Proctor Reaction Test achieves a CBR of no less than 8%.
- For Compacted Subgrade Embankment Fill, the thickness changes according to the original soil level and the designed surface level. 95% Field Density Modified Proctor Compaction Test yields no less than 8% CBR.
- Selected Fill materials with 95% Field Density Modified Proctor Compaction Test to achieve CBR of no less than 20% with the thickness 45 centimeters
- For the top soil and grassing materials, the 95% Field Density Standard Proctor Compaction Test, the CBR was no less than 6%, but no more than 10% with thickness 10 centimeters.

2) Rigid Pavement using concrete portland cement, comprising of:

2.1) The 23-meter driveway surface structure, the materials from the bottom to the top, consists of

- The original Compacted Existing Subgrade densely compressed with 95% Field Density Modified Proctor Reaction Test achieves a CBR of no less than 8%.
- Non-synthetic materials (Geotextile) placed on the original ground surface, densely compressed.
- For Compacted Selected Subgrade Embankment Fill, the thickness changes according to the original soil level and the surface level value designed, with 95% Field Density Modified Proctor Compaction Test to achieve a CBR of not less than 8%.
- For the Final Subgrade Material, the thickness of 30 centimeters, 100% densely compressed. Field Density Modified Proctor Reaction Test with the CBR is no less than 10%.
- Uncrushed Aggregate Subbase Course (materials P-154 according to FAA standard) with a thickness of 20 centimeters
- The floor materials of Cement Treaded Aggregate Base Course (CTB) (materials P-304 according to FAA standard) with the thickness of 25 centimeters.
- Cement Concrete Pavement (materials P-501 according to FAA standard), 50 centimeters thickness

2.2) The driveway shoulder structure, 10.5 meters wide each side, the materials from the bottom to the top, consists of

- The original Compacted Existing Subgrade densely compressed with 95% Field Density Modified Proctor Reaction Test achieves a CBR of no less than 8%.
- Non-synthetic materials (Geotextile) placed on the original ground surface, densely compressed.
- For Compacted Selected Subgrade Embankment Fill, the thickness changes according to the original soil level and the surface level value designed with 95% of the Field Density Modified Proctor Compaction Test to achieve a CBR of not less than 8%.
- The floor materials of Cement Treaded Aggregate Base Course (CTB) (materials P-209 according to FAA standard) with the thickness of 20 centimeters.
- Floor materials of HMA Binder Course (materials P-401 according to FAA standard) with thickness 5 centimeters
- The top surface of the concrete asphalt materials HMA Wearing Course (materials P-401 based on FAA standard). The thickness is 5 centimeters.

2.3) The structure in the area to adjust the level of safety around the driveway (Graded Area of Taxiway Strip) is 22.5 and 28 meters wide, depending on the distance from the shoulder edge of the driveway to the structure of each drainage, comprising of:

- The original Compacted Existing Subgrade densely compressed with 95% Field Density Modified Proctor Reaction Test achieves a CBR of no less than 8%.
- For Compacted Subgrade Embankment Fill, the thickness changes according to the original soil level and the designed surface level, 95% Field Density Modified Proctor Compaction Test yields no less than 8% CBR.
- Selected Fill materials with 95% Field Density Modified Proctor Compaction Test to achieve CBR of no less than 20% with the thickness 45 centimeters
- For Top soil and Grassing materials, the 95% Field Density Standard Proctor Compaction Test, the CBR was no less than 6%, but no more than 10% with 10 centimeters thickness.

2.9.4.3 *Driveway construction procedure*

Construction of pavement and the shoulders of the driveway has the following construction steps:

1) Flexible pavement construction

1.1) Compacted Existing Subgrade

- In the case of areas where soil quality needs to be improved, the engineering soil quality must be improved by Ground Improvement by Rapid Impact Compaction first
- In the case of land filling, the soil surface must be excavated to a depth of not less than 30 centimeters.

- In the event of digging, dig to the level specified by the survey team based on the level of pavement surface on the construction, which is approximately 44 meters wide.
- Use Bulldozer, Backhoe, Loader, and Truck to excavate and move soil.
- Adjust the slope correctly according to the construction using Grader and Backhoeackhoe.
- Use steel-wheeled crushers and watercars to crush to obtain the correct level, width, slope, and press-milled value as required.
- At this stage, the quality inspection will be carried out in 2 parts as follows:
  - Randomized compaction test.
  - Random survey of coordinates (Scope Level)

1.2) Comparted Selected Subgrade Embankment Fill to be thesupport layer of Final Subgrade. Thickness of this layer changes according to the original soil level and is based on the long surface level, and it can be crushed to achieve a CBR of no less than 8% by

- Placing Geotextile on Compacted Existing Sub-grade
- Used a truck to move materials for a filling.
- Use Bulldozer Grader and Backhoe to adjust the slopes correctly according to the construction style.
- Use a steel-wheeled crusher or a spiny-wheel according to the materials being used, and a watercar to compress for obtaining the correct level, width, inclined, and press-milled values as required.
- At this stage, the quality inspection will be carried out in 2 parts as follows:
  - Randomized compaction test.
  - Random survey of coordinates (Scope Level)

1.3) Final Subgrade Material, thickness 30 centimeters by

- Used a truck to move materials for a filling.
- Use Bulldozer Grader and Backhoe to adjust the slopes correctly according to the construction style.
- Use the steel wheel crusher to compress for obtaining the correct level of width, inclined, press-milled values as require.
- At this stage, the quality inspection will be carried out in 2 parts as follows:
  - Randomized compaction test.
  - Random survey of pavement coordinates (Scope level)

1.4) Uncrushed Aggregate Subbase Course (materials P-154 according to FAA standard) with a thickness of 30 centimeters

- Use a truck to transport the materials to fill by installing it at a thickness of 30 centimeters, only on the road surface.
- Use Bulldozer Grader and Backhoe to adjust the slopes correctly according to the construction style.

- Use the steel wheel crusher to compress for obtaining the correct level of width, inclined values, and press-milled values as require.
- At this stage, the quality inspection will be carried out in 2 parts as follows:
  - Randomized compaction test.
  - Random survey of pavement coordinates (Scope level)

1.5) The floor of Cement Treated Aggregate Base Course (materials P-304 according to FAA standard) with a thickness of 20 centimeters.

- Using a truck to transport materials to fill for a minimum of 20 centimeters thickness
- Use Bulldozer Grader and Backhoe to adjust the slopes correctly according to the construction style.
- Use the steel wheel crusher to compress for obtaining the correct level of width, inclined values, and the press-milled value as require.
- At this stage, the quality inspection will be carried out in 2 parts as follows:
  - Randomized compaction test.
  - Random survey of pavement coordinates (Scope level)

1.6) HMA Binder Course (P-401) 5centimeters thickness

- Use a trailer to transport materials and use Paverto place Hot-Mix Asphalt,installed at a thickness of 5 centimeters.
- Used wheel compactor
- Use Grader to adjust the slope correctly according to the construction style.
- At this stage, the quality inspection of work will be random survey of pavement coordinates (scope level).

1.7) HMA Wearing Course (P-401) layer, 5 cm thickness

- Use a truck to transport materials and use Paver placed Hot-Mix Asphalt by installed at a thickness of 5 centimeters.
- Used wheel compactor
- Use Grader to adjust the slope correctly according to the construction style.

At this phase, the quality inspection of work will be performed randomly by surveying the pavement range (scope level).

2) Rigid road construction

2.1) Compacted Existing Subgrade

- In the case of areas where soil quality needs to be improved, the engineering soil quality must be improved by Ground Improvement by Rapid Impact Compaction first
- In the case of land filling, the soil surface must be excavated to a depth of not less than 30 centimeters.

- In the case of digging, dig to the level specified by the survey team, based on the grade of the driveway surface according to the construction style, the width of the 44-meter driveway.
- Use Bulldozer, Backhoe, Loader, and Truck to excavate and move soil.
- Adjust the slope correctly according to the construction using Graderand Backhoe
- Use steel-wheeled crushers and watercars to crush to obtain the correct level, width, slope, and press-milled value as required.
- At this stage, the quality inspection will proceed in 2 parts as follows:
  - Randomized compaction test.
  - Random survey of coordinates (Scope Level)

2.2) Compacted Selected Subgrade Embankment Fill to be thesupport layer of .Final Subgrade. Thickness of this level changes to the original soil level and depends on the long surface level, and it can be ground to achieve a CBR of no less than 8% by

- Placing Geotextile on Compacted Existing Sub-grade
- Used a truck to move materials for a filling.
- Use Bulldozer Grader and Backhoe to customize the slopes according to the construction style.
- Use a steel-wheeled crusher or a spiny-wheel according to the materials being used, and a watercar to compress for obtaining the correct level, width, inclined, and press-milled values as required.
- At this stage, the quality inspection will proceed in 2 parts as follows:
  - Randomized compaction test.
  - Random survey of coordinates (Scope Level)

2.3) Final Subgrade Material, thickness 30 centimeters by

- Used a truck to move materials for a filling.
- Use Bulldozer Grader and Backhoe to adjust the slopes correctly according to the construction style.
- Use the steel wheel crusher to compress for obtaining the correct level of width, inclined, and press-milled value as require.
- At this stage, the quality inspection will proceed in 2 parts as follows:
  - Randomized compaction test.
  - Random survey of pavement coordinates (Scope level)

2.4) Uncrushed Aggregate Subbase Course (materials P-154

according to FAA standard) with a thickness of 30 centimeters

- Use a truck to transport the materials to fill by installing it at a thickness of 30 centimeters, only on the surface of the road.

- Use Bulldozer Grader and Backhoe to adjust the slopes correctly according to the construction style.
- Use the steel wheel crusher to compress for obtaining the correct level of width, inclined values, and the press-milled value as require.
- At this stage, the quality inspection will proceed in 2 parts as follows:
  - Randomized compaction test.
  - Random survey of pavement coordinates (Scope level)

2.5) The floor of Cement Treated Aggregate Base Course (materials P-304 according to FAA standard) with a thickness of 20 centimeters.

- Use a truck to transport the materials to fill by installing it at a thickness of 20 centimeters.
- Use Bulldozer Grader and Backhoe to adjust the slopes correctly according to the construction style.
- Use the steel wheel crusher to compress for obtaining the correct level of width, inclined values, and the press-milled value as require
- At this stage, the quality inspection will proceed in 2 parts as follows:
  - Randomized compaction test.
  - Random survey of pavement coordinates (Scope level)

2.6) Cement Concrete Pavement (materials P-501 according to FAA standard), 50 centimetersthickness

- Use a finished mixed concrete truck to pour the concrete onto the area and the castings prepared for each pouring.
- Pour the concrete, spread and shake the concrete continuously and fill each stage of the cast, giving the concrete a thickness that will be instantly finished every time.
- Adjust the level of the concrete surface when the concrete starts to solidify enough. Make the concrete surface rough in order to have friction between the concrete floor and the aircraft tire
- In this stage, the quality inspection of the work will be performed randomly to explore the resistance of concrete and to check the coordinates(scope level).

3) Roadside construction

3.1) Compacted Existing Subgrade

- In the case of areas where soil quality needs to be improved, the engineering soil quality must be improved by Ground Improvement by Rapid Impact Compaction first.
- In the case of land filling, the soil surface must be excavated to a depth of not less than 30 centimeters.
- In the case of digging, dig to the level specified by the survey team based on the level of the driveway surface in the construction form, approximately 10.5 meters in width, from the edge of the driveway.
- Use Bulldozer, Backhoe, Loader, and Truck to excavate and move soil.
- Adjust the slope correctly according to the construction using Grader and Backhoe.
- Use steel-wheeled crushers and watercars to crush to obtain the correct level, width, slope, and press-milled value as required.
- At this stage, the quality inspection will proceed in 2 parts as follows:
  - Randomized compaction test.
  - Random survey of coordinates (Scope Level)

3.2) Compacted Selected Subgrade Embankment Fill to be thesupport layer ofFinal Subgrade. Thickness of this layer changes to the original soil level and depends on the long surface level, and it can be crushed to achieve a CBR of no less than 8% by

- Placing Geotextile on Compacted Existing Subgrade.
- Used a truck to move materials for a filling.
- Use Bulldozer Grader and Backhoe to customize the slopes according to the construction style.
- Use a steel-wheeled crusher or a spiny-wheel according to the materials being used, and a watercar to compress for obtaining the correct level, width, inclined, and press-milled values as required.
- At this stage, the quality inspection will proceed in 2 parts as follows:
  - Randomized compaction test.
  - Random survey of coordinates (Scope Level)

3.3) Ground layer of coarse aggregate materials (crushed rock), Crushed Aggregate Base Course (materials P-209 according to FAA standard), with 20 centimeters thickness.

- Use a truck to transport the materials to fill by installing it at a thickness of 20 centimeters.
- Use Bulldozer Grader and Backhoe to adjust the slopes correctly according to the construction style.

- Use the steel-wheeled crusher to compress for obtaining the correct level of width, inclined values, and the press-milled values as require.
- At this stage, the quality inspection will proceed in 2 parts as follows:
  - Randomized compaction test.
  - Random survey of pavement coordinates (Scope level)

3.4) HMA Binder Course (P-401) 5 cm thickness

- Use a truck to transport materials and use Paver to place Hot-Mix Asphalt, by installing at a thickness of 5 centimeters.
- Used wheel compactor
- Use Grader to adjust the slope correctly according to the construction style.
- At this stage, the quality inspection of work will be performed randomly by surveying the coordinates (scope level).

3.5) HMA Wearing Course (P-401) layer, 5 cm thickness

- Use truck to transport materials and use aover placed on the Hot-Mix Asphalt and installed at a thickness of 5 centimeters.
- Used wheel compactor
- Use Grader to adjust the slope correctly according to the construction style.

At this phase, the quality inspection of work will be performed randomly by surveying the pavement range (scope level).

4) The construction of Graded Area of Taxiway Strip is as follows:

4.1) Compacted Existing Subgrade

- The soil surface dredging was carried out to the depth specified in the drawing. The Graded Area of Runway Strip is 22.5 and 28 meters wide on each side from the shoulder edge of the taxiway. Depending on the distance from the edge of the driveway shoulder to the line of each drainage structure
- Use Bulldozer, Backhoe and trucks to dig and move soil.
- Adjust the slopes to the correct construction by using Grader and Backhoe.
- Use steel-wheeled crushers and watercars to compress for obtaining the correct level of width, inclined, and press-milled value as require.
- At this stage, the quality inspection of the work will be performed randomly to test the compressed values.

4.2) Compacted Subgrade Embankment Fill, altered thickness according to existing soil level and driveway surface level

- Used a truck to move materials for a filling.
- Use Bulldozer Grader and Backhoe to adjust the slopes correctly according to the construction style.
- Use a steel-wheeled or spiny-wheeled crusher according to the materials being used, and a watercar to press for obtaining the correct level of width, inclined, and press-milled value as require.

- At this stage, the quality inspection will proceed in 2 parts as follows:
  - Randomized compaction test.
  - Random survey of pavement coordinates (Scope level)

4.3) Selected Fill materials with a thickness of 45 centimeters, with

- Used a truck to move materials for a filling.
- Use Bulldozer, Grader and Backhoe to adjust the slopes correctly according to the construction style.
- Use a steel-wheeled or spiny-wheeled crusher according to the materials being used, and a watercar to press for obtaining the correct level of width, inclined, and press-milled value as require.
- At this stage, the quality inspection will proceed in 2 parts as follows:
  - Randomized compaction test.
  - Random survey of pavement coordinates (Scope level)

4.4) Top Soil and Grassing materials layer with a thickness of 10 centimeters in both surface and pavement shoulder by

- Used a truck to move materials for a filling.
- Use Bulldozer, Grader and Backhoe to adjust the slopes correctly according to the construction style.
- Use the steel-wheeled crusher to compress for obtaining the correct level of width, inclined, and press-milled values as require.
- At this stage, the quality inspection will proceed in 2 parts as follows:
  - Randomized compaction test.
  - Random survey of pavement coordinates (Scope level)

Note : Volume of cut soil/filled soil for the construction of the runway 2 with tunnel under the runway and parallel driveway is shown in **Table 2.9-4**

Table 2.9-4 Summary of the volume of cut soil/filled soil for the construction of runway 2 with tunnel under the runway and parallel driveway

Construction activities	Soil volume (cubic meter)		
	Cut soil	Filled soil.	
		Original materials	New materials
1. Runway 2 with Tunnel under runway	1,389,000	214,000	2,386,800
2. Parallel driveway	3,704,000	3,911,600	3,948,000
Total amount	5,093,000	4,125,600	6,334,800

Notes: sandy soil materials, 1.95 tons/cubic meters
The original materials was soil caused by soil cut within the project.
New materials is soil that needs to be purchased

Source: Consultant designed the construction project for runway and driveway 2, U-Tapao International Airport, Ban Chang District, Rayong, 2021

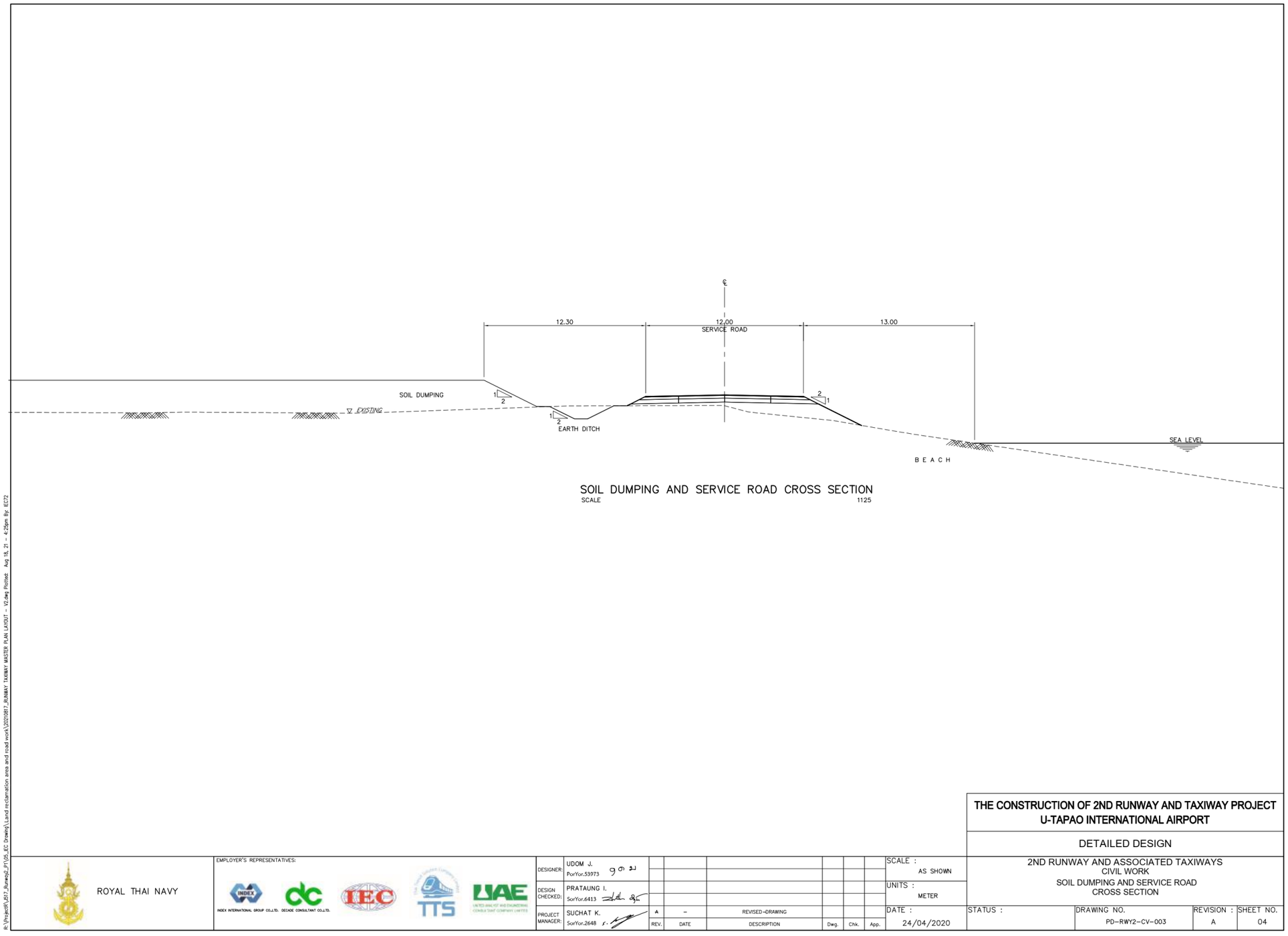
In order to assess the volume of materials being excavated and reused, it was permitted to lose and deduct the unqualified quantity from the excavated soil. The remainder of the product will be taken as a non-quality part to be consumed in the low area or the collection pile in the Navy area which allows the contractor to store the remaining materials from the floor level adjustment work shown in **Figure 2.9-**18 as follows:

- **Soil pile points 1 and 2:** The soil pile area from the MRO project (outside the orange area) is closest to the sea compared to other points which the construction design of Service Road is the internal road to the Royal Thai Navy's apron as shown Figure **2.9-19** the distance between the edge of the soil pile and the edge of the road, which is around 12.30 meters and from the edge of the road to the beach around 13.00 meters.) This will help prevent soil erosion and leaking into the sea including the use of engineering principle in soil pile by specify the slope of 1:1.
- **Soil pile points 3 and 4:** Based on the soil level adjustment work for the construction of the driveway and apron of the aircraft repair center
- **Soil pile points 5, 6, 7 and 8 soil: It** is thearea of the Royal Thai Navy, which is considered first to bring the soil to the ground to prevent the soil leaking into the sea.

In this regard, if the designated area is insufficient, the soil will be considered in the soil pile points 1 and 2, but the soil storagemust be determined by taking into account Slope Stability in order to prevent the collapse of the soil that may be leaking into the sea, which could affect the coast.

Source: Consultant on the design of the construction project of the runway and the 2nd taxiway, U-Tapao International Airport, Ban Chang District, Rayong Province, 2021

Figure 2.9-18 the position of the remaining pile of soil that is not of good quality



Source: Consultant on the design of the construction project of the runway and the 2nd taxiway, U-Tapao International Airport, Ban Chang District, Rayong Province, 2020.

Figure 2.9-19 Service Road construction design is an internal road to the Royal Thai Navy's apron that helps prevent soil from leaking into the sea.

2.10 Project construction phase management

Due to the overview project construction which divided the construction period into 3 phases, i.e. Phase 1, Phase 2, and Phase 3. Each construction phase will take 36 months. Therefore, the project has improved construction phase management, with construction workers and construction control officers working within U-Tapao International Airport which RTN and EECO have a policy that workers shall not be placed within the U-Tapao International Airport area. Therefore, contractor shall arrange for accommodation for workers outside the U-Tapao International Airport area, in accordance with Standards of the Engineering Institute of Thailand Under the Royal Patronage (April, 1994). The internal area of U-Tapao International Airport will be used to store materials and construction equipment, Construction Supervision Office and temporary workers accommodation during the construction period. The project will provide areas for various activities of the construction workers as follows:

2.10.1 Number of construction workers

Construction of various components in each construction period takes 36 months with details as follows:

- **Phase 1** will have a maximum number of 2,890 construction workers and construction supervisors, with a maximum of 2,654 construction workers and 236 construction supervisors. The maximum number of construction workers will be around 1 month in the 19th month as shown in **Figure 2.10-1**
- **Phase 2** will consist of construction workers and construction supervisors, with a maximum of 882 construction workers as well as 813 construction workers and a 69 construction supervisors. The maximum number of construction workers will be in a period of approximately 1 month during 22th month is shown in **Figure 2.10-2**
- **Phase 3** There will be a maximum number of 1,634 construction workers and construction supervisors, comprising of 1,504 construction workers and 130 construction supervisors. The maximum number of construction workers will be in a period of approximately 1 month during 19th month, as shown in **Figure 2.10-3**

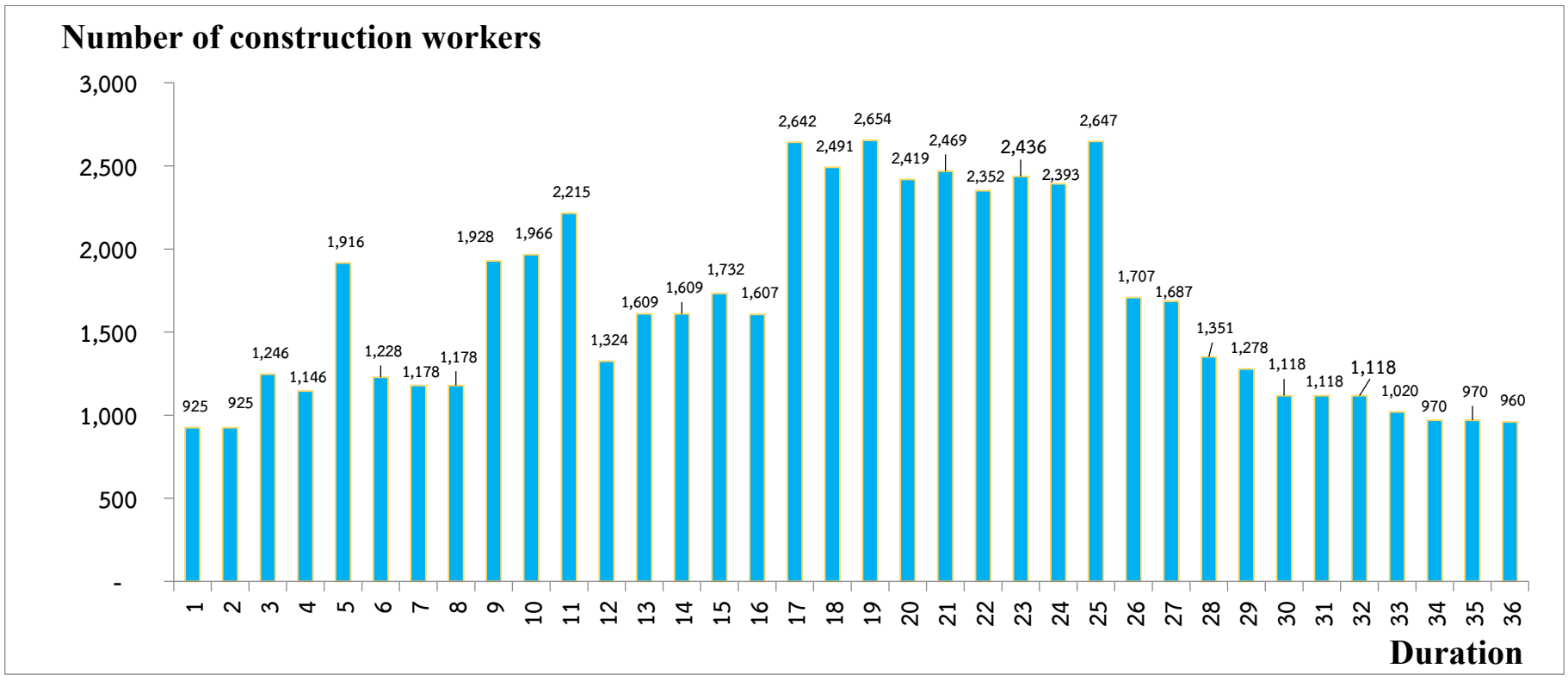


Figure 2.10 1 Number of construction workers in each period of construction phase 1

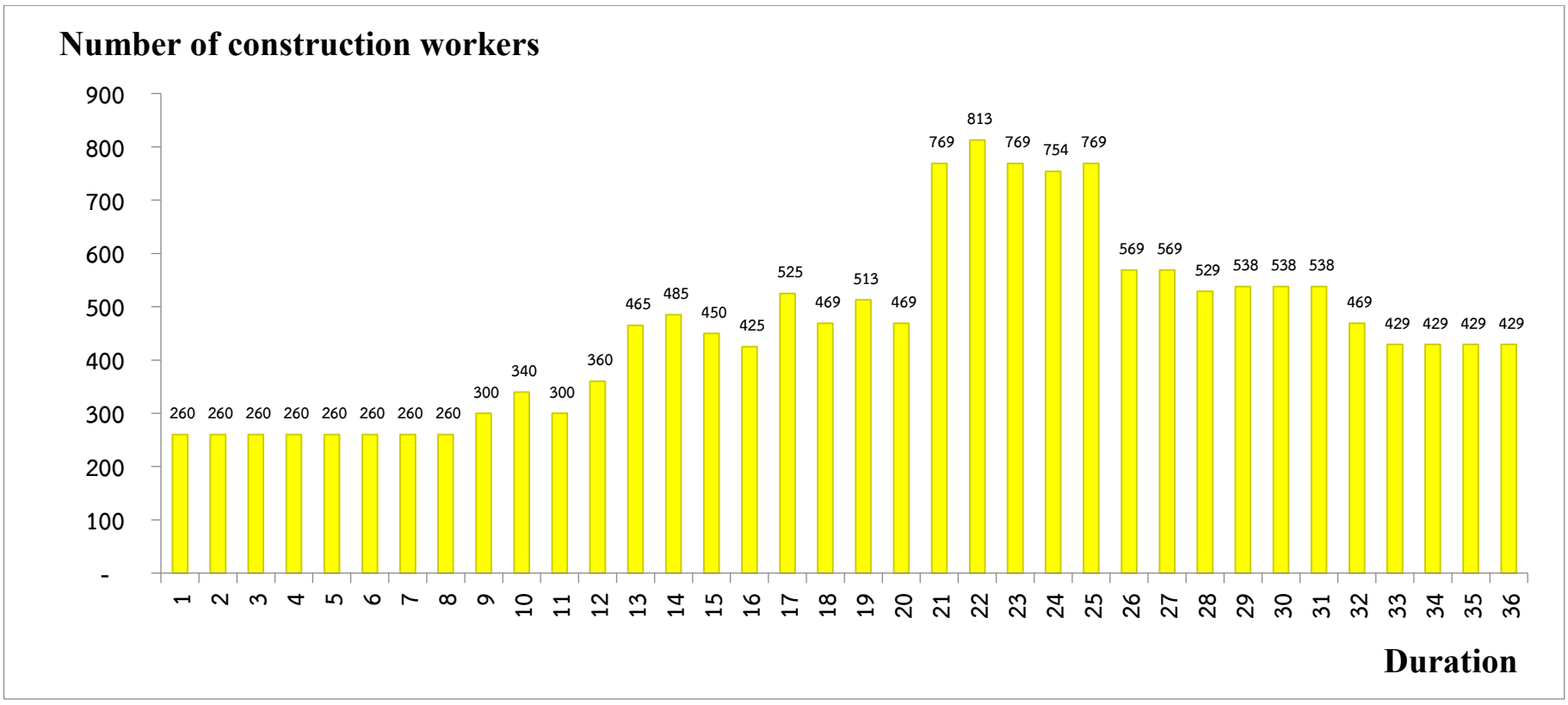


Figure 2.10 2 Number of construction workers in each period of construction phase 2

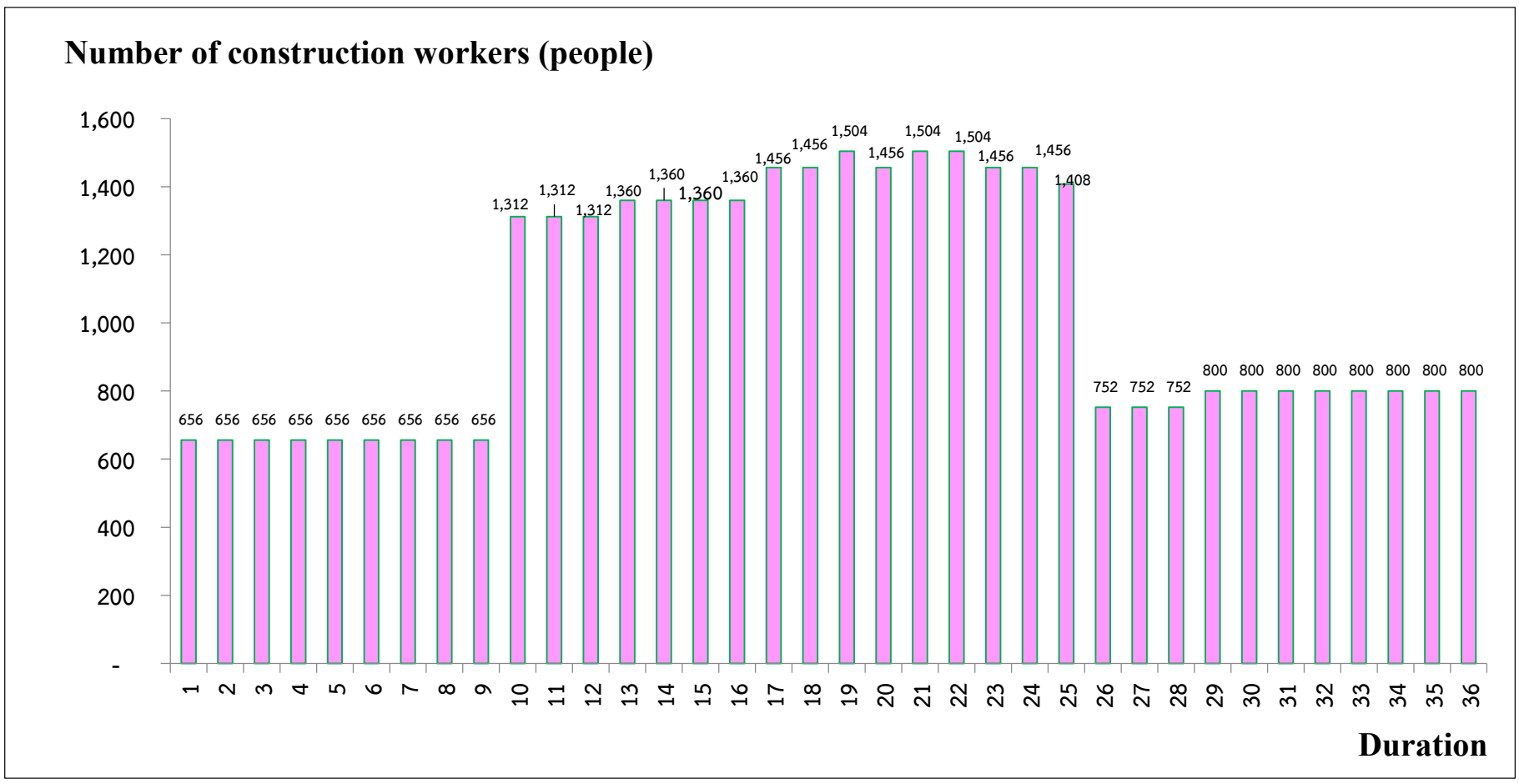


Figure 2.10 3 Number of construction workers in each period of construction phase 3

2.10.2 Preparing the area for setting up the project office for project consultants, Construction Supervision Officetemporary workers accommodation (lunch break) construction materials production plant, machinery repair plant and heavy machinery parking area in the U-Tapao International Airport

In the construction of project components in phase 1 RTN and EECO require the construction contractors to establish a construction supervision office, temporary workers accommodation (during lunch break), construction materials production plant, machinery repair plant and heavy machinery parking area within the U-Tapao International Airport area, as shown in **Figure 2.10-*4***. The said area must not obstruct the operation of U-Pao International Airport at present and provide the necessary public utility systems as well as maintaining safety in the construction area. Details as follows:

1) project office for project consultants

Set up an initial area for project consultants (position A) outside the project area, 20 meters wide, 30 meters long, or 600 square meters, which is enough for project advisers.

2) Construction Supervision Office and temporary workers accommodation (lunch break) in the construction area

The construction supervision office for construction contractors and temporary worker accommodation (lunck break) (position B) 20 meters wide, 30 meters long, or 600 square meters area, which is sufficient for the number of supervisors controlling the work, including providing maintenance buildings, stores for equipment storage, office equipment, fire extinguishers, toilets, and suitable parking spaces.

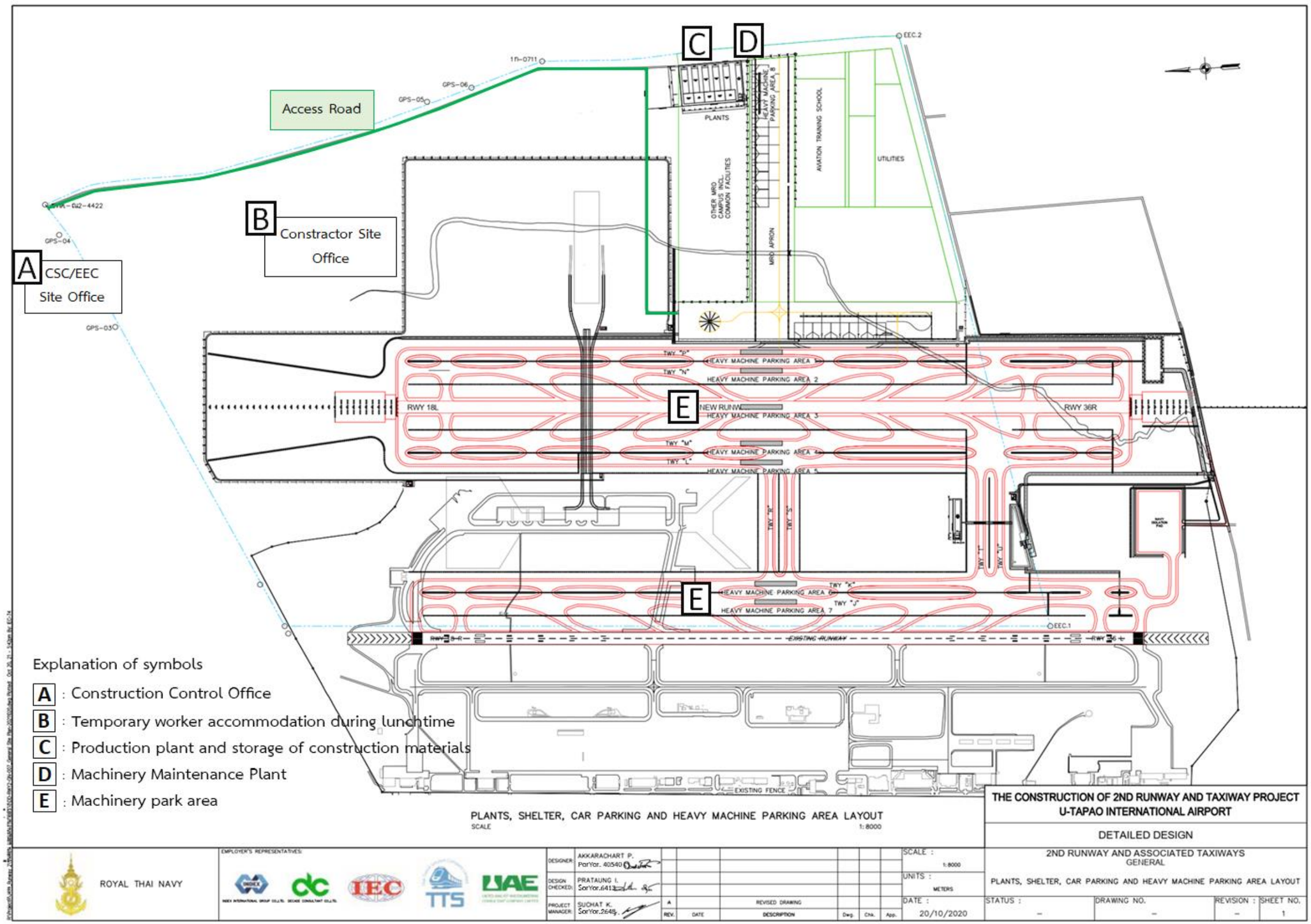
2.1 Management of public utility systems

Provide adequate public utility systems for supervisors working in the construction area, including the requirements for construction activities, such as drainage systems, electrical systems, water systems, waste water treatment systems, and waste management, as follows:

drainage system: establish drainage system from construction area to collect and drain water from the construction area to the natural water trough within the U-Tapao International Airport area.

Electrical systems: Providing enough electricity to meet the demand for use by requesting services from the electricity business Royal Thai Navy Concession Welfare or requesting service from the airport. Electricity supply is for lighting and power for machinery, construction equipment which must comply with the electrical circuit rules. Electrical power lines must be used in accordance with industry standards. Electrical wiring always floats above personnel, as well as intermittent protection bridges according to current power used. Electrical power must always be cut by an electrical engineer according to the construction plan of B.Grimm Power Public Company Limited, which has a development plan in the future to support electricity for the project during the construction period. However, if there is a construction project in place before the power plant is finished, the

contractor can request electricity services from the electricity business, Royal Thai Navy Concession Welfare.



Source: Consultant on the design of the construction project of the runway and the 2nd taxiway, U-Tapao International Airport, Ban Chang District, Rayong, 2020.

Figure 2.10□4 Initial layout showing the position of construction supervision office, temporary worker accommodation (lunch break), cconstruction materials production plant, machinery repair plant and heavy machinery parking area within the U-Tapao International Airport area

Water system used: Prepare enough water for the consumption of supervisors and construction workers who come to work. The water consumption in each phase of the construction is as follows:

- **Phase 1** The amount of water used by supervisors will be approximately 16.5 cubic meters per day and with the water usage of the construction workers who rest during lunch break at approximately 185.8 cubic meters per day, with water consumption rate of 70 liters per person per day ([redacted], 1994). Total water consumption at the construction supervision office was 202.3 cubic meters per day, in which the project must provide a reserved water tank that can hold backup water for 3 days, with a volume of no less than 606.9 cubic meters in the event that the public water supply does not flow and 61 tanks of 10 cubic meters of water are required in the area of the construction supervision office, which provides sufficient backup for the amount of water.
- **Phase 2** will have an approximate amount of water used by the supervisors around 4.8 cubic meters per day and water usage of construction workers resting during lunch break is approximately 56.9 cubic meters per day, with a water consumption rate of 70 liters per person per day ([redacted], 1994). Total water consumption at the construction supervision office was 61.7 cubic meters per day, in which the project must have a water reserved tank that can be used for storage for 3 days, with a volume not less than 185.2 cubic meters. In the event that the public water supply does not flow, 19 tanks of 10 cubic meters of water are required in the area of the construction supervision office, which provides sufficient backup for the amount of water.
- **Phase 3** The amount of water used by the supervisors will be approximately 9.1 cubic meter per day with water usage of construction workers resting during lunch break by approximately 105.3 cubic meters per day, with a water consumption rate of 70 liters per person per day ([redacted], 1994). Total water consumption at the construction supervision office was 114.4 cubic meters per day, in which the project must provide a reserved water tank that can hold backup water for 3 days, with a volume of no less than 343.2 cubic meters. In the event that the public water supply does not flow, 35 tanks of 10 cubic meters are required in the area of the construction supervision office, which provides sufficient backup for the water volume.

During the construction phase, it is possible to purchase public water supply from the area surrounding the project, namely Provincial Waterworks Authority Rayong Branch, Ban Chang Branch and Pak Nam Prasae Branch. The closest public water supply authority to the project area is Provincial Waterworks Authority Ban Chang Branch. When considering the statistical data of water users, volume of production and distribution of the Provincial Waterworks Authority Branches of Rayong, the amount of water produced exceeds the amount of water sold which is sufficient for distribution to the project area during the construction phase.

Waste water management : Prepare adequate toilets for the construction workers according to the Ministry of Interior's Announcment regarding welfare of hygiene requirements for employees, announced in the Government Gazette, version 103, section 17, dated 3 February 1986, clause 1(3) and 1(4) which required the workplaces with more than 80 workers must provide a toilets with no less than 3 places. There must be 1 additional place for every 50 workers, and for fraction of 50 people, if more than 25 people, it is considered 50 people. It is required in the contractor contract

to procure instant waste water treatment system which can treat waste water from construction workers' activities as follows:

- **Phase 1** procure instant waste water treatment system that can be used for waste water treatment from construction workers' activities of no less than 161.8 cubic meters per day. The project has specified 17 tanks of 10 cubic meters of the prefabricated septic tank and effluent manhole that can support waste water for 1 day before draining to natural water trough in the airport area, no less than 161.8 cubic meters.

Phase 2 procure instant waste water treatment system that can be used for waste water treatment from construction workers' activities of no less than 49.4 cubic meters per day. The project is required to have 5 tanks of 10 cubic meters of the prefabricated septic tank and effluent manhole that can support water for 1 day before draining the natural water trough in the airport area, no less than 49.4 cubic meters.

Phase 3 procure instant waste water treatment system that can be used for waste water treatment from construction workers' activities of no less than 91.5 cubic meters per day. The project is required to have 10 tanks of 10 cubic meters of prefabricated septic tank and effluent manhole that can hold water for 1 day before draining the natural water trough in the airport area, no less than 91.5 cubic meters.

Solid waste management: Place enough waste containers from the workers' activities. The solid waste generated within the project is divided into 2 types according to the nature of the activities, namely general solid waste and construction materials waste. The volume of solid waste generated in each construction phase is as follows:

- General solid waste, namely food scraps, paper scraps, and plastic scraps, etc., by assessing the rate of 0.44 kilograms of waste per person per day (the density of solid waste is 118.39 kilograms per cubic meters) (Thares Srisathit, 2004).
- Construction materials scraps including brick, lime, wood scrap, grout bags, and metal scraps that occur each day

The amount of solid waste generated during each construction phase is as follows:

- **Phase 1** The amount of solid waste generated 1,271.6 kilograms per day. The construction contractor must provide 27 dry solid waste bins of 200 liters and 27 wet solid waste bins of 200-liters, placed at points for sufficient number, and provide solid waste storage place that can support solid waste for no less than 3 days, with a capacity of not less than 32.2 cubic meters.
- **Phase 2** The amount of solid waste produced by 388.1 kilograms per day. The construction contractor must arrange 9 dry solid waste bins of 200-liters and 9 wet solid waste bin of 200-liters, placed at points for sufficient number, and provide solid waste storage place that can support solid waste for no less than 3 days, with a capacity of not less than 9.8 cubic meters.
- **Phase 3**: The amount of solid waste generated by 719.0 kilograms per day. Construction contractors must arrange for 16 dry solid waste bins of 200-liter and 16 wet solid waste of 200-liters placed at points for sufficient number, and provide solid waste storage place that can support solid waste for no less than 3 days, with a capacity of not less than 18.2 cubic meters.

2.2) Safety Management

- Check the history of all workers and supervisors who come to work at U-Tapao International Airport with Royal Thai Police for criminal records. If it is found that there is a criminal record and investigated as a serious matter. It is strictly forbidden to recruit for work to prevent sabotage and crimes.
- Make a list of workers who come to work and have to wear a card at all times while working in the area.
- Closely supervise workers' behavior so as not to cause trouble for employees and airport service users, as well as impose penalties for workers not complying with prescribed regulations.
- The construction area must be fully enclosed and has only one entry-exit point to facilitate effective access control and security.
- Arrange for security personnel to enforce 24 hours access control at the entry-exit point access.
- Install construction area signs, hazard warning signs, in points where visible.
- Install portable fire extinguishers in the supervision office building and construction office area, which are easily noticeable and accessible.

The project has laid out preliminary details in the construction supervisionoffice area and temporary worker accommodation (lunch break) both in Phase 1, Phase 2 and Phase 3. Details are shown in **Figure 2.10-5** to **Figure 2.10-7**

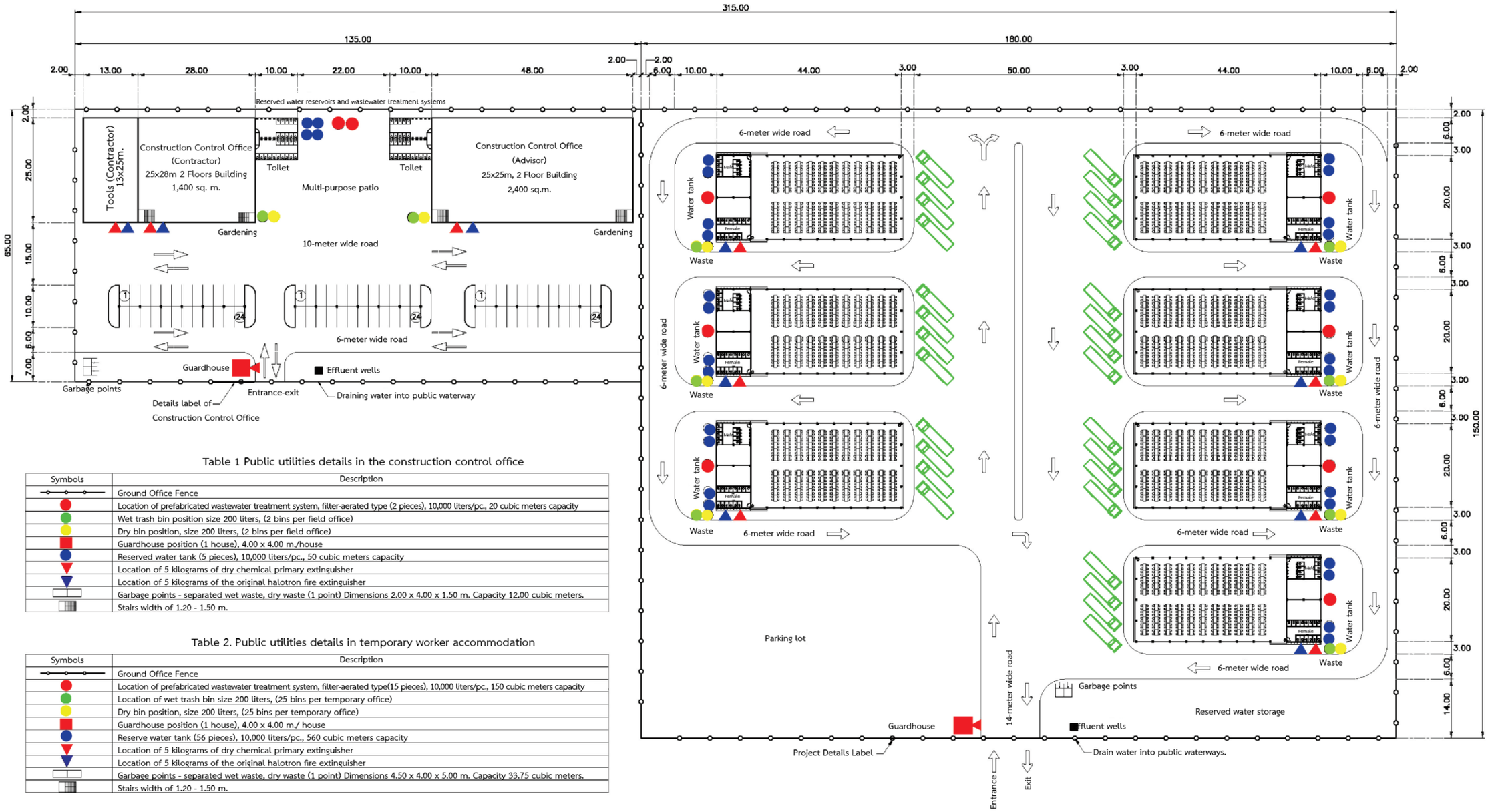


Table 1 Public utilities details in the construction control office

Symbols	Description
	Ground Office Fence
	Location of prefabricated wastewater treatment system, filter-aerated type (2 pieces), 10,000 liters/pc., 20 cubic meters capacity
	Wet trash bin position size 200 liters, (2 bins per field office)
	Dry bin position, size 200 liters, (2 bins per field office)
	Guardhouse position (1 house), 4.00 x 4.00 m./house
	Reserved water tank (5 pieces), 10,000 liters/pc., 50 cubic meters capacity
	Location of 5 kilograms of dry chemical primary extinguisher
	Location of 5 kilograms of the original halotron fire extinguisher
	Garbage points - separated wet waste, dry waste (1 point) Dimensions 2.00 x 4.00 x 1.50 m. Capacity 12.00 cubic meters.
	Stairs width of 1.20 - 1.50 m.

Table 2. Public utilities details in temporary worker accommodation

Symbols	Description
	Ground Office Fence
	Location of prefabricated wastewater treatment system, filter-aerated type(15 pieces), 10,000 liters/pc., 150 cubic meters capacity
	Location of wet trash bin size 200 liters, (25 bins per temporary office)
	Dry bin position, size 200 liters, (25 bins per temporary office)
	Guardhouse position (1 house), 4.00 x 4.00 m./ house
	Reserve water tank (56 pieces), 10,000 liters/pc., 560 cubic meters capacity
	Location of 5 kilograms of dry chemical primary extinguisher
	Location of 5 kilograms of the original halotron fire extinguisher
	Garbage points - separated wet waste, dry waste (1 point) Dimensions 4.50 x 4.00 x 5.00 m. Capacity 33.75 cubic meters.
	Stairs width of 1.20 - 1.50 m.

Area layout of the Construction Supervision Office and Temporary Workers Accommodation Phase 1

Source: Consultant on the design of the construction project of the runway and the 2nd taxiway, U-Tapao International Airport, Ban Chang District, Rayong, 2021

Figure 2.10□5 Structure of construction supervision office area and temporary worker accommodation (in construction area) Phase 1

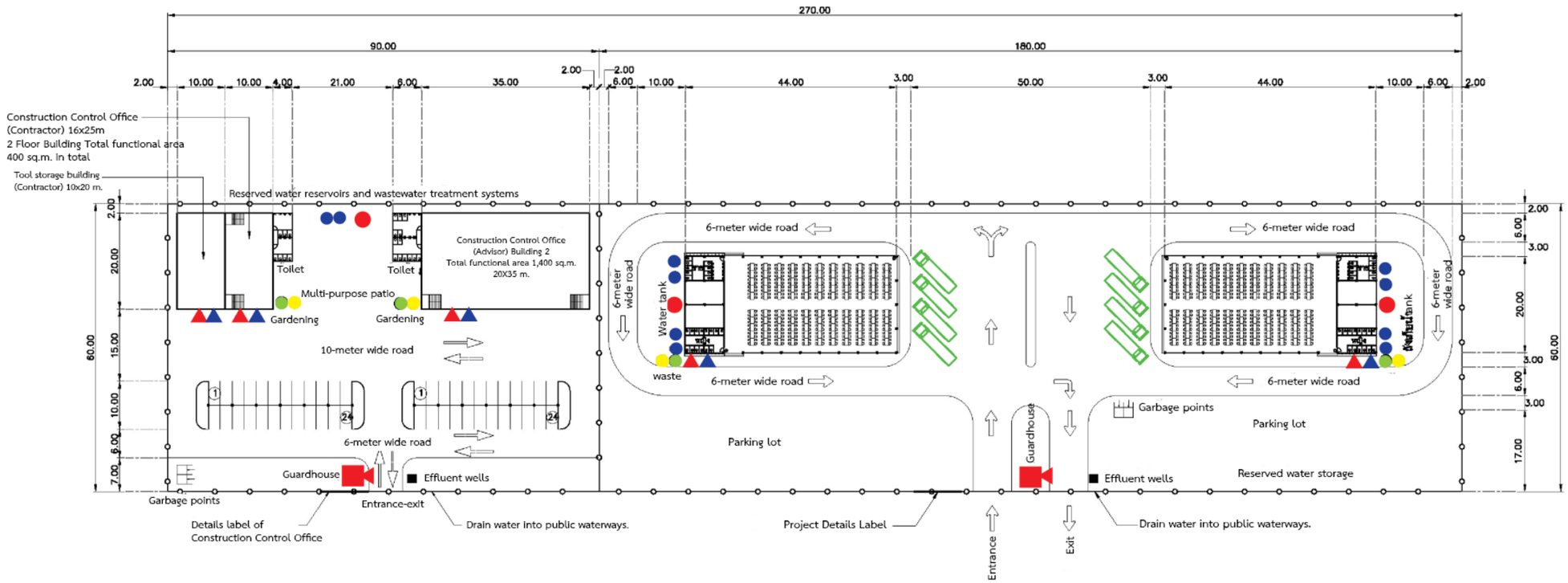


Table 1 Details of public utility systems in the construction control office

Symbols	Description
	Ground Office Fence
	Location of prefabricated wastewater treatment system, filter-aerated type (1 piece), 10,000 liters/pc., 10 cubic meters capacity
	Wet trash bin position size 200 liters, (1 tank per field office)
	Dry bin position, size 200 liters, (1 tank per field office)
	Guardhouse position (1 house), 4.00 x 4.00 m./ house
	Reserved water tank (3 pcs.), 10,000 liters/pc., 30 cubic meters capacity
	Location of 5 kilograms of dry chemical primary extinguisher
	Location of 5 kilograms of the original halotron fire extinguisher
	Garbage points - separated wet waste, dry waste (1 point) Dimensions 2.00 x 4.00 x 1.50 m. Capacity 12 cubic meters.
	Stairs width of 1.20 - 1.50 m.

Table 2, Public Utility Systems Details in Temporary Workers' Accommodation

Symbols	Description
	Ground Office Fence
	Location of prefabricated wastewater treatment system, filter-aerated type (4 pieces), 10,000 liters/pc., 40 cubic meters capacity
	Location of wet trash bin size 200 liters, (8 bins per worker accommodation)
	Dry trash bin position, size 200 liters, (8 tanks per worker accommodation)
	Guardhouse position (1 house), 4.00 x 4.00 m./ house
	Reserved water tank (17 pieces), 10,000 liters/pc., 170 cubic meters capacity
	Location of 5 kilograms of dry chemical primary extinguisher
	Location of 5 kilograms of the original halotron fire extinguisher
	Garbage points - separated wet waste, dry waste (1 point) Dimensions 2.50 x 4.00 x 1.50 m. Capacity 12.00 cubic meters.
	Stairs width of 1.20 - 1.50 m.

Layout of the Construction Supervision Office and Temporary Worker Accommodation Area, Phase 2

Source: Consultant on the design of the construction project of the runway and the 2nd taxiway, U-Tapao International Airport, Ban Chang District, Rayong, 2021

Figure 2.10 6Structure of construction supervision office area and temporary worker accommodation (in construction area) Phase 2

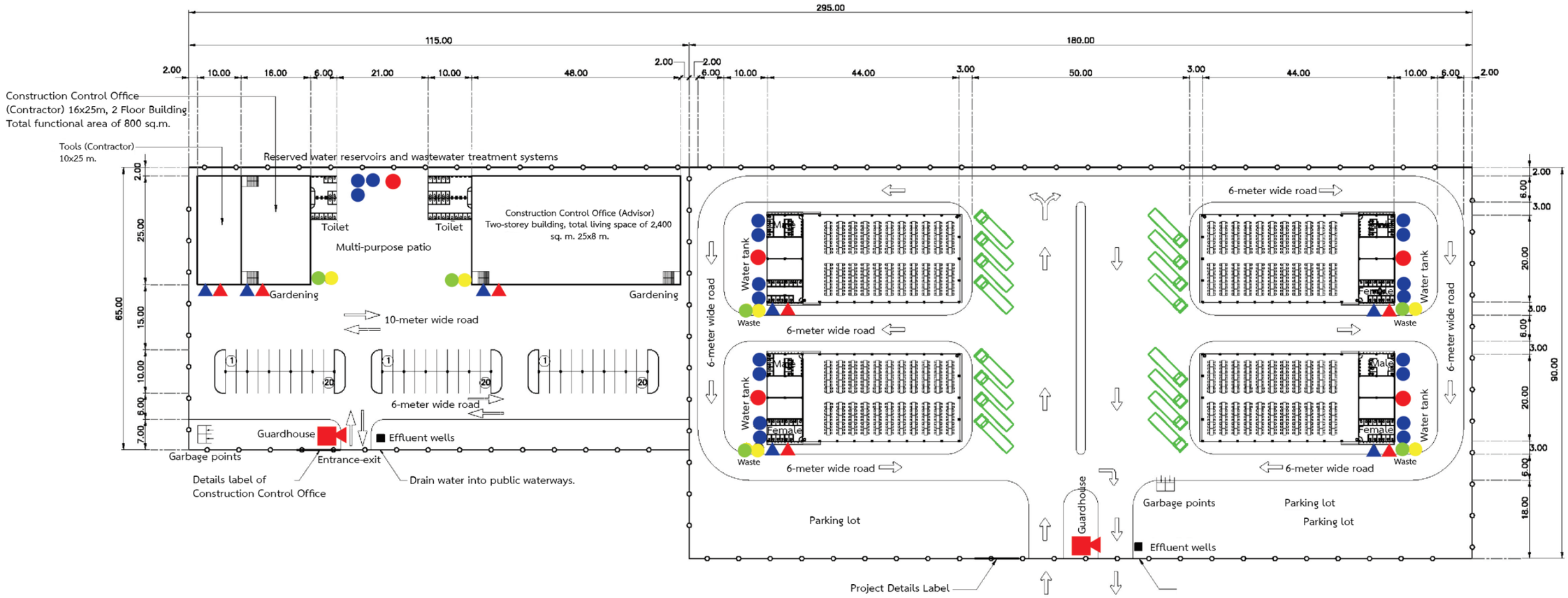


Table 1 Details of public utility systems in the construction control office

Symbols	Description
	Ground Office Fence
	Location of prefabricated wastewater treatment system, filter-aerated type (1 piece), 10,000 liters/pc., 10 cubic meters capacity
	Wet trash bin position size 200 liters, (1 tank per field office)
	Dry bin position, size 200 liters, (1 tank per field office)
	Guardhouse position (1 house), 4.00 x 4.00 m./ house
	Reserved water tank (3 pcs.), 10,000 liters/pc., 30 cubic meters capacity
	Location of 5 kilograms of dry chemical primary extinguisher
	Location of 5 kilograms of the original halotron fire extinguisher
	Garbage points - separated wet waste, dry waste (1 point) Dimensions 2.00 x 4.00 x 1.50 m. Capacity 12 cubic meters.
	Stairs width of 1.20 - 1.50 m.

Table 2, Public Utility Systems Details in Temporary Workers' Accommodation

Symbols	Description
	Ground Office Fence
	Location of prefabricated wastewater treatment system, filter-aerated type (9 pieces), 10,000 liters/pc., 90 cubic meters capacity
	Location of wet trash bin size 200 liters, (15 tanks per worker accommodation)
	Dry bin position, size 200 liters, (15 tanks per worker accommodation)
	Guardhouse position (1 house), 4.00 x 4.00 m./ house
	Reserved water tank (32 pieces), 10,000 liters/pc., 320 cubic meters capacity
	Location of 5 kilograms of dry chemical primary extinguisher
	Location of 5 kilograms of the original halotron fire extinguisher
	Garbage points - separated wet waste, dry waste (1 point) Dimensions 3.50 x 4.00 x 1.50 m. Capacity 21.00 cubic meters.
	Stairs width of 1.20 - 1.50 m.

Layout of the Construction Supervision Office and Temporary Worker Accommodation Area, Phase 3

Source: Consultant on the design of the construction project of the runway and the 2nd taxiway, U-Tapao International Airport, Ban Chang District, Rayong, 2021

Figure 2.10 7 Structure of construction supervision office area and temporary worker accommodation (in construction area) Phase 3

2.4) Construction materials production area (concrete mixed), Heavy machinery parking area in the construction area of the project

The project will take about 36 months to build, therefore, it is necessary to install concrete mixed mills, asphaltic concrete mills, CTB mills and high quality concrete mills (PQC) in U-Tapao International Airport area to facilitate construction operations, as well as to get quality construction components that can be used immediately. This is a backup area to construct other MRO in area 8 as shown in **Figure 2.3-1** Project area**,** which will not be constructed during the period of construction of the project. The location of the construction materials plant is as shown in Figure **Figure *2.10-4*** expanded layout showing of the arrangement as in **Figure 2.10-8**.

There is also a machinery repair plant (Car Parking Area) and there is an Oil Separetor in this area (position D) in **Figure 2.10-*4*** expanded layout showing of the arrangement as in **Figure 2.10-9**

In this regard, there are several areas for parking heavy machinery, such as grading, compactor, excavators, watercars, and paver for about 25-30 sets. There is a park in the area to construct the runways and driveways (position E) in **Figure 2.10-*4*** in order to be able to start work quickly in the morning. Each type of parking is shown in **Figure 2.10-*10***

2.5) Renovation of the area after construction by

When the construction is complete, the contractor company must improve the area after the construction by moving the project office, the construction materials out of the construction area, as well as reconditioning the area.

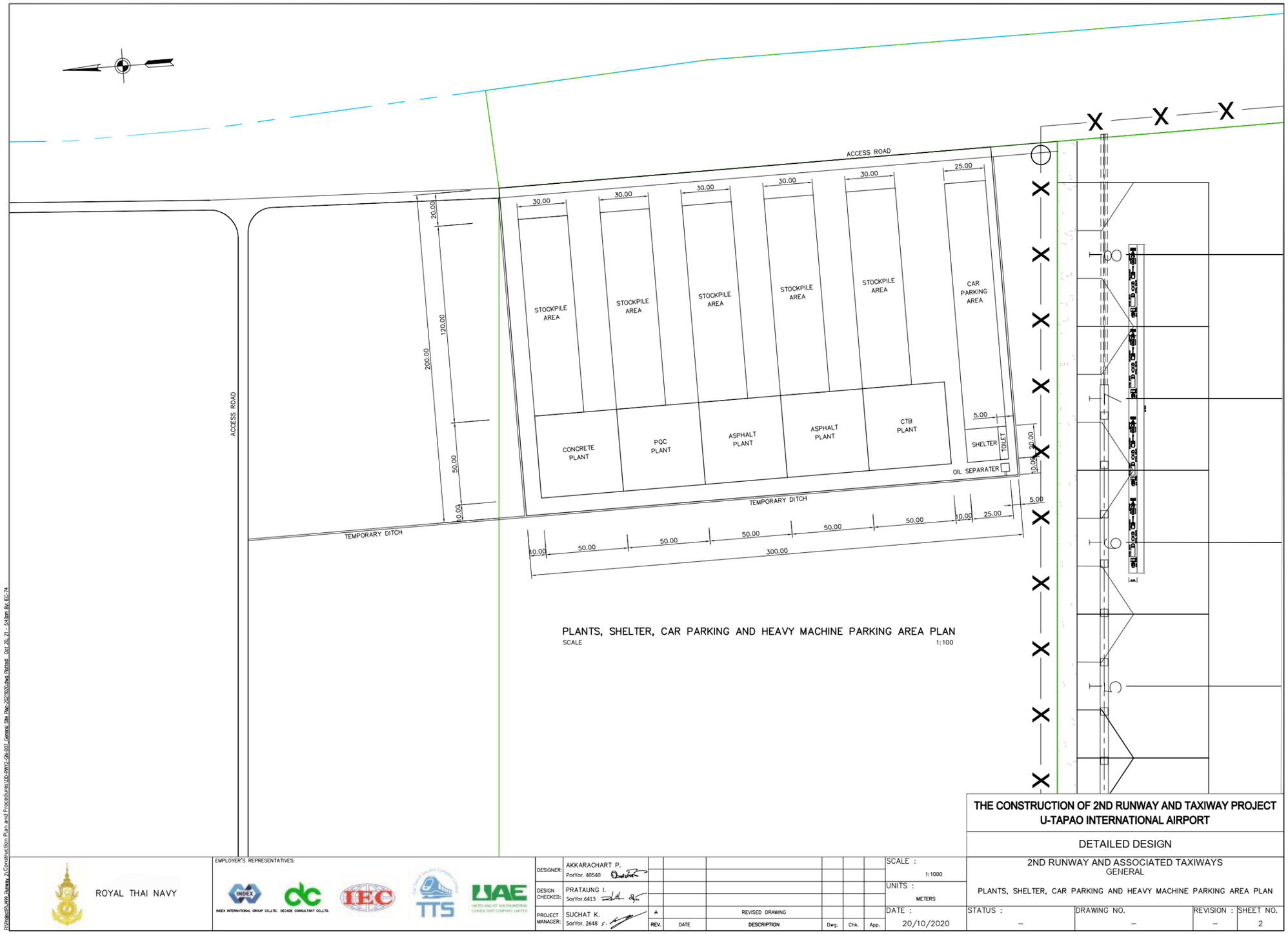


Figure 2.10 8 Location of pre-mixed concrete mills, asphaltic concrete mills, CTB mills and high quality concrete plants (PQC)

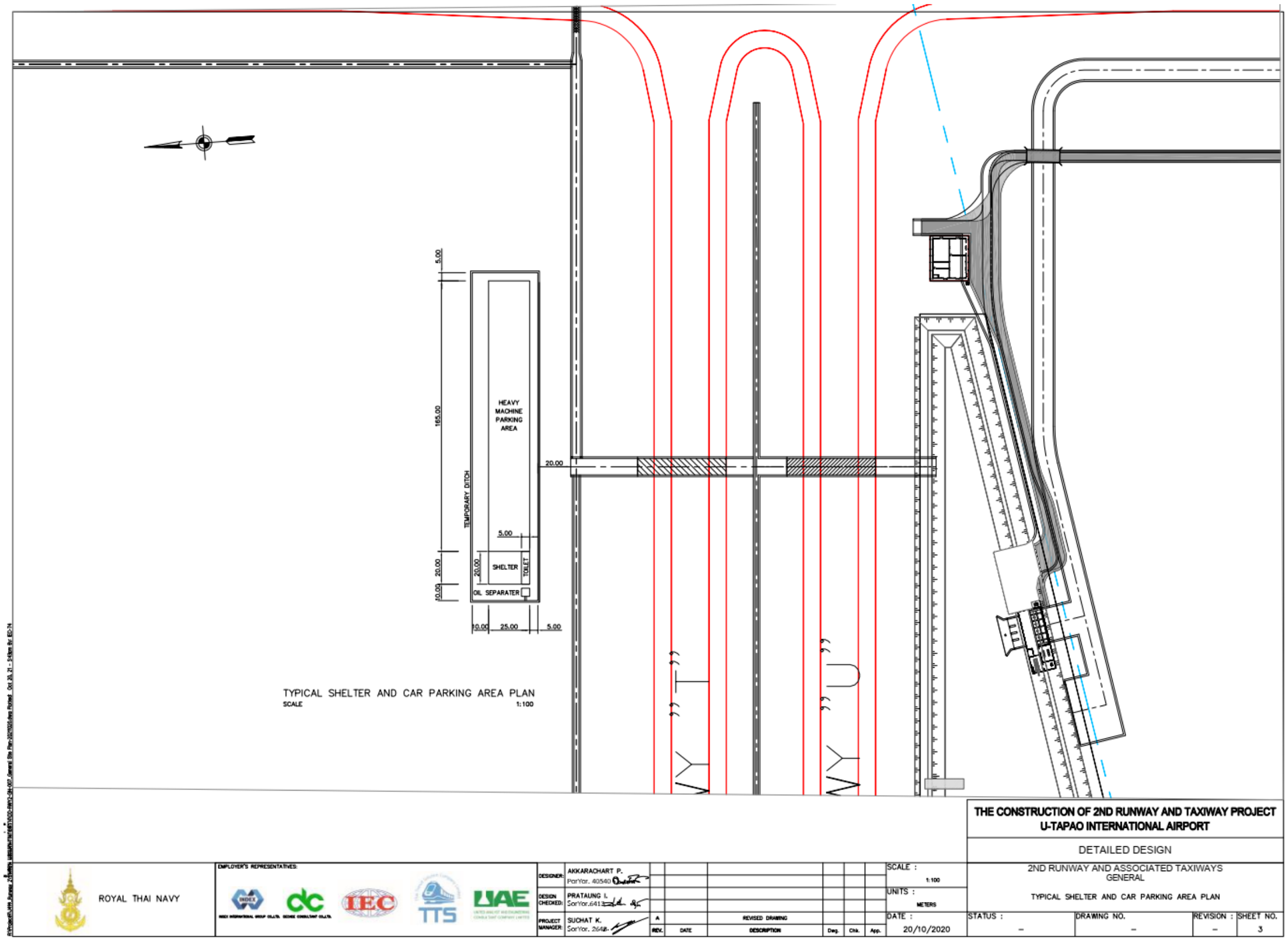


Figure 2.10 9 Machinery maintenance area

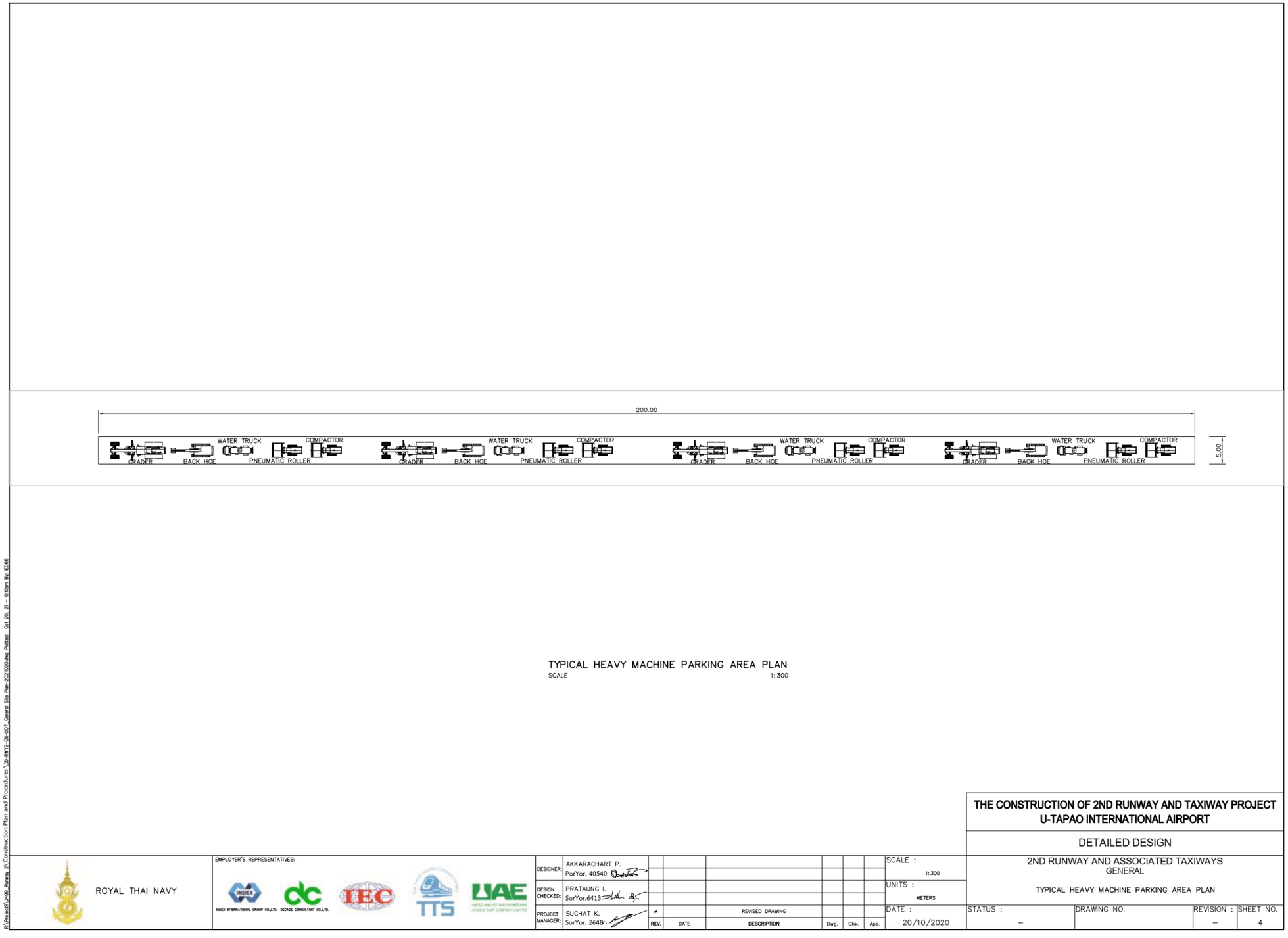


Figure 2.10 10 Parking of each type of machinery

In carrying out various activities in the construction area, the project has established measures to prevent and correct environmental impacts from the construction area, especially the impact on vision, convenience of entry and exit of the construction area, and various accidents that may occur from the work, including the impacts of oil and chemicals from repairing/maintaining machinery. The project therefore, has set measures to prevent and correct environmental impacts in the construction area as follows:

- Plan to define the detailed construction area boundary and must appropriately block in accordance with the construction contractor's ability to work and traffic conditions in order to use the construction area effectively and with minimal impact to the public.
- Establish installation of guardrails in the construction area appropriate to the work conditions and the area conditions.
- Establish installation of signs and traffic signals in accordance with the design and installation guidelines of symbols and signals of agencies related to the work, both during day and night.
- Soil piles and construction materials shall be kept as far as possible from the waterfront and must be covered with canvas or materials to protect against rain or wind stress. It must be ensured that the soil piles/construction materials piles will not be discharged into water sources, and that all transportation out of the area will be performed as quickly as possible after construction is complete.
- Equipment and machinery repair/maintenance facilities must be at least 200 meters away from water sources and in such areas, used oil drain containers (Spent Oil) must be prepared, as well as a simple waste water treatment system that can separate oil or fat and be collected in a 200 liters tank for disposal by the correct method or legally permitted company services.
- To prevent oil and chemical leaks used while building into water sources, dig and pour concrete floor around the reserved tank of oil and chemicals to collect oil and chemicals that may be leaking, while requiring operators to take precautions to transfer oil and chemicals to prevent leakage, to prevent contamination of oil and chemicals to soil and water sources.
- Construction contractors must pour concrete floor in areas where oil and fat leaks may occur in machinery maintenance areas with the activities of machinery maintenance, car washing yards, areas where fuel tank storage, oil and waste tank storage, by creating concrete floor, lifting the surrounding edge, and making continuous pipe between concrete floor and grease traps to collect leakage from concrete floor into the grease traps directly and draining the water that has been trapped to the combined waste water treatment system within the next construction area.

In this regard, the project requires a third party to monitor the project, both in terms of environmental impact and in terms of construction safety, in accordance with environmental prevention and correction measures, and measures in monitoring the environmental impact, both in the construction phase and in the operational period, as specified in the general measures of the project. Details are shown in the EIA 1 Form and set out in the contract as follows.

Third party for inspection of accident prevention and control in construction :

In order for construction work to be able to be carried out along with safety, occupational health and work environment, meaning that the actions or working conditions are free from incidents that could cause life, body, mind, or hygiene related to work, with issues to be considered, including:

- Inspection for construction contractors to prepare work safety plans for construction work
- Inspection of work safety plans for construction work shall include, at least,
  - Work safety oversight plan that complies with work safety laws
  - Work safety awareness training plan for employees who have work-related duties
  - Work safety promotion plan
  - Audit plan, analysis and accident reports
- Auditing the results of work safety plans implementation
- Auditing the work safety management system of the project, which must include at least
  - Safety, Occupational Health and Work Environment Policy
  - Safety, Occupational Health and Work Environment Management Structure
  - Safety, Occupational health, and Work environment plans and implementation
  - Evaluation and review of the management of safety, occupational health, and work environment
  - Actions to improve safety, occupational health, and the work environment
  - To allow construction contractors to improve and develop work safety management systems
- Inspections for the construction contractor to prepare details of the “work safety management system” which comply with relevant laws/regulations and conditions/contract requirements and can actually perform, with important requirements comprising:
  - Determining Safety, Occupational Health and Work Environment Policies
  - Organization for Safety, Occupational Health and Work Environment, including Responsibilities
  - Laws and related requirements
  - Training on Safety, Occupational Health and the Work Environment
  - Determining preventive measures and controlling hazards
  - Construction safety inspection
  - Establishing safety rules for construction work
  - Control, Safety, Occupational Health and the work environment of sub-contractor
  - Auditing and monitoring operations
  - Accident reporting and investigations and analysis of accidents

- Promotion of Safety, Occupational Health, and Work Environment
- First aid
- Emergency Planning
- Management and storage of relevant documents

Third Party for monitoring environmental measures compliance: As part of the project's environmental management plan, the construction contractor must propose a work plan for the environment that is specified as the contractor's responsibility for carrying out the work and responsibility, both in the pre-construction phase and in the construction phase, to be in accordance with the details specified in the reviewed environmental impact assessment report, which is a part of work environment management plan of the project by which the construction contractor must hire Third Party to monitor the environmental impact according to preventive and corrective measures and environmental impact monitoring measures, and prepare a summary report of environmental impact prevention measures and environmental impact monitoring outcomes measures proposed to RTN and EECO, in accordance with the schedule throughout the construction period of the project. It is required that the construction contractor/concessions make the document or report by inspection or certification by an individual or a legal entity as specified in the Ministerial Regulation.

3) Workers accommodation

The establishment of the construction worker accommodation for the project has the following criteria:

In construction of the project, there will be a maximum number of 2,890 construction workers and construction supervisors (2,654 are construction workers and 236 are construction supervisors). All workers live outside the U-Tapao International Airport area and have shuttle service. Therefore, the construction area has only construction supervisors and temporary worker accommodation (lunch break).

The area where workers' accommodation will be constructed (overnight stay), projecthas specified criteria and measures to prevent and correct the impacts of construction workers' accommodation on nearby communities as follows:

- The project will require contractor to select only legitimate workers (in the case of foreign labors).
- The workers are not allowed to rest in the project area, but there will be no more than 5 workers in charge of the night time store control.
- Have the head of the workers supervise the construction workers to avoid causing trouble for neighboring residents.
- Requiring security officers to take care of entering and exiting the construction area, with construction workers being able to leave the construction area only when permitted
- Specify clear and decisive penalties for violations of regulations

At present, the project has not yet selected and hired the contractor, therefore, it is not possible to specify the clear workers' accommodation position. However, the project will require the construction contractor to design temporary buildings for construction workers to comply with the standards and construction drawings for temporary buildings for construction workers of the Engineering Institute of Thailand under the Royal Patronage(Standard No. WorSorTor. 1010-34), which has the following details:

2.1) Workplace layout

- There must be fences around the area and there is one entrance-exit gate.
- There must be a guard with a guardhouse in the entrance - exit area for security and check entry -exit at all times.
- Provide electric lighting at night, sufficiently illuminate the surrounding area
- There must be a system for disposing of solid waste, both wet and dry systems.

2.2) Accommodation building of construction workers

- There should be no less than 1,327 workers' accommodation (The occupancy rate is 2 people per room.).
- The area of the workers' accommodation must have a proportional fence.
- Inside the workers' accommodation area, toilets, laundry stations and shops must be provided.
- The workers' accommodation building must be raised to the ground level not more than 1 meter high and not planted on a marsh, stagnant water or land reclaimed with solid waste, except that it will be filled with soil with a thickness of 30 centimeters. The workers' accommodation building must be stable and the appearance is not harmful to the residents..
- The occupancy room shall be at least 2.4 meters wide or length, not less than 9 square meters for 1 family (2 adults and 3 small children) and no less than 5.5 square meters for double rooms, and with at least 10 percent vents of the space.
- Keep at least 1 door and window in each room.
- The inside passage for residence must be at least 1 meter wide and have clear light.
- The vertical distance to the top of the floor or the top of the building must not be less than 3 meters.
- The width of the ladder must not be less than 90 meters. A range of heights not more than 3 meters, taller than 20 centimeters, and up to 22 centimeters.
- The building's foundation must be permanent and stable enough to safely support the load.
- There must be adequate drainage for the rainwater and before releasing to public drainage, a waste trap must be in place for inspection.

- There must be 1 set of lamps and plugs in the working room and the electrical system must bein a safe manner.
- Prepare at least 1 set/building of hand-held dry extinguishers or install within the distance not less than 45 meters.

2.3) Bathroom-Toilet Building of construction workers

- There must be a hygienic toilet for accommodation at a ratio of no less than 1 room to 20 persons.
- There must be a total bathroom area and laundry yard for residential workers at a ratio of not less than 7 square meters per 20 workers.
- The size of the toilet must have an internal area of not less than 0.9 square meters and an internal width of not less than 0.9 meters.
- There must be enough water wells or water tanks, taps to allow bathing and washing clothes.
- There must be a used water drainage trough that can easily and sufficiently flow before releasing to public drainage. The waste trap must be in the inspection area.
- The waste water treatment from the toilet must be carried out hygienically before releasing overflow water into the public waterway.
- Electricity in toilets and bathrooms must be adequately illuminated.

In this regard, the layout of the workers' accommodation follows standard, which may be changed as appropriate, of the area that will be the workers' accommodations in the future. However, it must be in accordance with standard and construction drawings for temporary buildings for construction workers of the Engineering Institute of Thailand under the Royal Patronage of H.M.(standard of WorSorTor. 1010-34)

In addition, the project must control and supervise the workers' accommodation to be in a calm place so that it does not adversely affect the trouble of neighboring communities by establishing measures to prevent and correct potential impacts to nearby areas, as follows:

1) Install a signboard in front of the workers' accommodatio by specifying the contractor company, contractor/supervisor name with contact telephone number so that nearby occupants in the workers' accommodation area are informed, and can contact the contractor/supervisor directly in the event that there is a trouble from the workers' accommodation.

2) Have the head of the workers in charge of the construction workers to avoid causing trouble for the neighbors.

3) Issue regulations on working within workes' accommodation to avoid impacts to nearby residents as follows:

- Do not cause fires before they are permitted to prevent fire.
- Do not play any kind of gambling to prevent the possibility of assemblage and quarrel.
- Do not sell any type of drug or possess for the safety of workers and nearby residents.

- Do not make loud noises to disturb other people.
- Do not quarrel under any circumstances for peace and order in the area of the workers' accommodation. If there is a quarrel, it is considered leaving both parties.
- Do not steal. If theft occurs, lawsuits may be brought.
- Do not use outsiders to rest in the worker housing area without permission. For order and safety in the worker housing area.
- Do not feed any animals.

4) Strictly control compliance and clearly impose penalties by taking decisive action with violating person.

5) Encourage workers to maintain cleanliness in the construction worker's accommodation.

In addition to the above measures, the project focuses on the selection of construction workers, which will not affect the adjacent communities as follows:

- The construction contractor shall select and check the workers' history who will be recruited for the project for accuracy. In accordance with the law, the construction worker history registration is prepared with photos in the project office. When there is a problem or a complaint, the investigation can be called immediately.
- Hiring of labor or supporting local businesses is required.
- Prepare construction workers' accommodation appropriately and with a clear proportion, as well as establishing control measures for the construction area and workers' accommodation to prevent the workers from causing problems and trouble, for example, do not play gambling, do not use illegal drugs, do not cause noise, etc., with strict penalties.
- Provide watchmen to maintain order and take care of tidiness in the construction area or workers' accommodation area at all times, and have the head of the workers to monitor and control the behavior of the construction workers to help alleviate public safety concerns, such as criminal problems, theft problems, etc.

In this regard, the study has established public health, occupational health and safety measures related to the supervision of contractor at the construction workers' accommodation to control and prevent communicable diseases as follows:

- Requiring health check-up and notifying workers list with their health history before working to the local health department
- Direct the contractor to provide knowledge and advice to the workers regarding good hygiene practices, cleanliness and protection of contact diseases by asking for assistance from public health facilities in project areas, such as hospitals, public health services, and should begin at the beginning of construction.
- require the contractor to strictly comply with laws, notices and regulations related to the control and prevention of communicable diseases, such as Public Health Act Communicable diseases act, including complying with public health measures to control the outbreak of infectious

diseases with public health urgency, such as coronavirus (SARS-CoV, Covid-19), bird flu, Influenza 2009 by complying with both national and international laws and regulations, such as (1) Infectious Diseases Act 2015; (2) Annoucement of the Department of Public Health on the Regulations, Procedures, and Prevention of Risk from coronavirus disease 2019 (COVID-19) for government sites, private workplaces and business establishments in 2020 (3) Announcement of the Department of Health on the Criteria, Procedures, and Prevention of Risk from Coronavirus Disease 2019 (COVID19) for public transport service providers in 2020 (4) Suspected comunicable disease universal precaution Kit (IATA, 2017), (5) Communicable disease surveillance and response systems: Guide to monitoring and evaluating (WHO, 2006)

- There shall be regulations for the prevention and disposal of disease carrier. For the construction workers' accommodation, to prevent the breeding of the disease carrier and the spread of infectious diseases, and strictly supervise.
- The Contractor is required to prepare a plan for the prevention of communicable diseases in the construction workers' accommodation areas proposed to RTN and EECO.
- Required RTN and EECO to coordinate with local public health agencies to plan the implementation and prevention of environmental and health problems in the construction workers' accommodation area of the project.
- Inform the local public health agencies of the activities, number of workers, and duration of work.
- Prepare media and promote communication channel with RTN and EECO, send to public health agencies for acknowledgement and record details of activities related to supporting public health agencies health agencies.
- There are regulations for the prevention and disposal of disease carrier. For the construction workers' accommodation, it is used to prevent the breeding of disease carrier and the spread of infectious diseases, and it must be strictly monitored.
- Schedule of periodic sanitation inspections from time to time by working with public health officials, local administrative organisations,
- Cooperation with prevention, vaccination, or eliminating carrier sources at the time of the outbreak or when requested by public health authorities

2.1) Management of public utility systems

Provide adequate public utility systems and public facilities for workers staying in workers' accommodation areas, such as drainage systems, electrical systems, water systems, waste water treatment systems, waste management, fire prevention and protection systems as follows:

- The drainage system must have a rainwater drain and a used drain trough to allow sufficient flow before releasing to public drainage areas. And a waste trap must be in the inspected area.

- Electrical system provides enough power to meet the demand for use. The B.Grimm Power Public Company Limited's system construction plan, which will be completed in 2021, will also provide electricity for the duration of construction of the project. However, if the

project starts to build before the power plant is finished, the contractor can request electricity from the electricity business, Royal Thai Navy Welfare Concession.

- Water system used to provide adequate water ponds or water storage tanks and faucets for use, and provide adequate water usage for workers' consumption in the area of workers' accommodation, with the following estimates of water usage at each phase of construction:

Phase 1 As the construction phase 1 has a maximum number of 2,654 workers, the worker accommodation is divided into 2 places, supporting 1,327 workers each, with the following details:

Total water consumption for workers in phase 1 is approximately 398 cubic meters per day (water usage rate for workers in worker's accommodation is 150 liters per person per day according to the rate of water usage for temporary workers' accommodation, [redacted], public water engineering, 1993). The project has provided a reserved water storage tank that can be stored for 3 days, with no less than 1,194 cubic meters. In case of non-flow water supply, there is a requirement of 120 water storage tanks of 10 cubic meters in construction supervision office, which can reserve water volume adequately.

Water consumption of workers in phase 1 (per site) will be approximately 199 cubic meters per day (water usage rate of workers in the accommodation of 150 liters per worker per day according to the rate of use of the temporary rental accommodation, [redacted], water engineering, 1993). The project will provide a reserved water storage tank that can be used for reserving water for 3 days, no less than 597 cubic meters, in case of non-flow water supply , there is requirement of 60 water storage tanks of 10 cubic meters construction supervision office, which can reserve water volume adequately.

Phase 2 The water consumption will be approximately 122.0 cubic meters per day (water usage rate of 150 liters of workers in worker's accommodation per day according to the rate of temporary rental accommodation water use, [redacted], water engineering, 1993). The project has provided a reserved water storage tank that can be stored for 3 days, with no less than 366.0 cubic meters. In case of non-flow water supply, there is a requirement of 37 water storage tank of 10 cubic meters in construction supervision office, which can reserve water volume adequately.

Phase 3 The water consumption will be approximately 225.6 cubic meters per day (water usage rate of 150 liters per workers' accommodation per day according to the water usage rate of the temporary rental accommodation, [redacted], water engineering, 1993). The project will provide a reserved water tank that can be stored for 3 days, with no less than 676.8.8 cubic meters. In case of non-flow water supply, there is a requirement of 68 water storage tank with 10 cubic meters in construction supervision office, which can reserve water volume adequately.

During the construction phase, it is possible to purchase public water supply from the area surrounding the project, such as Provincial Waterworks Authority Rayong Branch, Ban Chang Branch and Pak Nam Prasae Branch. The water supply closest to the project area is the Provincial Waterworks Authority, Ban Chang branch. When considering the statistical data of water users, volume of production and distribution of the Provincial Waterworks Authority Branches of Rayong, the amount

of water produced exceeds the amount of water sold which is sufficient for distribution for the consumption of construction workers

- waste water management, provide a bathroom sanitary toilets for workers to be sufficient for construction workers in the ratio of not less than 1 room per 20 people, and waste water treatment from toilets must be hygienic before being released into public drainage. The waste water generated from construction workers' accommodation comes from daily activities. The daily life of construction workers, such as waste water from washing tools and construction equipment. washing and other sewage water mainly from the toilet. It is estimated that the amount of waste water will occur approximately 80 percent of the amount of water used. (Pollution Control Department Designers and manufacturers of sewage systems attached to the manual, Volume 2, Wiang Kaew Printing, 1994). The amount of waste water generated in each construction phase is as follows:

Phase 1 As the construction phase 1 has a maximum number of 2,654 workers, the workers' accommodation is divided into 2 places, supporting 1,327 workers each, with the following details:

The total amount of waste water for the worker in phase 1 is approximately 318 cubic meters per day and must be effective in treating no more than 20 milligrams per liter. The project has defined 32 prefabricated waste water treatment tank of 10 cubic meters and must provide effluent manhole that can store waste water for 1 day before draining into the public drain trough. The project has specified effluent manhole with a minimum size of 318 cubic meters.

The total amount of waste water for workers in phase 1 (per site) is approximately 159 cubic meters per day and must be effective in treating the waste water with BOD values no more than 20 milligrams per liter of drainage. The project has determined that there will be 16 prefabricated waste water treatment tanks of 10 cubic meters and must provide effluent manhole that can accommodate waste water for one day before discharging it into a public drainage trough. The project has determined that the effluent manhole size is not less than 159 cubic meters.

Phase 2 The water volume will be approximately 97.6 cubic meters per day and must be effective in treating the waste water with BOD values no more than 20 milligrams per liter of drainage. The project has determined that there will be 10 prefabricated waste water treatment tanks of 10 cubic meters and must provide effluent manhole that can accommodate waste water for one day before discharging it into a public drainage trough. The project has determined that the effluent manhole size is not less than 97.6 cubic meters.

Phase 3 The waste water volume will be approximately 180.5 cubic meters per day and must be effective in treating the waste water with BOD values no more than 20 milligrams per liter of drainage. The project has determined that there will be 19 prefabricated waste water treatment tanks of 10 cubic meters and must provide effluent manhole that can accommodate waste water for one day before discharging it into a public drainage trough. The project has determined that the effluent manhole size is not less than 180.5 cubic meters.

- Solid waste management by placing enough solid waste containers from the workers' activities that occur within the project, divided into 2 types according to the nature of the activity, namely:

- General solid waste, such as food scraps, paper scraps, and plastic scraps. Placing enough solid waste bins from the workers' activities. The rate of solid waste generated from the workers' accommodation is 0.71 kilogram per worker per day (153.57 kilograms of solid waste per cubic meter) (Thares Srisathit, 2004). The amount of solid waste occurs at 2,052 kilograms per day.

- Construction materials scraps, namely brick, cement, wood scrap, grout bags, and metal scraps that occur each day.The contractor will conduct the necessary segregation and not dismantle the materials in the area by moving them out of the area.

The amount of solid waste generated during each construction phase is as follows:

Phase 1 As the construction phase 1 has a maximum number of 2,654 workers, the workers' accommodation is divided into 2 workers, supporting 1,327 workers each, with the following details:

The total amount of waste for the worker's accommodation in phase 1 is approximately 1,884 kilograms per day. Construction contractor must provide 31 dry waste bins of 200 liters and 31 wet waste bins of 200 liters placed at various points, which is sufficient, and provide the total waste bins that can support solid waste for at least 3 days, with a capacity of no less than 37 cubic meters.

The total amount of waste for the worker's accommodation in phase 1 (per site) is approximately 942 kilograms per day. The construction contractor must provide 16 dry waste bin of 200-liter and 16 wet waste bin of 200-liter placed at various points, which is sufficient, and provide the total waste bins that can support the waste for at least 3 days, with a capacity of no less than 18.4 cubic meters.

Phase 2: The amount of solid waste generated is approximately 577 kilograms per day. The construction contractor must provide 10 dry waste bin of 200-liters and 10 wet waste bin of 200-liters, placed at a sufficient number of points, and provide a total storage area that can support for solid waste for at least 3 days, with a capacity of no less than 11.3 cubic meters.

Phase 3: The amount of solid waste generated is approximately 1,068 kilograms per day. Construction contractors must provide 18 dry waste bin of 200-liters and 18 wet waste bin of 200-liters placed at various points, which are sufficient, and provide total waste storage that can support solid waste for at least 3 days, with a capacity of no less than 20.9 cubic meters.

2.2) Safety Management

In order to prevent the issue of quarrel and conflict between the construction workers and people living in the area, the contractor must specify preventive measures in the form of entry and exit control, and specify rules for directing, supervising, and controlling the workers' conduct, namely:

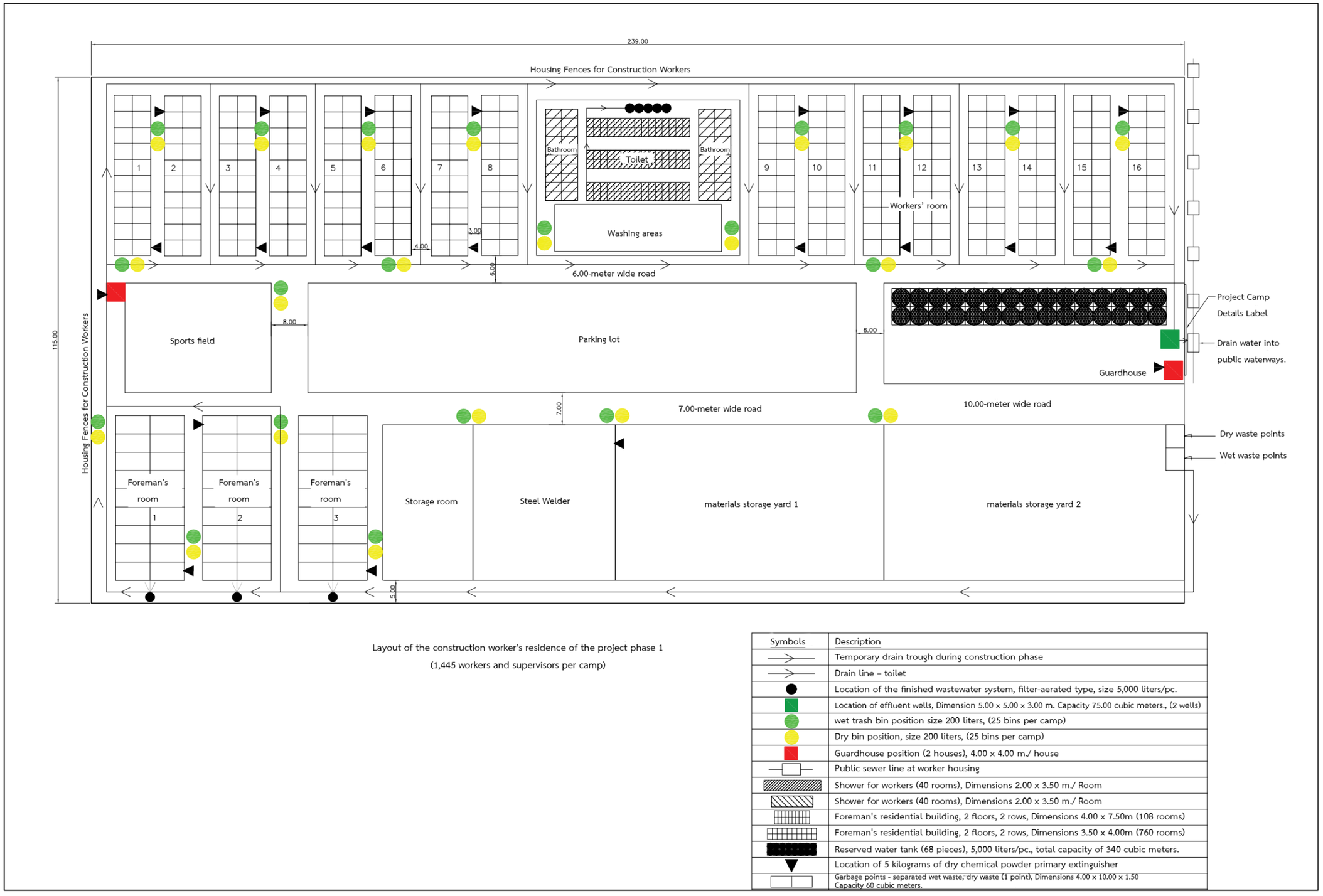
- Check the history of all construction workers working at the airport and stay at the workers' accommodation with the Royal Police Office. If it was found that there is a criminal record and investigated as serious. It is strictly forbidden to recruit for work to prevent sabotage and crimes
- Surround the workers' accommodation and control access and use one way for entry or exit for security convenience.
- Arrange for security personnel to enforce 24 hours access control at the entry-exit point, and set the time to open and close of the gate.
- Prepare a list of workers' names, addresses living in workers' accommodation areas.
- Provide enough electricity, night light in areas.
- Closely supervise workers' behavior so that they do not cause trouble for people in the area, including determining penalties for workers violating, and not complying with prescribed regulations.
- Coordinate with local police officers to help monitor the behavior and orderliness of construction workers.

2.3) Renovation of the area after construction

When the construction is complete, the contractor company is required to move or dismantle the construction workers' accommodation from the area as well as recalibrate the area as before.

In consideration of the construction area for workers, the construction contractor may consider workers' accommodation in other areas as appropriate. Initial layout of the construction workers' accommodation area for Phase 1 through Phase 3 is shown in **Figure 2.10-11** to **Figure 2.10-**13. Also, the construction workers' accommodation extension layout is shown in **Figure 2.10-**14

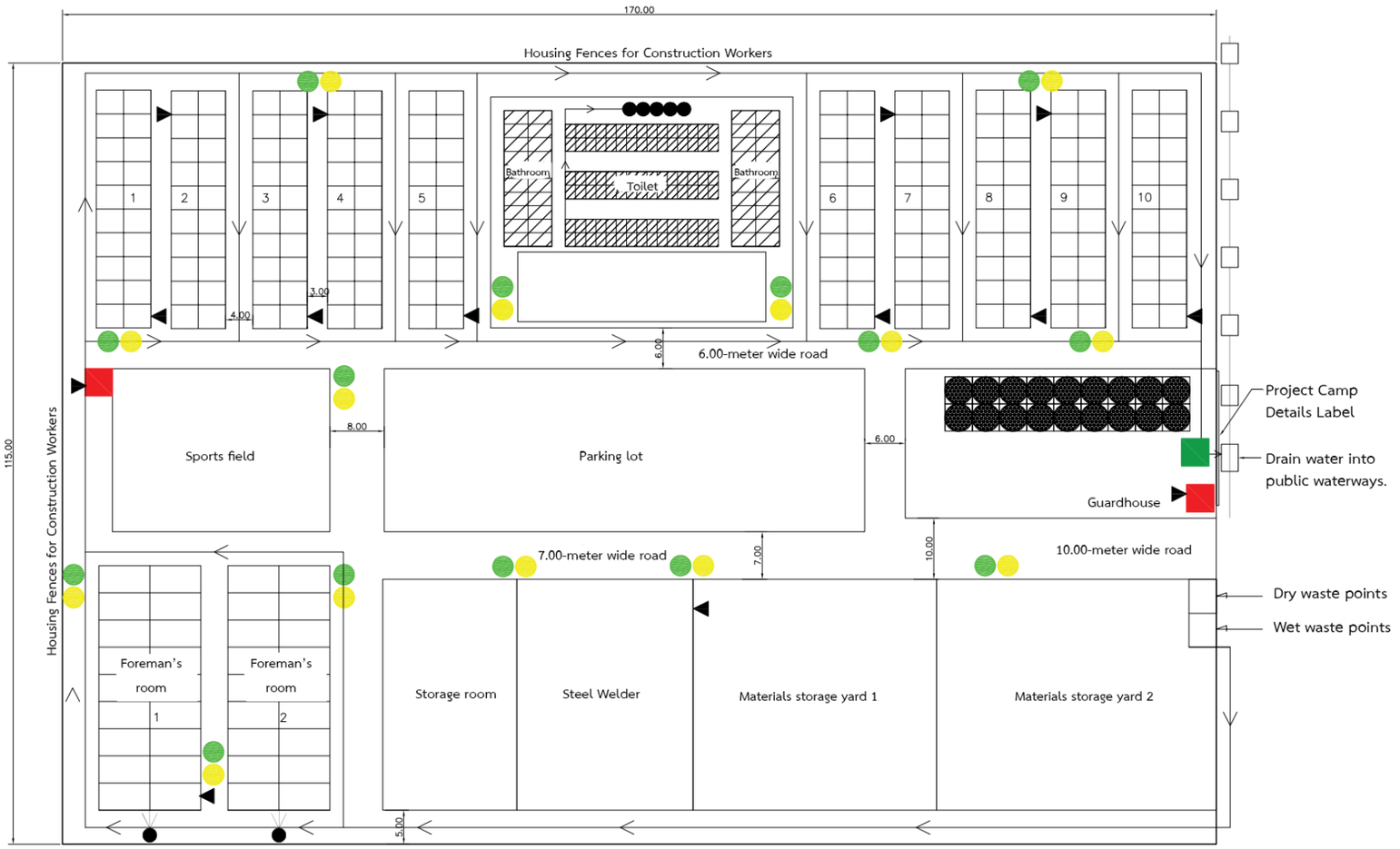
The environmental management of the construction supervision office and workers' accommodation areas can be summarized as shown in **Table 2.10-1**



Layout of the construction worker's residence of the project phase 1
(1,445 workers and supervisors per camp)

Source: Consultant on the design of the construction project of the runway and driveway 2, U-Tapao International Airport, Ban Chang District, Rayong, 2021

Figure 2.10 11 Project Construction workers' accommodation area layout of Phase 1

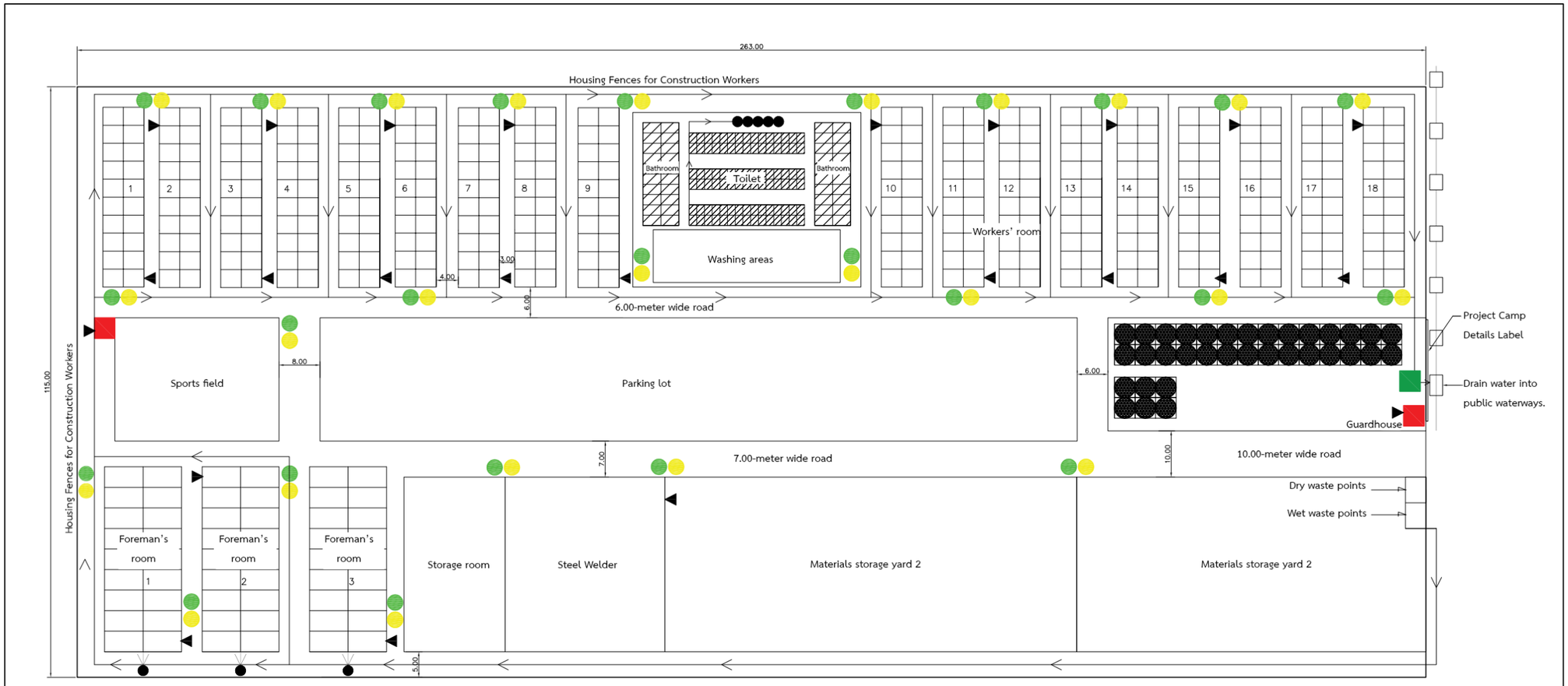


Layout of the construction worker's residence of the project, phase 2
(822 workers and supervisors per camp)

Symbols	Description
	Temporary drain trough during construction phase
	Drain line – toilet
	Location of the finished wastewater system, filter-aerated type, size 5,000 liters/pc.
	Location of effluent wells, Dimension 5.00 x 5.00 x 3.00 m. Capacity 75.00 cubic meters., (2 wells)
	wet trash bin position size 200 liters, (25 bins per camp)
	Dry bin position, size 200 liters, (25 bins per camp)
	Guardhouse position (2 houses), 4.00 x 4.00 m./ house
	Public sewer line at worker housing
	Shower for workers (40 rooms), Dimensions 2.00 x 3.50 m./ Room
	Shower for workers (40 rooms), Dimensions 2.00 x 3.50 m./ Room
	Foreman's residential building, 2 floors, 2 rows, Dimensions 4.00 x 7.50m (108 rooms)
	Foreman's residential building, 2 floors, 2 rows, Dimensions 3.50 x 4.00m (760 rooms)
	Reserved water tank (68 pieces), 5,000 liters/pc., total capacity of 340 cubic meters.
	Location of 5 kilograms of dry chemical powder primary extinguisher
	Garbage points - separated wet waste, dry waste (1 point), Dimensions 4.00 x 10.00 x 1.50 Capacity 60 cubic meters.

Source: Consultant on the design of the construction project of the runway and driveway 2, U-Tapao International Airport, Ban Chang District, Rayong, 2021

Figure 2.10 12 Project construction workers' accommodation area layout of Phase 2

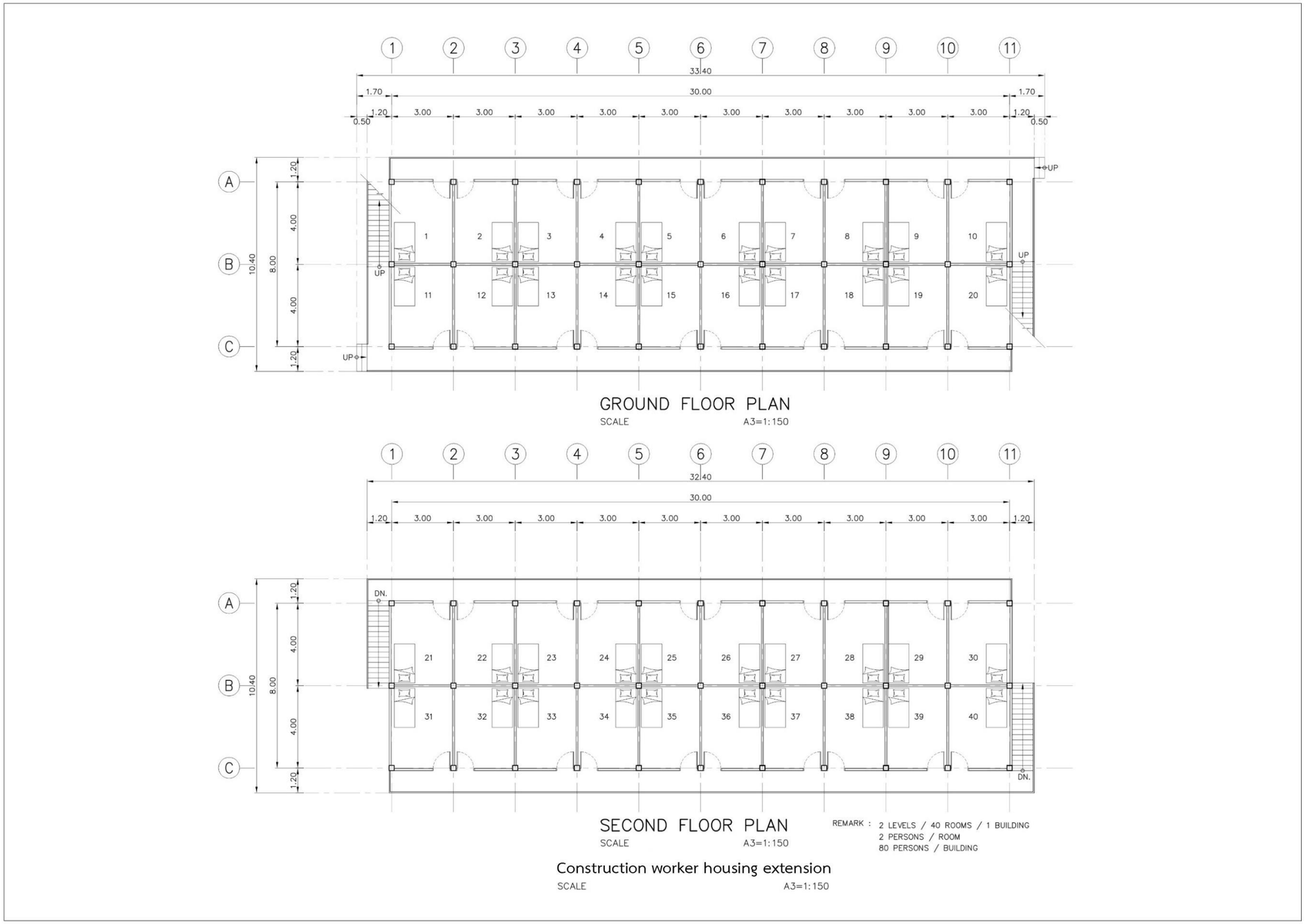


Layout of the construction worker's residence of the project phase 3
(Number of workers and supervisors 1,634 per camp)

Symbols	Description
	Temporary drain trough during construction phase
	Drain line – toilet
	Location of the finished wastewater system, filter-aerated type, size 5,000 liters/pc.
	Location of effluent wells, Dimension 5.00 x 5.00 x 3.00 m. Capacity 75.00 cubic meters., (2 wells)
	wet trash bin position size 200 liters, (25 bins per camp)
	Dry bin position, size 200 liters, (25 bins per camp)
	Guardhouse position (2 houses), 4.00 x 4.00 m./ house
	Public sewer line at worker housing
	Shower for workers (40 rooms), Dimensions 2.00 x 3.50 m./ Room
	Shower for workers (40 rooms), Dimensions 2.00 x 3.50 m./ Room
	Foreman's residential building, 2 floors, 2 rows, Dimensions 4.00 x 7.50m (108 rooms)
	Foreman's residential building, 2 floors, 2 rows, Dimensions 3.50 x 4.00m (760 rooms)
	Reserved water tank (68 pieces), 5,000 liters/pc., total capacity of 340 cubic meters.
	Location of 5 kilograms of dry chemical powder primary extinguisher
	Garbage points - separated wet waste, dry waste (1 point),
	Dimensions 4.00 x 10.00 x 1.50 Capacity 60 cubic meters.

Source: Consultant on the design of the construction project of the runway and driveway 2, U-Tapao International Airport, Ban Chang District, Rayong, 2021

Figure 2.10 13 Project construction workers' accommodation layout of Phase 3



Source: Consultant on the design of the construction project of the runway and driveway 2, U-Tapao International Airport, Ban Chang District, Rayong, 2021

Figure 2.10 14 Construction workers' accommodation extension layout

Table 2.10□1 Environmental Management of Construction supervision office and workers' accommodation

Issue	Description		
	Phase 1	Phase 2	Phase 3
1. Construction period	36 months	36 months	36 months
2. Number of construction workers and construction supervisors	2,890 persons - Construction workers: 2,654 workers - 236 Construction Supervisors	882 persons - Construction workers : 813 workers - 69 Construction Supervisors	1,634 persons - Construction workers: 1,504 workers - 130 Construction Supervisors
3. Workers' accommodation and construction supervision office	- Workers' accommodation : 2 places (1,327 workers/place) - Construction Supervision Office: 1 place for 236 persons	- Workers' accommodation : 1 place (813 persons) - Construction Supervision Office : 1 place (69 persons)	- Workers' accommodation : 1 place (1,504 persons) - Construction Supervision Office : 1 place (130 people)
4. sanitation Management Details			
■ Use of water during construction phase - Workers' accommodation, water usage rate for construction workers 150 liters/person/day - Construction Supervision Office charges the rate of water use in the construction office area of 70 liters/person/day (calculation as worst case that all workers enter the construction area simultaneously).	- Workers' accommodation 398 cubic meters/day (199 cubic meters/day/place) - Construction Supervision Office 202.3 cubic meters/day	- Workers' accommodation 122.0 cubic meters/day - Construction Supervision Office 61.7 cubic meters/day	- Workers' accommodation 225.6 cubic meters/day - Construction Supervision Office 114.4 cubic meters/day
■ 10 cubic meters of water storage tank (water reserved for 3 days)	- Workers' accommodation for 120 tanks (60 tanks/place) - Construction Supervision Office for 61 tanks	- Workers' accommodation for 37 tanks - Construction Supervision Office for 19 tanks	- Workers' accommodation for 68 tanks - Construction Superviision Office for 35 tanks

Table 2.10□1 Environmental Management of Construction supervision office and workers' accommodation

Issue	Description		
	Phase 1	Phase 2	Phase 3
5. waste water Management			
■ The amount of waste water that has occurred. (Calculated as 80% of the water used)	- Workers' accommodation 318 cubic meters/day (159 cubic meters/day/place) -Construction Supervision Office 161.8 cubic meters/day	-Workers' accommodation 97.6 cubic meters/day - Construction Supervision Office 49.4 cubic meters/day	- Workers' accommodation 180.5 cubic meters/day - Construction Supervision Office 91.5 cubic meters/day
■ 10 cubic meters of prefabricated waste water treatment tank	- Workers' accommodation for 32 tanks (16 tanks/place) - Construction Supervision Office for 17 tanks	- Workers' accommodation for 10 tanks - Construction Supervision Office for 5 Tanks	- Workers' accommodation for 19 tanks - Construction Supervision Office for 10 tanks
6. Solid waste management			
■ Maximum amount of solid waste - The workers' accommodation is calculated at a rate of solid waste generation of 0.71 kilograms/person/day, solid waste density of 153.57 kilograms per cubic meter. - The construction supervision office is calculated the rate of solid waste generation 0.44 kilograms/person/day, solid waste density of 118.39 kilograms per cubic meter.	- Workers' accommodation for 1,884 kilograms/day (942 kilograms/day/place) - Construction Supervision Office for 1,271.6 kilograms/day	- Workers' accommodation for 577 kilograms/day of workers - Construction Supervision Office 388.1 kilograms/day	- Workers' accommodation for 1,068 kilograms/day of workers - Construction Supervision Office for 719.0 kilograms/day
■ Number of solid waste bin with capacity of 200 liters	- Workers' accommodation for 62 tanks (32 tanks/place) - Construction Supervision Office for 54 tanks	- Workers' accommodation for 20 tanks - Construction Supervision Office for 18 tanks	- Workers' accommodation for 36 tanks - Construction Supervision Office for 32 tanks

2.10.3 Transportation of materials, equipment and construction workers

The quantity of materials, routes used for transportation, the types of cars used for transportation, and the volume of transportation for materials and construction workers are as follows:

2.10.3.1 *Quantity of construction materials*

Based on the assessment of the amount of materials used in construction, the runway 2, with a tunnel under the runway and parallel driveway, uses about 12,352,860 tons of soil, approximately 4,476,840 tons of crushed stone, about 2,315,700 tons of sand, about 705,100 tons of cement, and about 238,800 tons of steel bar,547,296tons of asphaltic concrete, total quantity of main materials that is required, totaling about 20,636,596 tons of materials.

Based on the construction activities that will take place in the project area, for 3 phases, estimate the volume of construction materials as shown in **Table 2.10-*2***

Table 2.10-2 Estimate the quantity of construction materials to be used in project areas.

Construction phase information	Phase 1 Year 2021-2023	Phase 2 Year 2030-2032	Phase 3 Year 2040-2042
Runway, driveway, tunnel work	12,352,860		
- Soil (tons)	4,476,840		
- Rock (tons)	2,315,700		
- Sand (tons)	705,100		
- Cement (tons)	238,800		
- Steel rod (tons)	547,296		
- Asphaltic concrete (tons)	**20,636,596**		
Total (tons)			
Additional work			
- Soil (tons)	4,972,500	1,989,164	2,739,539
- Rock (tons)	455,079	182,047	250,720
- Sand (tons)	910,158	364,093	501,440
- Cement (tons)	223,548	89,426	123,161
- Steel rod (tons)	41,782	16,714	23,019
Total (tons)	**6,603,066**	**2,641,445**	**3,637,879**
Total (tons)	**27,239,662**	**2,641,445**	**3,637,879**

Source: Consultant on the design of the construction project of the runway and driveway 2, U-Tapao International Airport, Ban Chang District, Rayong, 2021

2.10.3.2 *Sources of materials and routes used in transportation*

The project considers the main source of soil and rock from Khao Chi Chan (approximately 22 kilometres distance) by using ten-wheeler transportation to the area of the project, taking Highway 332 (Sattahip-Samnak Thon Route), cutting to Highway 3 (Sukhumvit Road), and entering the project area on the North entry-exit route, as well as other construction materials from the adjacent areas, namely:

- The soil/sandy soil materials sources that the project considered using in soil filling obtained from several sources are as follows:
- Kero Sand Pond, 21 kilometres from the materials sources to U-Tapao Airport
- Charothon Sand Pond 1 and 2, 21 kilometers from the materials source to U-Tapao Airport
- Mok Muk Mueang Sand Pond, 22 kilometres from the materials source to U-Tapao Airport
- Noppakao Sai Thong Sand Pond, 40 kilometers from the materials source to U-Tapao Airport
- ChokeBT soil pond, 40 kilometers from the materials source to U-Tapao Airport
- Garuna Panich soil pond, 43 kilometers from materials source to U-Tapao Airport

Note : sources of soil materials are subject to change.

Asphaltic work

Since the work of asphaltic concrete materials must be used in a large quantity per day, in the construction work, it is considered to determine the location of the production plant in the project area. Details are shown in **Section 2.10 Project Period Management (Sub-section 2.10.2)** and to increase production capacity from factories located in nearby areas such as Rayong. The characteristics and properties of engineering shall be determined by the contractors and operators. The measures shall be taken to maintain the characteristics and specifications of the engineering.

Concrete work

For concrete work, the pre-mixed concrete will be taken from the outside for use in the construction of some basic structures. After that, there will be a Concrete Plant in the project area to produce concrete in the construction. It is expected that the Concrete Plant will be located in the east, near the temporary entrances used for construction (as shown in **Figure 2.10-*4***). This means short transit time does not affect concrete quality.

In addition, the project reviewed the sources of materials from other sources for backup from Phetchaburi and Ratchaburi provinces, which will be transported by boat and brought to Koh Samet port, which will be transferred to the project area via a 10-wheel truck, by using highway 3126 and highway 3. Main road for transporting construction materials into the project area as shown in **Figure 2.10-15**

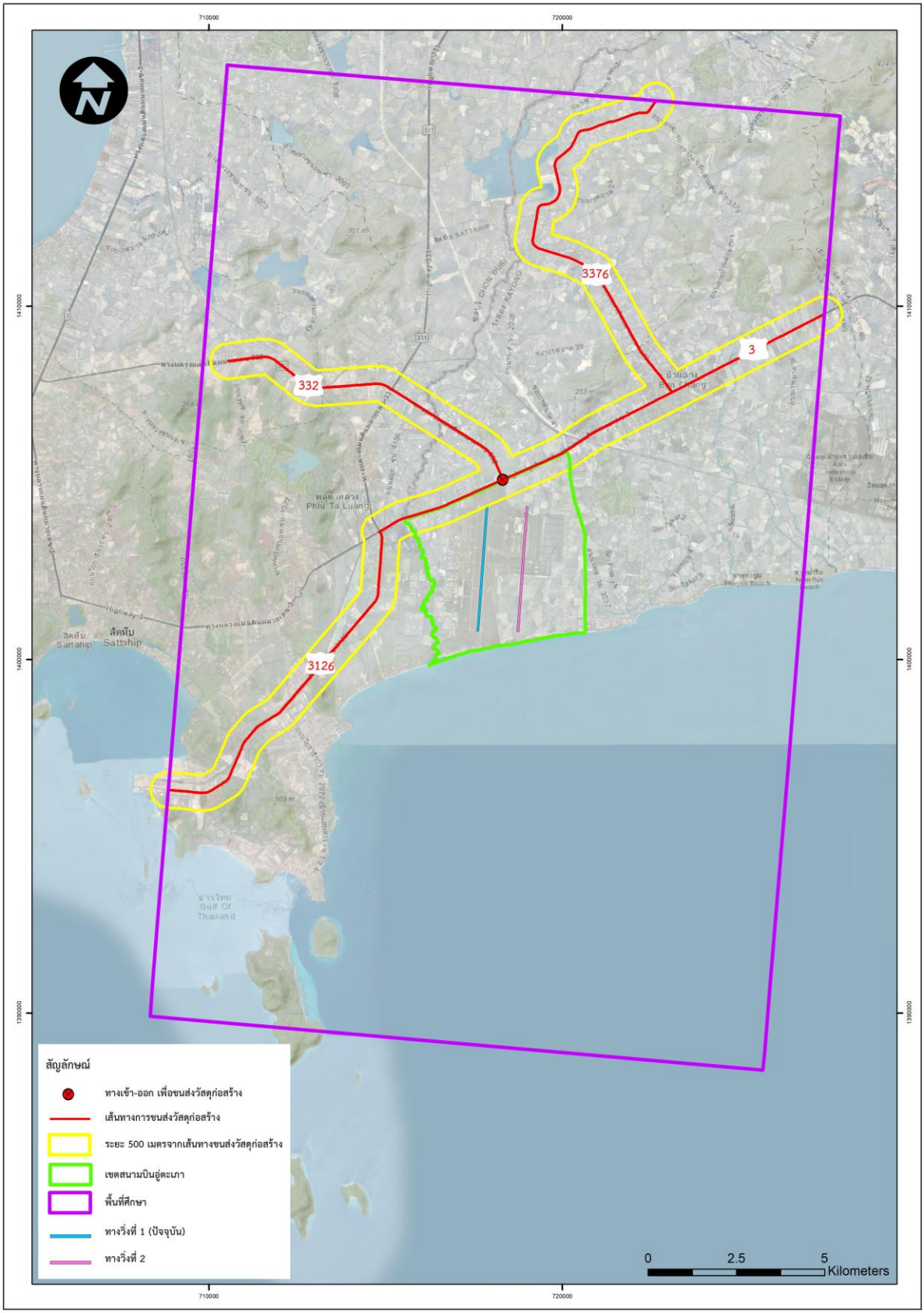


Figure 2.10 15 Main path for transporting construction materials into the project area

2.10.3.3 ***The type of car used for transportation.***

The transportation of construction materials from the project area consists of soil, rock, sand, and asphaltic concrete.All will be transported by 10-wheel truck, which is required by law to have a maximum net load of 25 tons (including the total truck weight), with a maximum load of 16 tons per truck. The cement and steel bars will be carried by 3 trailers, 18 wheels, with a maximum net load (including the total truck weight) of 47 tons, with a load limit of 30 tons and the truck speed is limited at no more than 60 kilometers per hour.

2.10.3.4 ***Quantity of materials transportation***

Construction phase 1, year 2021-2023 (3 years or 36 months)

Construction in phase 1 will consist of 2 parts, namely, part 1 is construction of runway 2 with tunnel under the runway and parallel driveway. The 6 types of main materials quantities required are soil, rock, sand, cement, steel bar and asphaltic concrete, with a total weight of approximately 20,636,596 tons. And part 2 is additional works. There are 5 types of construction materials, namely soil, rock, sand, cement and steel bar, with a total weight of about 6,603,066 tons. Thus, the total quantity of construction materials that must be transported in the construction phase 1 has a weight of about 27,239,662 tons.

Construction phase 2 year 2030-2032 (3 years or 36 months)

Construction in Phase 2 Main materials used aresoil, rock, and sand, transported by 10-wheel truck, rated at approximately 16 tons per truck-way, with total of 2,535,304 ton of all materials. Cement, and steel bar will be transported by 3-shaft trailer, 18 wheels, rated at approximately 30 tons per truck-way. The total quantity of both materials are at 106,140 tons

Construction Phase 3, Year 2583-2585 (3 Years or 36 Months)

Construction in Phase 3:Main materials used are soil, rock, and sand, transported by 10-wheel truck, rated with a load of approximately 16 tons per truck-way, with the total volume of 3 types of materials 3 is 3,491,699 tons. Cement, and steel bar will be transported by 3-shaft trailer, 18 wheels, rated with a load of about 30 tons per truck-way. The total quantity of both materials are in total volume of 146,180 tons.

The transportation is scheduled for 10 hours per day, during day hours, between 9am and 6pm (7 hours), 6pm and 9pm (3 hours) at night. This would avoid impacts on traffic volume during peak hours. Therefore, there would be an approximate amount of 93 materials vehicles per hour (round trip).

The main road that the project used as materials transportation channel into the project area is Highway 3 (Sukhumvit Road) 332 (Sattahip-Samnak thon Route) and 3126 (Phlu Ta Luang - Samaesarn).

Safety management for construction materials transportation both inside and outside the airport: The project required measures during construction to reduce the impacts of traffic by having a manual on Uniform Traffic Control Device (MUTCD) in the United States. It specifies that the Taper range is used while reducing enough traffic lanes and in accordance with speed, so that traffic through the construction area can be easily accessed without any accidents. It emphasizes safety, both inside and outside the airport, which will reduce traffic impacts to the people who have a need to pass through the construction area with the main goal to maintain traffic as smooth as possible compared to the normal conditions by requiring the contractor to proceed as follows,

- Plan to define the area boundary of construction that must be appropriately blocked in accordance with the ability of the construction contractor and traffic conditions to effectively use of that construction area and have the least impact on the public.
- Establish installation of guardrails in the construction area appropriate to the work conditions and the area conditions.
- Arrange for installation of traffic signs and signals in accordance with the design and installation guidelines of symbols and signals of agencies related to work under the contract, both during day and night.
- For high traffic volume roads, installation of temporary traffic signs should be made into reflective signs.
- Provide a detour or expand the road surface to replace the lost road surface.
- Plan the transportation of construction materials and construction machinery appropriately by avoiding rush hour operations.
- Check the condition of the construction contractors' vehicles used during the construction to prevent damage to those vehicles while in use and obstruct traffic.
- Oversees the drivers of construction contractors who enter the construction area to drive with caution and comply with traffic rules to prevent accidents.
- Have a traffic officer to facilitate while there is a vehicle entry and exit of the construction area. The staff must dress and have personal safety equipment. The sample is shown in **Figure 2.10-*16***

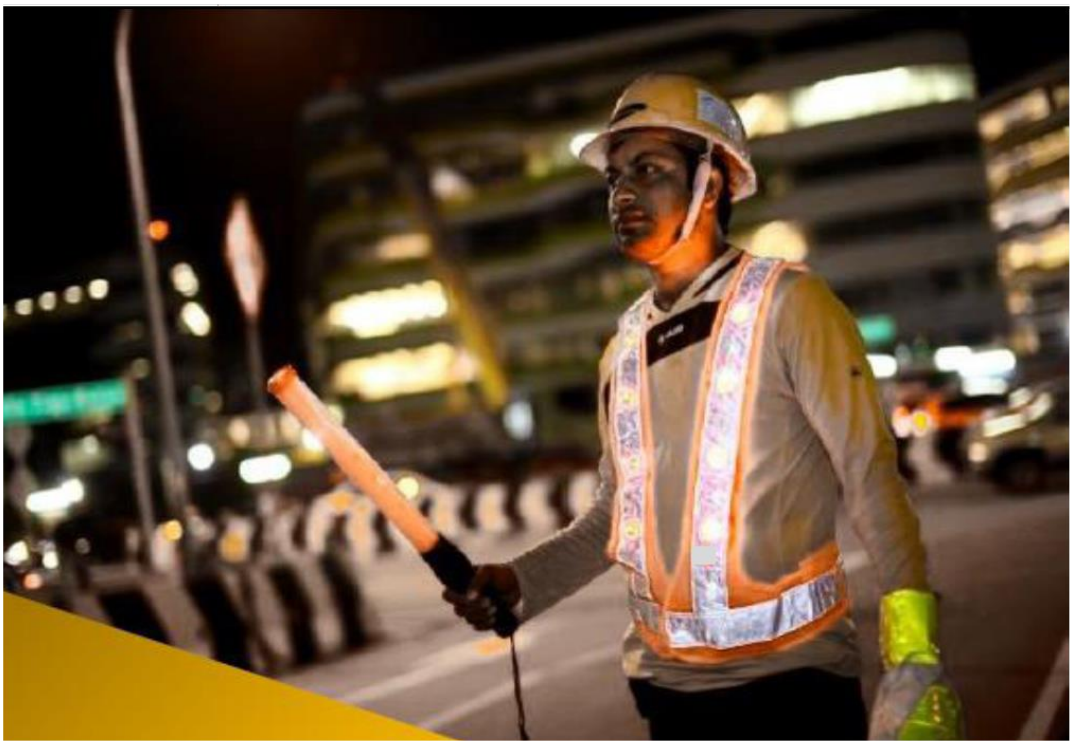


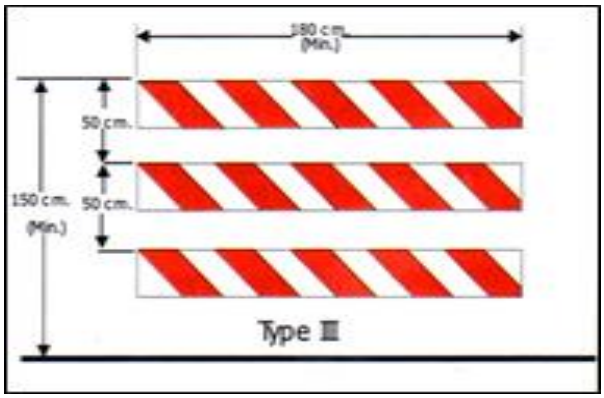
Figure 2.10-16 Example of dress code with personal safety equipment for traffic personnel

Most construction work will be conducted in construction areas, except in some cases such as transporting construction materials, moving machinery into the construction area and bringing concrete mixers into the work area, there needs to be more traffic disturbances than usual, but it will be a short period of time. Considering the necessity of work, urgent work requirements and traffic conditions, managing in the area of construction, cutting off areas and on Sukhumvit Road, the points must be cut through traffic areas outside the project. Therefore, there must be traffic arrangements during construction period by considering of convenience and safety of people using the route. Enough temporary traffic signs and light signals need to be prepared in accordance with work and locate them in right and safe positions.

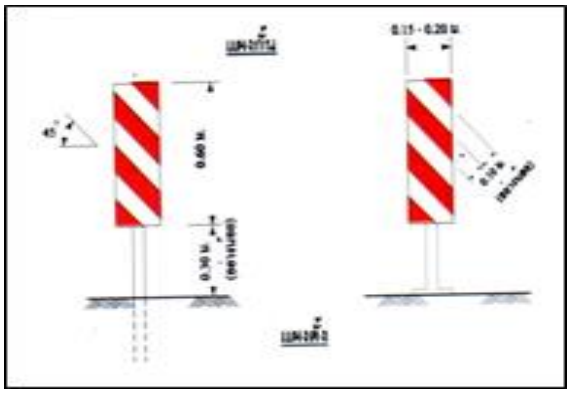
An example of equipment that will be used to control traffic safety during construction is shown in **Figure 2.10-**17 and a sample of traffic management to support the entry-exit is shown in **Figure 2.10-18** as follows:

Sign indicating the starting points and end of construction zone

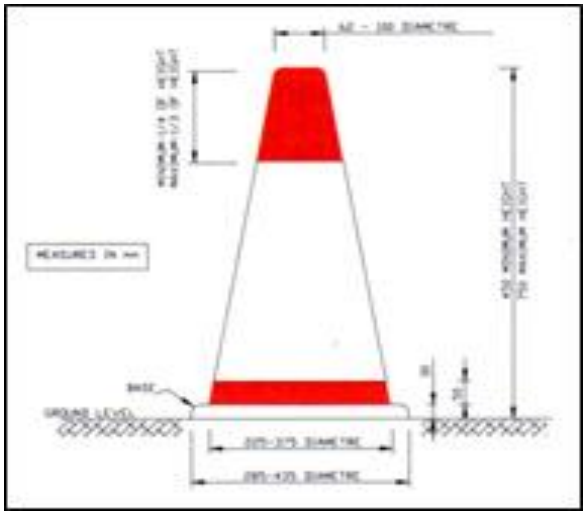
A sign indicating to take a detour and reduce speed



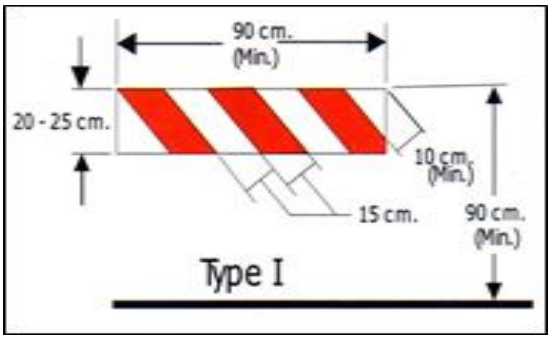
Used to block roads which can extend across the width of the road.



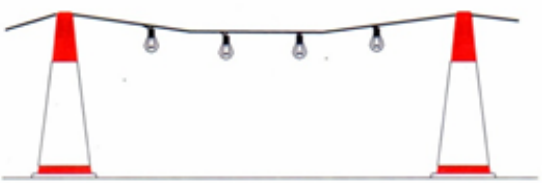
Concrete Barrier, Wall Barrier



Traffic funnel



Used on roads where low speed vehicles are allowed

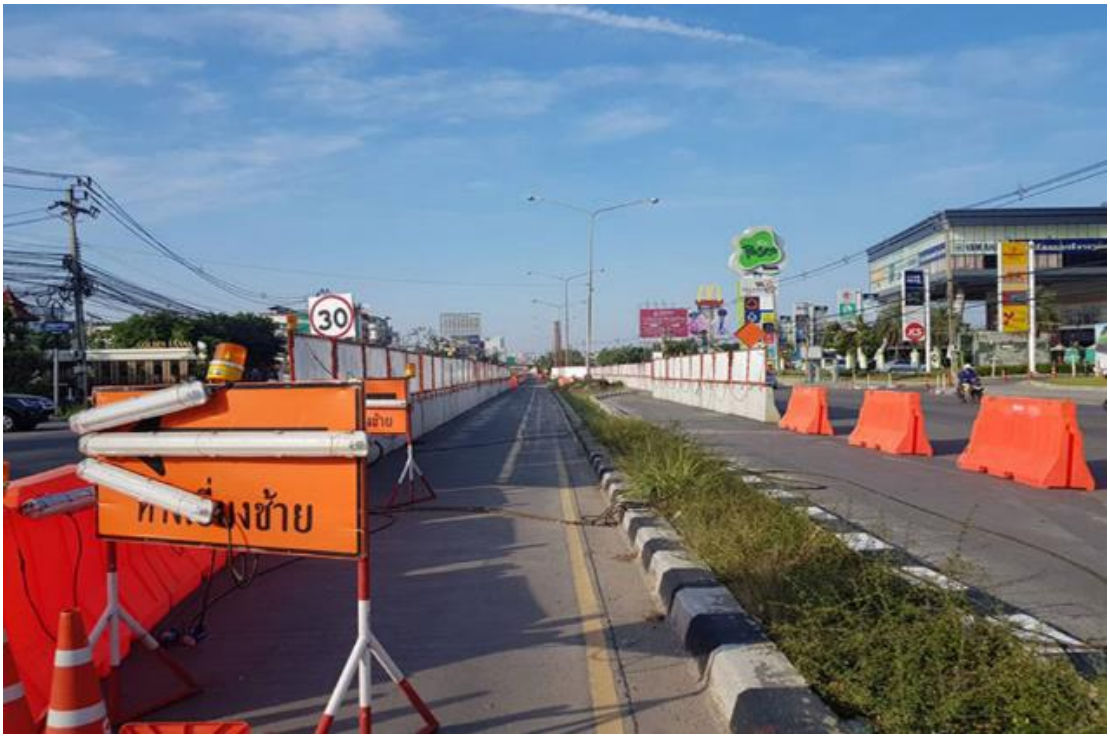


Flashing lights and speed limit labels Electrical tube

Figure 2.10-17 Example of equipment that will be used to control traffic safety during construction

- Barricades/Barrier which are either permanent or plastic, are illustrated as**Figure 2.10-18**. The stripes on the barrier are reflective orange and white with diagonally down 45 degrees in the direction of traffic pass through.
- Blinking lights, direct light, and reflective glass next to the light bulb, so they are effective in any weather condition. They can be seen from long distance as flashing lights spread out the light in a narrow angle. Therefore, blinking lights go straight into traffic that comes in.
- Electrical lamps : Electrical lamps arranged as shown in the figure are very beneficial, with trench digging along walkways and other places which pedestrians and cyclists need to guide and warn.

These traffic signs must be provided and in perfect condition at all times during construction, and can be seen clearly both day and night. Therefore, sufficient light or light signal should be provided, especially in points where there is a risk of accident. If the signal sign is lost or hits, it must be corrected and used at all times.



Example of traffic management to support entry and exit

Figure 2.10-18 Example of the use of barricades to control traffic safety during construction

2.10.3.5 *Transportation of construction workers*

Construction will take 3 years or approximately 36 equal months, with a maximum number of 2,890 construction workers and construction supervision officers (2,654 construction workers and 236 supervisors). Transport of workers will use medium-sized buses (6-wheeled buses), carrying 30 passengers per vehicle, using 10 cars per day, considering round trips and must be completely unloaded within 1 hour. 20 cars will be used per hour. Transportation time for coming to work is (07.00 a.m.) and after work is (evening 04.00 p.m.) available on Monday - Saturday (Closed on Sundays) by using Highway 3 (Sukhumvit Road), 332 (Sattahip - Samnak Thon) and 3126 (Phlu Ta Luang - Samaesarn) as the main transport for construction workers.

2.11 Project construction plan

Construction plan for activities within the project area (extension of the airport area) consisting of runway and driveway 2, underpass tunnel, and parallel driveway, terminal 3, ground transportation center, aviation control tower, commercial business center, cargo building, other assembly buildings, approximately 36 months in each construction period. Details of construction are shown in **Table 2.11-1**

Table 2.11 1 Project construction planin the extended airport area

D1:D1:W57

Construction activities	Duration of construction for each activity (months)
	1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31 33 36
1. Runway 2	
Area adjustment and stump dig work	
Stump dig and level adjustment work	
Soil Improvement Work	
Road soil work	
Surface work	
Safe area work around runway 2	
Drainage structure work	
Traffic marking work	
2. Tunnel under Runway and Driveway 2	
Area adjustment and stump dig work	
Piling work	
Excavation work	
Tunnel construction and drainage structure	
Mechanical and Electrical Work	
Soil filling and bridge slope work	
Architecture inside a tunnel	
3. Driveway M and Driveway N	
Area adjustment and stump dig work	
Stump dig and level adjustment work	
Soil Improvement Work	
Road soil work	
Surface work	
Safe area work around driveway M and N	
Drain structure construction work	
Traffic marking work	
4. Express way out	
Stump dig and level adjustment work	
Soil Improvement Work	
Road soil work	
Surface work	
Safety area work around express way out	
Drainage structure work	
Traffic marking work	
5. Driveway L and Driveway P	
Area adjustment and stump dig work	
Stump dig and level adjustment work	
Soil Improvement Work	
Road soil work	
Surface work	
Safe area work around driveways L and P	
Drain structure construction work	
Traffic marking work	
6. J and K driveway and express way out to runway 1	
Area adjustment and stump dig work	
Stump dig and level adjustment work	
Soil Improvement Work	
Road soil work	
Surface work	
Safe area work around driveway J and K	
Drain structure construction work	
Traffic marking work	
7. Parking lots and pits	
dig and adjust area	
Soil improvement work	
Soil filling work	
Floor Structure Work	

Table 2.11-1 Project construction planin the extended airport area

D1:D1:W57

Construction activities	Duration of construction for each activity (months) 1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31 33 36
8. Terminal 3	
dig and adjust area	
Foundation-based work	
Structure work	
Architecture and system work	
9. Warehouse building	
dig and adjust area	
Foundation-based work	
Structure work	
Architecture and system work	
10. Aviation Control Unit	
dig and adjust area	
Foundation-based work	
Structure work	
Architecture and system work	
11. Ground transportation center	
dig and adjust area	
Foundation-based work	
Structure work	
Architecture and system work	
12. Parking lot building	
dig and adjust area	
Foundation-based work	
Structure work	
Architecture and system work	
13. Fire-fighting building	
dig and adjust area	
Foundation-based work	
Structure work	
Architecture and system work	
14. Roads	
dig and adjust area	
Foundation-based work	
Elevated structure	
Soil filling work	
Floor Structure Work	
Surface work	
Traffic marking work on road surface (painting a road line)	
Electrical work	
15. Office building / store	
dig and adjust area	
Foundation-based work	
Structure work	
Architecture and system work	
16. Flight support area	
dig and adjust area	
Foundation-based work	
Structure work	
Architecture and system work	
17. High-speed train station	
dig and adjust area	
Piling construction	
Digging work, pouring concrete into the rough, and pulling the pin head	
Site structure work	
Systems and interior architecture work in the station	

Source: Consultant on the design of the construction project of runway and driveway 2 , U-Tapao International Airport, Ban Chang District, Rayong, 2021

2.12 Occupational health and safety management

U-Tapao International Airport currently has an occupational health agency that is Occupational Safety and Health Department, which reports to the Airports and Aviation Standards Division U-Tapao Airport, which is responsible for the planning, administering, directing and operating of work to prevent accident, occupational health and work environment, also analyzes, evaluates, designates measures, controls, and prevents hazard, works together with agencies within the U-Tapao Airport, and other related agencies. The International Safety Standards are announced in 2019 that U-Tapao Airport have been in compliance with Aerodrome Safety Policy (as shown in **Appendix 2-9**)implemented in accordance with safety standard both national standard and international standard, that is

1) U-Tapao Airport supports and promotes Royal Thai Navy in developing safety policy of Airports to advance in parallel with the growth of air transportation business under the laws and regulations of the International Civil Aviation Organization

2) Airport safety reporting is the responsibility and accountability of all executives, civil servant, and employees, with the awareness and cooperation on airport safety at all times.

3) All supervisors must be responsible for airport security by ordering to comply with the rules strictly established safety standards.

4) Directors, civil servant, officers and all employees must be aware of the safety of their work in U-Tapao International Airport and the systematic environment management.

5) Provide training to rehearse the plan to ensure that personnel with continuous expertise are adequate to ensure that they are in accordance with the U-Tapao International Airport's safety strategy and policy.

6) Launching public relations campaign, motivating all related parties to comply with rules, regulations and safety standards with acceptance and conscience until it becomes a corporate culture.

7) Conduct monitoring and assessment of compliance with this policy in order to achieve practical outcomes and to continually develop.

2.12.1 Regulations and Handbook on Work Safety

The specification of the project for selection of construction contractors is to be used as a regulations and guidelines on work safety as follows:

1) Prevention of intrusion into nearby areas: The Contractor must limit the scope of construction and must strictly prevent its employees from invade the adjacent area. The Contractor must pay compensation expenses, including recovering when there is any claim of damages caused by the actions of its employees in the event of intruding nearby areas.

2) Third party protection and nearby buildings: The Contractor must prevent outside persons or persons not authorized by the work control officer to the construction area during the period of construction, both day and night, the Contractor shall strictly comply with this section. At the end of each day, the Contractor shall ensure that all persons leave the building, except for maintenance guard or overtime work, only by approved persons.

The Contractor must install anti falling device that can be life threatening or damage to property and nearby buildings without obstructing public traffic.

3) Pre-existing building protection

- Adjacent structures:The Contractor must prevent any damage to the adjacent buildings during the construction. If damage occurs, the Contractor shall be responsible for repairing, correcting, and returning it to its original condition without delay. In the event that the operator determines that the protection or correction done by the Contractor is insufficient or unsafe, it may issue an order for the Contractor to amend as appropriate.

- Underground construction: The Contractor must investigate until it is clear that there are underground structures in the construction area or nearby areas, such as water supply pipes, drainage, lines, etc.The Contractor must be careful to maintain good condition throughout the construction period. If there is any damage, the Contractor shall be responsible for repair and fix to be in the same condition as soon as possible. In the case of obstruction, the Contractor must request to remove the relevant equipment.

4) Protection, maintenance of construction work and fire prevention

- Construction prevention and maintenance: The Contractor shall be responsible for the protection and maintenance of the construction work, including the equipment installed or stored in the construction area, from the start of work until the Employer submits the final work. In the event that it is necessary for the Contractor to establish protection against damage to the materials and construction work, whether it's building shelter, protection, scratching, setting up a pump, flood protection and other protection which supervisor considers appropriate, as well as methods to prevent the loss of equipment such as thorough and strict inspections of all persons who enter and exit the construction area at all times.

- Fire protection: Contractor shall provide adequate and effective fire extinguishers in the construction area, including in temporary offices, storage facilities, and other necessary locations with strict protection against sources of fuel and flammable materials, with outstanding warning signs. Fires or fire-producing materials shall not be brought close to sources of flammable materials, smoking or lighting fire are strictly prohibited in construction buildings.

5) Avoidance of nuisance: construction work or any action by an employee that is likely to cause trouble to persons nearby. The controller may order the contractor to perform the construction work in a right way and time, or inform the contractor to find ways to prevent such troubles. The contractor must speed up the process immediately.

6) Work safety equipment : The Contractor shall arrange construction sites with a good, clean environment with no health and life hazards for the employees. The workers shall be clearly marked with noticeable signs in all potentially dangerous areas or accidents in the construction area. The Contractor shall provide safety equipment in strict compliance with applicable laws throughout the construction period.

7) First aid and life support equipment: The Contractor must provide the necessary first aid drugs and medical supply and life support equipment as appropriate or required by relevant laws and must always provide adequate additions throughout the construction period.

8) Insurance :The Contractor shall provide insurance for all person damage related and not directly related to the construction according to the law and insurance for property damage in the construction area and nearby, including damage caused by natural disasters and other accidents as specified in the contract or by law, according to the value of construction work and the construction period, with the approval of the supervisory officer and the Employer beforehand.

9) Accident reporting: When there is any accident occurring in the construction area, regardless of the cause, there is an impact on the construction work or not, the Employer's Representative shall immediately report the incident to the supervisory officer and then make a written report specifying the details of the incident, resolving the incident, and preventing the recurrence.

2.12.2 Occupational health and safety requirements and conditions for contractor

To enable construction of the project to be carried out concurrently with safety, occupational health, and the work environment, meaning the actions or working conditions, which are free from causes, life, body, mind, or health and hygiene hazards resulting from work or work related health, which are specified in the Term of Reference (TOR), there are issues to be considered as follows:

1) Inspection for construction contractors to prepare work safety plans for construction work

2) Inspection of work safety plans for construction, which must include at least

- Work safety oversight plan that complies with work safety laws
- Work safety training plan for employees who have work-related duties
- Work safety promotion plan
- Audit plan, analysis and incident reporting

3) Audit report on work safety plan implementation results

4) Auditing the work safety management system of the project, which must include at least

- Safety, Occupational Health and Work Environment Policy
- Safety, Occupational Health and Work Environment Management Structure
- Safety, Occupational health, and Work environment plans and implementation
- Evaluation and review of work safety, occupational health and environmental management
- Actions to improve safety, occupational health, and the work environment
- To allow construction contractors to improve and develop work safety management systems

2.12.3 Aerodome Safety Management System

At present, U-Tapao Airport has an Aerodome Safety Management System, along with an Aerodome Safety Planning, which has the following objectives and goals for airport safety operations:

1) In order for the airport to be able to implement a safety management system concretely, complies with the airport's safety policy and goals with the highest efficiency and effectively, correctly according to international regulations and standards, until it finally becomes the organization's safety culture.

2) To enable the airport to have process and procedures to identify or search for hazards or events that may affect the safety of operations related to providing airport services effectively and efficiently

3) To ensure that the airport's hazard identification or searching process and related incidents assess the likelihood of a danger or event occurring and the resulting impact. Details, steps, procedures and guidelines for use in preventing such hazards or incidents are contained in the operational system at which the airport can control and change operations systems quickly and constantly, consistent with the changing circumstances.

4) In order for the airport to be able to receive an Aerodrome certificate from the regulatory agency and ensure safety for the airport's service users.

The target level of airport safety (Acceptable Level of Safety-ALOS) is defined as 2 levels, namely the airport level and airport squadron level, and also has correcting, monitoring and analysis process of Acceptable Level of Safety (ALOS). And the airport's safety management system manual is revised and reviewed on a monthly basis.

For the responsibilities of the airport security agency comprising of,

1) Plan and supervise various aspects of the airport operations, to meet Standards and Aerodome Safety and international standards and requirements in order to be able to receive Aerodome Certificate.

2) Implement and maintain a safety management system in accordance with the standards of the regulatory agency by ensuring compliance with the requirements and ensuring enforcement of the requirements by establishing an audit of the operations of UIA.

3) Prepare and update the Aerodome Manual, Aeronautical Information Publication (AIP)

4) Plan and evaluate airport safety activities to the Airport Safety Committee.

5) Suggest guidelines for the development of airport safety projects to the Airport Safety Committee

6) Publish and provide training and clarifications to airport security officers and related agencies.

7) Collect evidence of accidents, incidents, and dangers that occurred.

8) Follow up on daily, weekly airport inspection corrections and monthly safety management system monitoring.

9) Specify measures and information on accidents to those assigned to publicize news to mass media if necessary

10) Collect and prepare the regulations, orders, manuals, technical documentation, and instructions of U-Tapao Airport. The relevant agencies shall use the operational control of the security of U-Tapao Airport as references to comply with the standards set by the U-Tapao Airport.

11) Provide support and suggestions for operational solutions to other agencies within the airport.

12) Oversees the operation of the outsourcing agency in its duties and responsibilities.

13) Perform other related work or other works as assigned.

14) Collect information on physical changes in the airfield to revise in Aerodrome ICAO Chart, Aerodrome obstacle Chart, Aerodrome Ground Movement Chart, Aerodrome Parking and Docking Chart.

The investigation of safety incidents occurring at the airport is the finding of causes, factor of any events taking place(accidents, incidents) and make an analysis to find cause and causal elements of accidents including suggesting corrections for management to acknowledge and order the correction to prevent accidents likewise. In the case of aircraft accidents, serious incidents and happenings, there will be reports on the airport safety by investigating and analyzing of aircraft accidents, serious incidents and incidents are carried out by the aircraft accident investigation committee of the kingdom. But for the airport security investigation committee, preliminary data will be collected for use in supporting information to the aircraft accident investigation committee in the kingdom and after the investigation has been concluded, the airport investigation committee will then go to the airport safety committee meeting for consideration to develop a guideline to prevent such incidents from happening again.

In the case of accidents that are not related to aircraft such as aircraft accidents, aircraft incidents, and serious aircraft accidents caused by incidents occurring during vehicle crashes with another vehicle, vehicle crashes facilities, or other incidents occurring in the aviation sector, the investigation of the cause will be carried out by the airport safety investigation committee to find the cause and the resolution of safety issues by reporting to the Director of Airports and the airport safety committee, as well as those involved for acknowledgment of further remedial action. The airport security department is responsible for coordinating with airport security investigation committee about the results of the analysis, cause of the incident findings and use it to formulate preventive measures. The security investigation committee later presented the results of the security investigation which consists of the results of the analysis of the causes of the incident, remedial Instructions to the airport safety committee to assign the responsible agency of the airport to take corrective action.

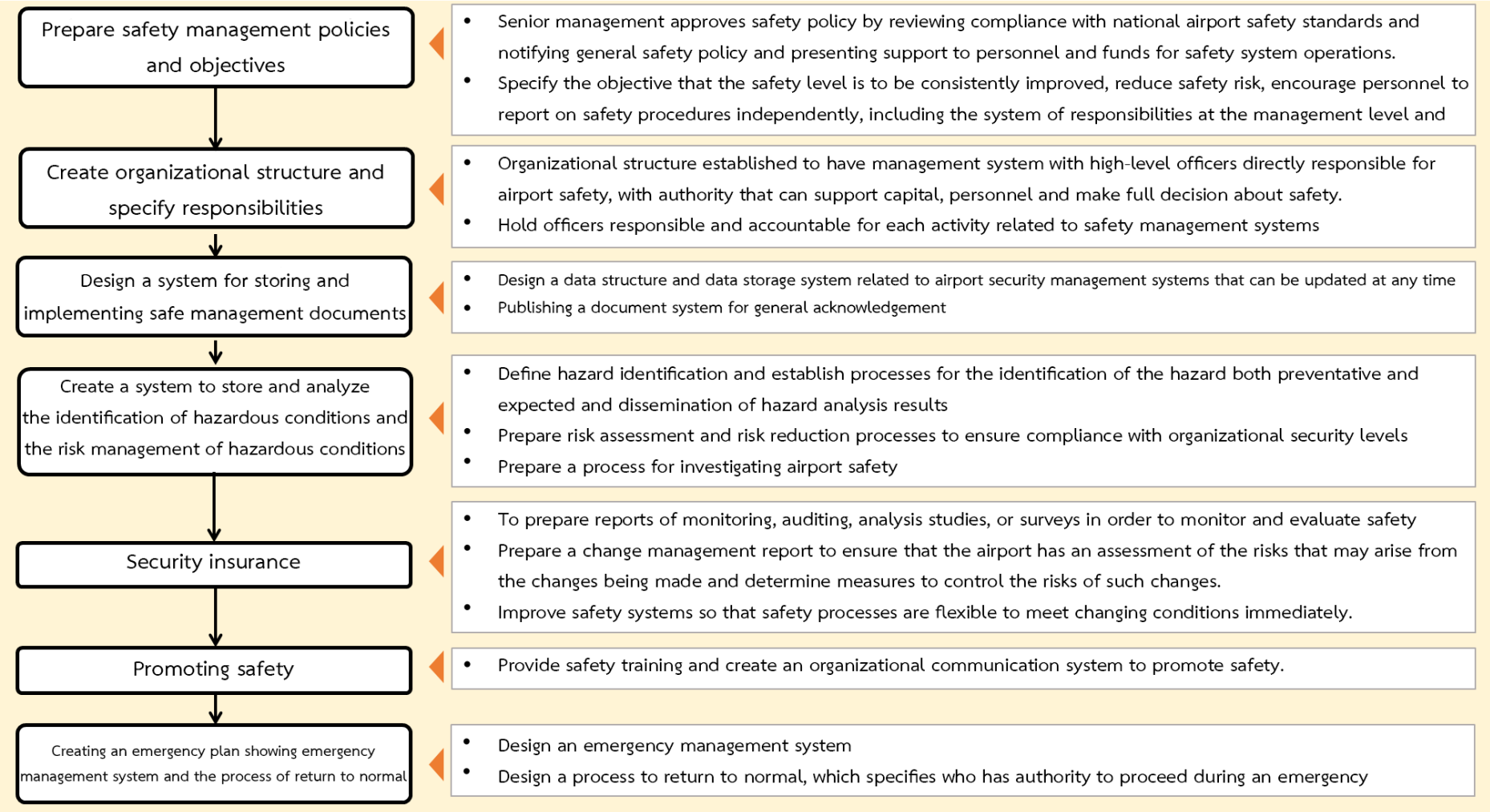
The risk assessment of the hazards that caused the incidents, the safety committee carried out by applying the Safety Risk Assessment and Mitigation to assess the safety risks after corrective action according to the investigation whether it was within the acceptable criteria. If it was assessed and committee agreed that existing hazards still cannot be accepted, the airport safety committee will proceed and issue new measures to reduce the safety risk level to be within the acceptable criteria.

In order to reduce Safety Risk Mitigation after the Airport Safety Department has conducted the assessment of safety risk, the assessment will be accompanied by the airport safety committee. If the risk is related to and impacts to the airport's internal and external agencies, such as airlines, aviation control towers, meteorological stations, etc., the Airport Safety Department will

prepare a letter to invite the relevant agencies to attend the meeting to recommend guidelines for the risk reduction. If some types of hazards are found to be unacceptable, the risk assessment, the Airport Safety Department will proceed with the approval of the Airport Director and present results of the proceeding to the airport safety committee.

In the future, following the opening of runway 2, agencies that have followed airport operational safety requirements shall have missions to meet the airport safety objectives in order to ensure that U-Tapao Airport safety management is complete, efficient, and effective according to The Air Navigation Act B.E. 2497 (No. 11), amended in 2013 and the Regulations of the Civil Aviation Board, No. 82 concerning Airport Safety Management System including the requirements of the International Civil Aviation Organization (ICAO).

The project has been additionally added to the airport safety management system, which is referred to detail according to the regulations of the Civil Aviation Committee, No. 82. This is required for public airports licensee to operate public airports only when the airport safety management system of the airport has been arranged. At present, the airport has established an airport safety management system and emergency plan of U-Tapao Airport, which is made as part of the airport manual that must be submitted to the Civil Aviation Office for approval. The project has added the layout of airport safety management with reference of details according to the regulations of the Civil Aviation Committee, no. 82, as shown in**Figure 2.12-*1***.



Source: Prepared by the consultant of EECO with reference to the Regulations of the Civil Aviation Board No. 82 on Airport Safety Management System, 2008

Figure 2.12 1 Layout of Airport Safety Management System

2.13 Airport Emergency Plan

The Airport Emergency Plan is used as a procedure for preparing, controlling (Control), and commanding (Command) to resolve situations or emergencies that may occur within the responsibilities and vicinity of the airport by co-operation between the agencies, both within and outside the airport and communities surrounding the airport, with the purpose of reducing violence, protecting the lives and property of passengers, aircraft, and related persons. The scope and responsibilities of the airport are as follows:

On-Airport area and Off-Airport area within a radius of 8 kilometres from the airport reference point

There are three types of training that are conducted in the airport's emergency plan:

- Table Top by the Airport Safety and Standards, in conjunction with the Fire Fighting and Rescue Section, provides training every 6 months by inviting internal airport department (Airline) to practice.
- Partial training of emergency plan by the Airport Safety and Standards, together with the division responsible for the training plan, will be conducted annually by inviting the internal and external agencies listed in the plan to practice.
- Full Scale training, with the Airport Safety and Standards, in collaboration with all parts of the airport, will be conducted every 2 years by inviting the internal and external agencies listed in the plan to practice.

After the training has been completed, the agency responsible for each training will summarize the training results, submit to the Airport Safety and Standards, who will present to the Emergency Plan Training Committee meeting to consider the conclusion of the recommendations on safety guidelines. When complete, the airport safety and standards will present to the Airport Safety and Standards Division.

The components of the airport's emergency plan are divided into 14 chapters as follows:

1. Aircraft Accident means an aircraft crashing on ground, aircraft, vehicle, or building, which results in damage, fire, injury, or death.
2. Aircraft Ground Incidents means the case where the aircraft cannot be driven by engine power, which may be due to an accident or incident which causes minor damage, severe damage, or loss of the whole aircraft.
3. In-flight Emergencies: an emergency that occurs or is expected to occur on an airplane during flight
4. Structural Fires and Explosions means fires or explosions at the airport, which are not occured by aircraft, can be classified widely as fires in building or fires in the airport area.
5. Dangerous Goods Accidents and Incidents arising from the transportation, storage or use of dangerous goods on the aircraft or within the airport area, including incidents that result in personal injury, property damage, fire, breakage, overflow, leakage, radiation, or incidents caused by inadequate packaging or incorrect storage, as well as errors in the use of hazardous substances.

6. Natural Disasters are disasters caused by the actions of nature.

7. Domestic Disturbances are cases of problems caused by a large number of people, such as the assembly or movement of people to the airport or the area around the airport. Events like this will cause chaos or may cause a serious accident with normal traffic including the traffic of passengers who come to use the service.

8. Unlawful Interference consists of illegal acts towards the business of aviation, including anonymous acts of terrorism or acts of willful danger to persons or property in the responsibility of the airport.

9. Bomb Threats happen in the case that the airport is notified that explosive materials or explosive materials are concealed in the aircraft or close to the aircraft, vehicles, or structures.

10. Unexploded Devices means explosive or incendiary materials, which are hazardous substances and are assembled to have the effect of destroying them. This includes suspicious materials that contain hidden explosives.

11. Unlawful Seizure occurs in the case of illegally taking possession of an aircraft, place or object and capturing an object and capturing a person which may use intimidation methods to use violent force or for revenge

12. Casualties is a passenger who is injured inside the aircraft, who has an accident or other dangerous event, including a passenger who is physically or mentally injured, or a patient who is on a flight entering the airport, or a patient who is within the airport zone.

13. Tsunami means the natural disaster caused by the earthquake in the sea, causing a gigantic wave to blow into the coast.

14. Public Health Emergency means Germs can be transmitted to others and it is necessary to isolate them from the general public to prevent transmission.

For the criteria to consider the topics used in each emergency plan drill, the Airport Safety and Standards shall be the one who selects the topics proposed to the Airport Safety Committee meeting by considering the results of internal audit of which subjects are impair, and considering the appropriateness of the situation.

In addition, the project has additionally added the Aerodome Emergency Plan, as the airport plan which must be prepared according to the requirements of the Civil Aviation Authority of Thailand, No. 4, regarding of Airport Standard 2019 for the benefits of preparation of the airport for emergencies that may occur in airports or nearby, and reduce the impact, especially saving lives, property, and maintaining aircraft operations. The emergency plan will specify the coordination process of all relevant agencies to support emergency. U-Tapao Airport Emergency layout, approved by The Civil Aviation Authority of Thailand on November 23, 2020. The project has used the aforementioned emergency plan together with the requirements of the Civil Aviation Authority of Thailand No. 4 as a reference guideline in making airport emergency plan layout as shown in **Figure 2.13-1.**

Source: Prepared by the consultant EECO with reference to the requirements of the Civil Aviation Authority of Thailand No. 4 on Airport Standards 2019, and the emergency plan of U-Tapao International Airport approved by the Civil Aviation Authority of Thailand already on November 23, 2020, as accompanying information in preparation.

Figure 2.13-1 Airport Emergency Plan Layout

2.13.1 Airport Security Programme (ASP)

U-Tapao Airport has prepared a security plan of U-Tapao International Airport in accordance with the National Civil Aviation Security Programme (NCASP) established by the Civil Aviation Office of Thailand and the International Civil Aviation Organization (ICAO) as a standard and guidelines for security operations at U-Tapao, Rayong, Pattaya International Airport. The security measures set in the U-Tapao, Rayong, Pattaya International Airport Security Plan areproactive and preventive measures. There are ongoing revisions on measures to comply with the threats, as well as keeping up with the current situation.

2.13.2 Preventive Security Measures

U-Tapao airport has established standard security measures that are effective and consistent with state and international standards as follows:

2.13.2.1 *Measures Relating to Access Control*

The U-Tapao Airport has designated restricted areas for security in the airport area by issuing of security cards for persons and vehicles that are allowed to enter and exit restricted areas as well as providing security channel for inspecting persons, baggage, and vehicles before passing through or leaving restricted areas to prevent unauthorized entry and exit.

2.13.2.2 *Measures Relating to Aircraft*

U-Tapao Airport and the aircraft operator, jointly responsible for the security of aircraft parked in the Airside area of airports by U-Tapao International Airport has installed illumination light at the apron, including monitoring the security of the area of the airport that aircraft parked by a pedestrian patron, vehicle inspection patron, and closed circuit television: CCTV). Furthermore, aircraft operators can provide additional measures to ensure the security of the aircraft parking, such as inspecting/checking the aircraft before departure, controlling persons/vehicles that access the parking area, and controlling all channel that lead to the aircraft on the ground, etc.

2.13.2.3 *Measures Relating to Passenger and Their Cabin Baggage*

U-Tapao Airport is responsible for searching according to the Air Transportation Act, Section 60/17, with measures for inspection and standard operating procedures in accordance with state regulations and consistent with international standards. It has been arranged to search passengers before boarding the aircraft with modern security equipment, such as Full Body Scanner, Walk Through Metal Detector, Hand Held Metal Detector for unregistered baggage that passenger brings together on cabin. This will be examined by up to date X-Ray and Explosive Trace Detector (ETD) to prevent the delivery or carriage of weapons/hazardous substances/ restricted articles with aircraft.

2.13.2.4 *Measures Relating to Hold Baggage*

The U-Tapao Airport provides inspection of all baggage that can be carried on an airplane by X-ray, Explosive Trace Detectors (ETD) and enhanced the cargo search at U-Tapao, Rayong, Pattaya International Airport with In-line Screening system installed with an advanced technology X-ray of

explosive detection. Baggage that has passed the inspection at theairportthen will be protected from unlawful interference until it is brought to the aircraft by the Aircraft Operator, the airport security officer who patrols the sorting area and the Closed Circuit Television (CCTV).

2.13.2.5 *Measures relating to landside*

U-Tapao Airport conducts land security risk assessments, off-flight areas, and sets up security measures in the off-flight areas that comply with the threat of U-Tapao, Rayong, Pattaya International Airport. This includes the main measures, including monitoring public areas by pedestrian inspection lines and CCTV for continuous periods, An audible announcement warns airport passengers from leaving their belongings unattended and publicize the channel for reporting the incident when seeing suspicious persons/objects/vehicles including arranging Explosive Ordnance Disposal (EOD) personnel with Explosive Ordnance Inspection Dogs (K-9) to inspect suspected explosives.

2.13.2.6 *Measures Relating to Cargo/Mail and Other Goods*

The aircraft operator must prepare a security plan in accordance with the security plan of U-Tapao International Airport. As the aircraft operator provides catering security that will be carried on the aircraft, air cargo inspection is arranged, and mail which will be carried on by X-ray machines. It must provide control and secure the items that have been inspected from the starting points until they are loaded onto the aircraft to be free from the act of unlawful interference. U-Tapao International Airport Security measures have been put in place for air cargo, mail and catering operations to support the security of air operators, such as access control and patrolling the area, etc.

2.13.3 Information Security Measures

The U-Tapao Airport has continually collaborated with state security and intelligence agencies, such as news division, Naval Aviation Division, Naval force and the National Intelligence Agency at U-Tapao International Airport To be informed of threats and to analyze and assess potential risks which may occur in U-Tapao International Airport, as well as to formulate proactive security measures to be able to deal with threats quickly and efficiently.

2.13.4 Emergency Security Measures

U-Tapao Airport has prepared an Emergency Plan and a Contingency Plan in accordance with the International Civil Aviation Organization standards (ICAO), including organizing a training plan continuously for a specified period of time consisted of Full-Scale Exercise, Partial Exercise, and Table-top Exercise. U-Tapao airport has set the standard for readiness for security, which is consistent with the guidelines for assessing the risk of civil aviation security in Thailand, established by Civil Aviation Authority of Thailand.

Furthermore, there have been amendments to the U-Tapao Airport Emergency Plan and Action Plan to ensure consistency in order to comply with the Safety and Security Management System. The emergency plan and the incident response plan will be implemented in the event of an emergency situation at U-Tapao Airport, comprising 7 emergency plan as follows:

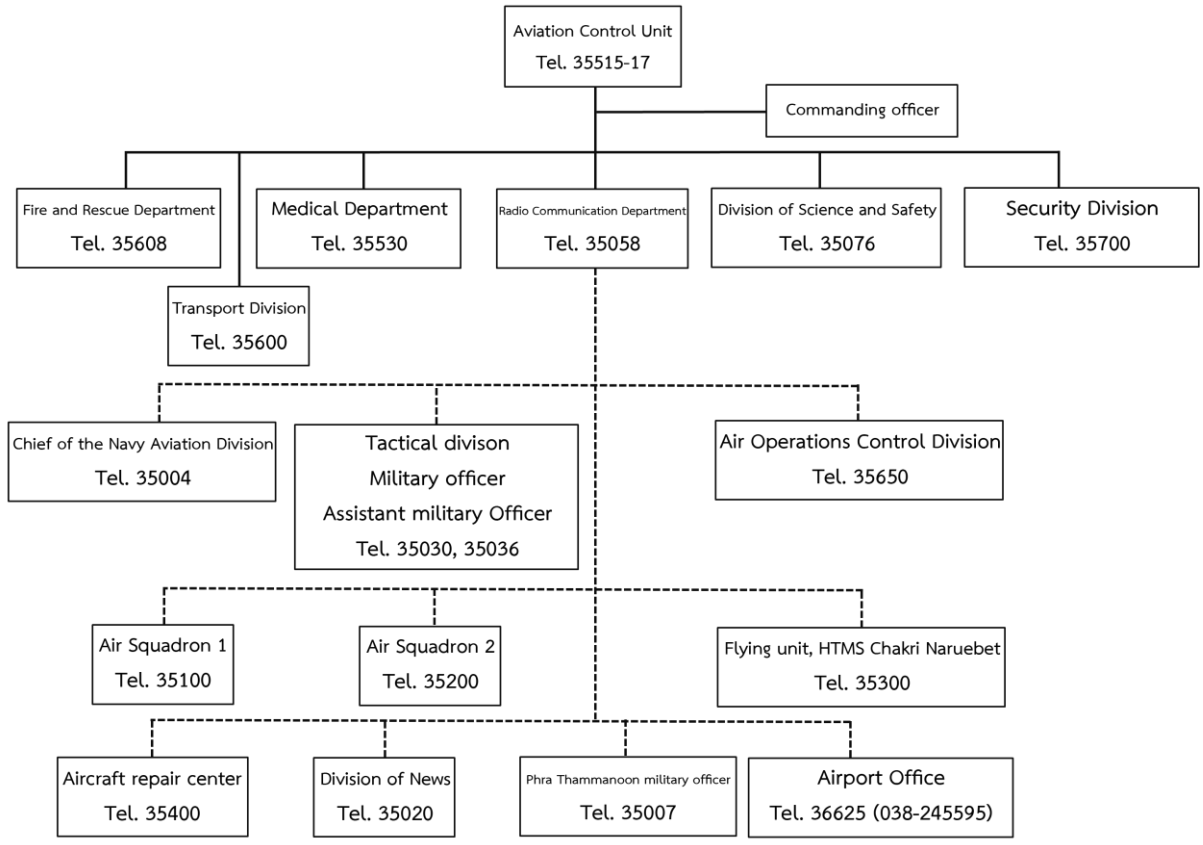
1) Aircraft Accident

2) Aircraft ground accidents and in-flight emergencies
3) Building Fire and Explosion
4) Accidents and incidents from dangerous goods
5) Dangerous goods on airplanes
6) Natural disaster
7) Communicable diseases and quarantine

There are 7 scenarios as follows:

1) Aviation seizure
2) Armed attacks or sabotage
3) Bomb threat
4) Detection of suspect items or prohibited articles
5) Crowd control
6) Taking hostage
7) Security violations

In order to assist pilots, aircraft staff and passengers in the event of an aircraft emergency or accident, so that the situation can be completed quickly and safely, and can maintain evidence of the aircraft accident for the purpose of analyzing the cause of the aircraft accident. At present, U-Tapao International Airport has prepared a plan for officers and related agencies to adhere to the operation, including setting the criteria and responsibilities that are current and consistent with international standards, as shown in **Figure 2.13-2.**



Source: Naval Aviation Division 2017

Figure 2.13-2 The Crash Alarm System

with civil servants and agencies that require cooperation in accordance with this plan, including:

1) Reported by the Fire and Rescue Department, including:
   - Transport Division, Sattahip Naval Base
   - Sattahip Police Station, Ban Chang Police Station
   - Phlu Ta Luang Police Station
   - Fire Department, Sattahip Naval Base
   - Fire Department, 106 Air Force Squadron
   - Fire Department, Ban Chang Municipality
   - Fire Department, Sattahip Municipality
   - U-Tapao Airport Service
   - Aircraft and Ship Disaster Search and Rescue Operations Control Center 1st Naval Area
2) Reported by the Medical Department, including:
   - Queen Sirikit Hospital
   - Naval Medicine Department
   - Apakorn Kiatwong Hospital
   - Sattahip Naval Base
   - Ban Chang Hospital
   - KM.10 Hospital
   - Chalerm Phrakiat Hospital Her Royal Highness Princess Maha Chakri Sirindhorn
   - National Institute of Emergency Medicine (NEP 1669)

In the case of aircraft outside Royal Thai Navy coming to use U-Tapao International Airport in the event of an aircraft emergency or accident in the area of U-Tapao International Airport and outside the area within 8 kilometers, government agencies according to the news of aircraft emergency or accident notification-receive system follow this plan by allow to use under the guidance of the aircraft owner and provide assistance to victims and rescue according to the correct methods immediately with fullest ability.

When it is necessary to remove the aircraft that had been in an accident, proceed as follows:

1) In the event that the aircraft obstructs the boarding and landing of the aircraft, the commander of the Navy Aviation Division or the director of the U-Tapao Airport can direct the move.

2) In the event that the aircraft obstructs traffic on roads or public places of interest, the officer shall order the Navy Aviation Division to jointly consider the administrative officers, the owner of the aircraft, and the civil aviation officer of Thailand for movement.

The costs incurred from moving aircraft in accident shall be covered by the owner of the aircraft and before moving, procedure shall be as follows:

1) Photos of documentary evidence
2) Record the nature of the aircraft crashed on the ground and record the details before moving.
3) Make a map of what is moved.
4) Parts moved away from their original position must be placed in a safe place and placed in a similar location before moving.
5) Parts of the aircraft with various meters shall be moved with caution against increasing damage as it will be used as evidence of further investigation.
6) In the case of aircraft accident that damages the civils, both life and property, including the public interest, the consideration to proceed shall be within the authority of the Accident Investigation Committee.

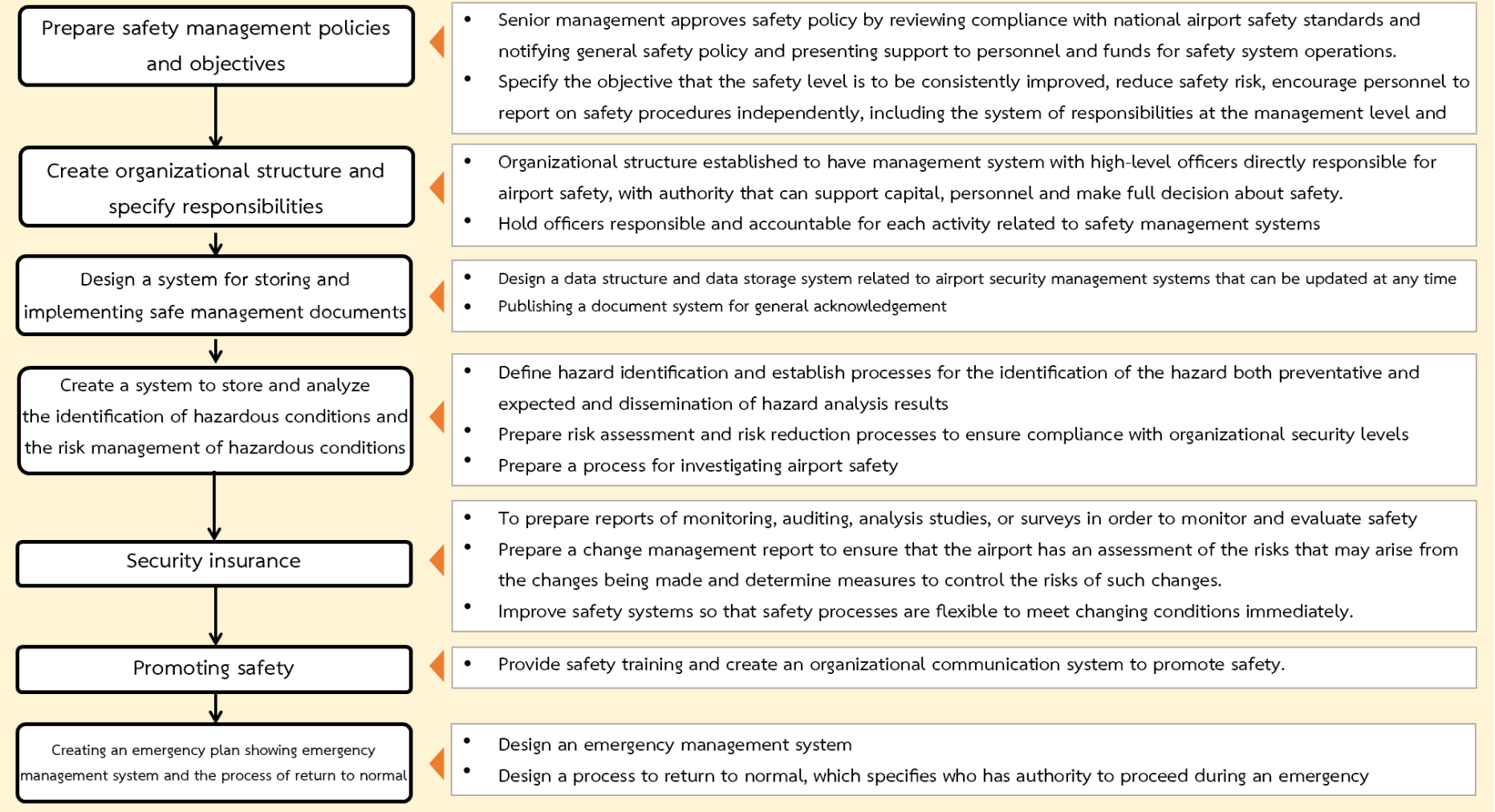
U-Tapao International Airport has conducted training on emergency plan in accordance with the requirements of the International Civil Aviation Organization (ICAO) as follows:

1) Full Scale Exercise, at least once every 2 years
2) Partial Exercise, at least once a year in a year that does not have full training or as necessary to maintain the effectiveness of the plan.
3) Try to practice the Tabletop Exercise at least once every 6 months, unless in 6 months that have full training.
4) Full incident plan training, at least once every 3 years

However, in the future when runway 2 is opened, there will be private sector / people managing U-Tapao international airport must continue to create aNotification-receive system News of the aircraft emergency or accident (The Crash Alarm System) in more detail.

2.14 Aerodrome Safety Management System

The airport safety management system will be implemented according to the regulations of Civil Aviation Board No. 82, which requires public airports licensee to operate public airports only when the airport safety management system is arranged. The airport has now established an airport safety management system and emergency plan at U-Tapao International Airport, which is made as a part of the airport manual that must be submitted to the Civil Aviation Office for approval. The project has added a layout of the airport safety management system, which references the regulations of the Civil Aviation Board, No. 82, as shown in **Figure 2.14-1**.



Source: Prepared by the consultant of EECO with reference to the Regulations of the Civil Aviation Board No. 82 on Airport Safety Management System, 2008

Figure 2.14 1 Layout of Airport Safety Management System

2.15 Rescue and Fire Fighting of the present U-Tapao International Airport

The objective of fire fighting and aircraft rescue is to save lives with method to deal with accidents that occur in and around U-Tapao International Airport. The firefighting capacity of U-Tapao International Airport is at Level of Protection Category 10 according to ICAO standards. Firefighting equipment includes the type of car and ship, as detailed in **Table 2.15-1**

Table 2.15-1 Firefighting Equipment according to ICAO Level of Protection Category 10

Type of Fire Fighting Equipment	Description
	**Fire Fighting 1 :** Type of medium-sized fast-moving aircraft fire extinguisher - 407 horsepower engine - Sourced on 26 Jul 1993 - 77% readiness status - Water tank capacity / foam tank 3,600 liters / 400 liters - Water injection rate up to 2,400 liters/minute
	**Fire Fighting 2:** Type of Main Aerospace Truck - 705 horsepower engine - Sourced on 25 April 2011 - 83% readiness status - Water tank capacity / foam tank 12,000 liters / 1,500 liters - Water injection rate up to 4,500 liters/minute
	**Fire Fighting 3:** Main type of aircraft fire extinguisher - 705 horsepower engine - Sourced on 24 Jan 2012 - 83% readiness status - Water tank capacity / foam tank 12,000 liters / 1,500 liters - Water injection rate up to 4,500 liters/minute
	**Fire Fighting 7 : Fire Fighting Vehicle** Type - Water capacity of 4,000 liters - 500 liters of foam - 250 liters of chemical powder - Injection rate of 3,800 liters/minute **Currently waiting to receive 1 more car.** - 6,000 liters capacity - 500 liters of foam - 250 liters of chemical powder - Injection rate of 3,800 liters/minute - 240 horsepower engine

Table 2.15□1 Firefighting Equipment according to ICAO Level of Protection Category 10

Type of Fire Fighting Equipment	Description
	**Ladders:** The type of aircraft ladder - Scannia car body - 360 horsepower engine - Rosenbauer Ladder - Extends up to 8.30 meters
	**Rescue 4 :** Medium Rescue Vehicle Type - 177 horsepower engine - Sourced on 14 Sep 1995 - 83% ready status - Water tank/foam tank capacity - Maximum water injection rate
	**Fire Fighting 6 : Medium Building Fire Truck** - 138 horsepower engine - Sourced May 9, 1977 - Readiness status, 69% - Water tank /foam tank capacity 3,000 liters/ 500 liters - Water injection rate up to 500 liters/minute
	**Fire Fighting 7 : Foam Fire Truck Type** - 260 horsepower engine - Sourced on 5 Mar 1977 - 69% readiness status - Water tank capacity / foam tank 6,000 liters / 600 liters - Water injection rate up to 600 liters/minute
	**Water Truck 1 :** Mid-sized Water Truck Type - 115 horsepower engine - Sourced on 16 Jan 1986 - 76% readiness status - Water tank capacity 7,000 liters
	**Water Truck 2 :** Mid-sized Water TruckType - 212 horsepower engine - Sourced on 15 Dec 2009 - 76% readiness status - water tank capacity 6,000 liters

Table 2.15□1 Firefighting Equipment according to ICAO Level of Protection Category 10

Type of Fire Fighting Equipment	Description
	**Water Truck 3:** Mid-sized Water Truck Type - 212 horsepower engine - Sourced on 21 Mar 2012 - 76% readiness status - water tank capacity 6,000 liters
	**Ambulance:** Ambulance type - 97 horsepower engine - Sourced on 16 Feb 2001 - 75% readiness status
	**RTNAB 2 Motor Boat:** Life-saving speedboat type - 200 HP MERCURY ENGINE, Number 6073699 - Delivered on 28 Apr 1992 - Estimate load of 8 people - 8 life vests - 60% ready state
	**RTNAB 3 Motor Boat:** Life-saving speedboat type - 200 HP MERCURY ENGINE, Number 6073700 - Delivered on 28 Apr 1992 - Estimate load of 8 people - 8 life vests - 60% Ready state
	**RTNAB 4 Rubber Boat :** Life-saving speedboat type - 40 HP YAMAHA Engine Number 1016580 - Delivered on 17 Feb 2005 - Estimate load of 8 people - 8 life vests - 70% readiness status

Source: U-Tapao Airport, 2020.

The development of U-Tapao International Airport in the future will be based on construction of fire and rescue stations, which will be located on the east side of the airport, and are located in the center of the runway according to ICAO. There is equipment capable of supporting firefighting and rescue levels in accordance with the International Civil Aviation Organization level 10 standards. Considering the length of time access to the accident site located in the area of both runways, the details mentioned above in **Section 2.5.9, Fire and Rescue stations.**

2.16 Project Public Relations Plan

The project has a plan for public relations, educational plans, and information related to projects. The objective is to continually disseminate information about the project to stakeholders and interested parties. There are various communication channel appropriate to the communication of project information in each period and each group of targets which will help build knowledge and understanding of the project, as well as providing channel to listen to opinions, suggestions, and notify complaints, and make involvement in all sectors, both national and local level. In the implementation of the public relations project, there is a need to monitor the implementation of the public relations plan in each public relations period and report the results in the project's environmental impact monitoring report. The details are shown in **Chapter 7, Section 7.3.19 (Public Participation and Public Relations Action Plan)**, in which compensation for the noise affected by the development of the Runway and Driveway 2 Construction Project, U-Tapao International Airport. The project has set up a working group to explore and consider compensation, to conduct a survey, to prepare a database and compensation plans for those affected which must be completed before Runway 2 is opened.

2.17 A plan to install a permanent sound monitoring station and a project air quality monitoring station

The project has defined an action plan to install a Permanent Noise Monitoring Station andan Air Quality Monitoring System (AQMS) of the project to prevent and monitor impacts by establishing a plan for the installation of a permanent noise monitoring station and air quality monitoring station before the launch of runway 2. As well as providing noise level and air quality measurements at the station before operations are conducted at each station. The station and the measurement system are linked to flight database and flight routes. It is an important tool to obtain data to solve problems that may arise from the project implementation. Details are shown in **Table 2.17-1** and **Table 2.17-2**.

Table 2.17-1 Implementation Plan for Permanent Noise Monitoring Station Installation

Action Plan	Action Plan for Fixed Noise Monitoring Station Installation															
	2564				2565				2566				2567			
	Month:															
	1-3	4-6	7-9	10-12	1-3	4-6	7-9	10-12	1-3	4-6	7-9	10-12	1-3	4-6	7-9	10-12
1. Construction of the Runway and Driveway 2					■	■	■	■	■	■	■	■	■	■	■	■
2. Study of Consideration for selection of a permanent sound measurement system					■	■										
3. Surveying and designing permanent sound monitoring stations							■									
4. Construction of a permanent sound monitoring station							■	■								
5. Install the Hardware/Server of the permanent sound monitoring station.								■	■	■						
6. Test the operation of the entire sound measurement station.											■					
7. Collect the Baseline before operation of Runway 2.												■	■	■	■	
8. Enable runway 2																★

Notes : ■ ■ ■ Refers to the runway 2 testing period before operation.

Source: The Eastern Economic Corridor Policy Office, 2021

Table 2.17□2 Air Quality Monitoring System (AQMS) Installation Plan

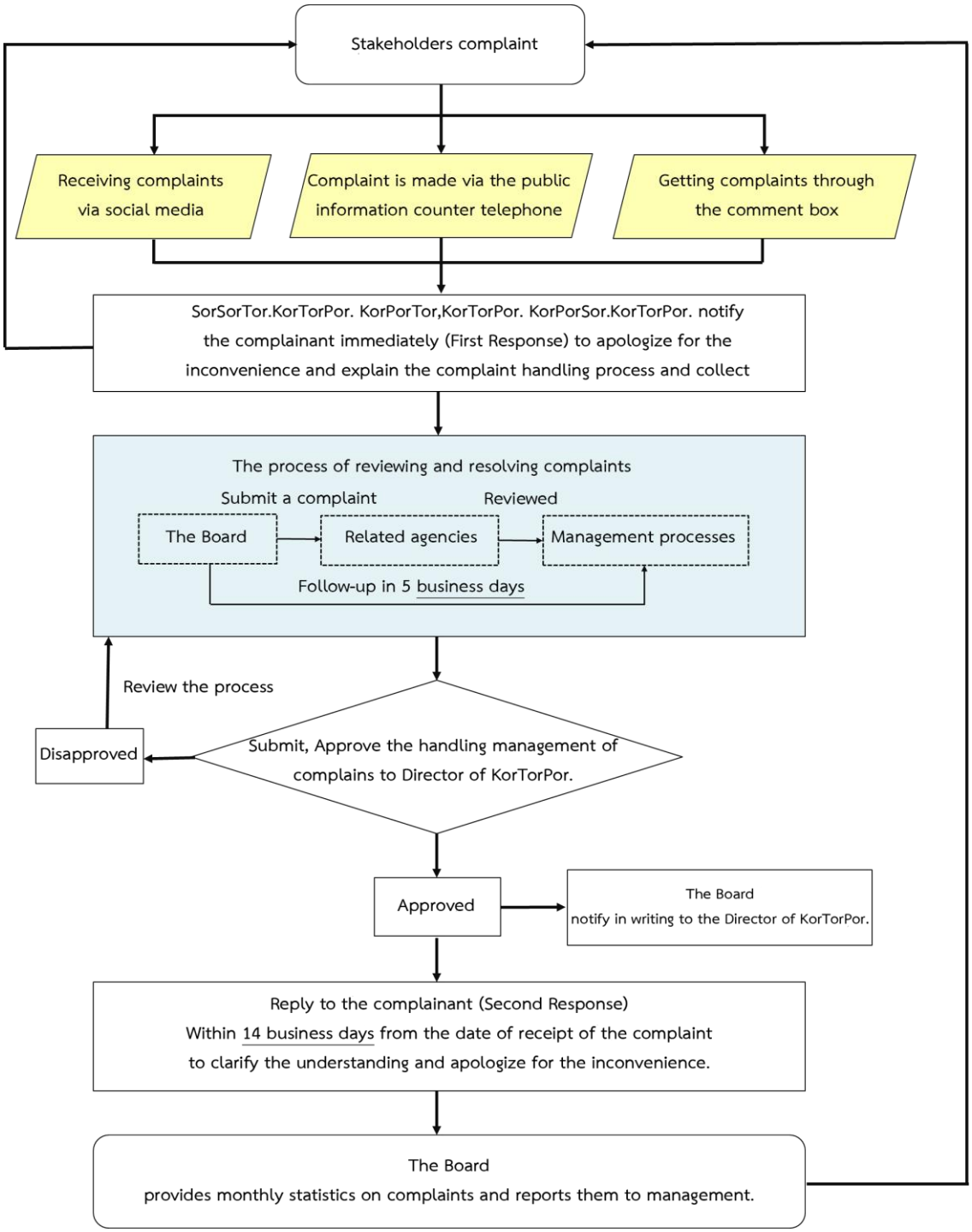
Action Plan	Action Plan for Automated Air Quality Monitoring Station Installation															
	2564				2565				2566				2567			
	Month															
	1-3	4-6	7-9	10-12	1-3	4-6	7-9	10-12	1-3	4-6	7-9	10-12	1-3	4-6	7-9	10-12
1. Construction of the Runway and Driveway 2					■	■	■	■	■	■	■	■	■	■	■	■
2. Study Review of automated air quality monitoring system selection					■	■										
3. Automated survey and design of air monitoring stations							■									
4. Automated air monitoring station construction								■	■							
5. Install the automated air monitoring station Hardware/Server .									■	■						
6. Test the operation of the automatic air monitoring station throughout the system.											■					
8. Collect the Baseline before operation of Runway 2.												■	■	■	■	
9. Enable Runway 2																★

Notes : ■ ■ ■ Refers to the runway 2 testing period before operation.

Source: The Eastern Economic Corridor Policy Office, 2021

2.18 Complaint handling plan

At present, U-Tapao Airport has a plan for handling complaints and a process as shown in **Figure 2.18-1**



Source: U-Tapao Airport, 2020.

Figure 2.18-1 Workflow diagram of the complaint management system

However, in the future when Runway 2 is opened, there will be private sector/persons managing the U-Tapao International Airport, which will continue to prepare a detailed complaint handling plan.