NATURAL DISASTER RISK ASSESSMENT AND AREA BUSINESS CONTINUITY PLAN FORMULATION

BANGKADI INDUSTRIAL PARK AREA
PATHUMTHANI PROVINCE, THAILAND

Facilitated by

Asian Disaster Preparedness Center

For

National Economic and Social Development Board

Supported by

Japan International Cooperation Agency (Thailand Office)

Disclaimer

The document is based on existing reports as well as evidenced through data collection and analysis informed by a series of workshops and consultations with relevant stakeholders. The document is considered to be a living document and needs to be kept updated as per the Area BCM cycle approach taken under the project.

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Note: this version of the report contains revisions which incorporate feedback and comments provided by the National Steering Committee of Area BCM project in February 2017

List of key modification points to Area BCM report

	Topic	Location in the report	Details of modifications
1	Disaster Risk Reduction Measures for Effective Area BCM for Floods	Table 7.2	Table 7.2 is merged with Table 7.3 (Original) and Flood Risk Level and BCM Strategies are improved. Also, Bottlenecks are reclassified to be in line with the rest of the report.
2	Measures that have been prioritized to prepare for Area BCM action plans	Table 8.1	Measures are improved/added from 18 to 20 measures according to the suggestions from the steering committee.
3	Action plans for Area BCM	Table 8.2	Action plans are improved/added from 4 to 20 action plans according to the suggestions from the steering committee.
4	Measures and detailed plans that are relevant to Full Scale Exercise	Table 8.3	This table is added from selecting 10 measures and detailed plans that are relevant to Full Scale Exercise by focusing on "During Disaster" measures according to the suggestions from the Provincial Area BCM Board of Committee.
5	Plan Review	Section 9.1	This topic is moved from Chapter 8 to Chapter 9.
6	Suggestions from the Steering Committee	Section 9.2.2	Format and content are improved to be consistent with the suggestions as shown in the formal meeting minute of the steering committee meeting on December 6, 2016. Also, more explanation is added to this section as well to be in line with the suggestions from the committee.
7	Suggestions from the Provincial Area BCM Board of Committee	Section 9.2.3	This section is added where some guidelines for Full Scale Exercise are included. Also, agency that will take responsibility and ownership of the plan has been decided and the agency that will be in charge of Full Scale Exercise is assigned and indicated in this section as well.

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Chapter 1 - Introduction

1.1 Background and Rationale

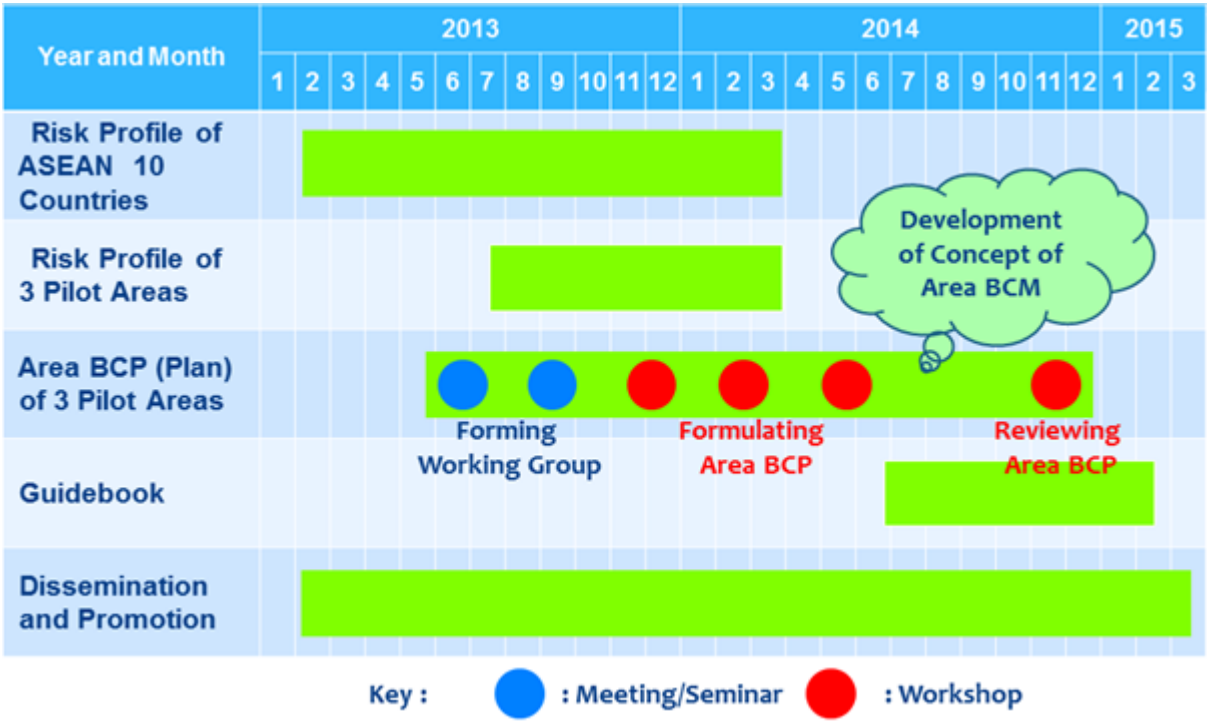
During the past decade, catastrophes occurred in many areas. For example, the 2011 Great Earthquake in Japan was unexpectedly devastating and caused significant damages to many unprepared organizations who had limited capacity to handle the disaster. This in turn affected social, economic and industrial sectors especially those with extensive supply chain trade networks.

As a result, the Japan International Cooperation Agency (JICA) has developed a new concept and operating framework in order to mitigate the issue. This concept is called Area Business Continuity Management (Area BCM) and its purpose is to initiate collaboration among stakeholders, including public sector, private sector and the community, especially in industrial areas. This collaboration is aimed at creating strategic plans to prevent and reduce disaster risk and also strengthen the capacity of the concerned sectors to be ready and resilient for disaster events as well as to be prepared for recovery following disasters.

1.1.1 Project Background, "Natural Disaster Risk Assessment and Area Business Continuity Plan Formulation for Industrial Agglomerated Areas in the ASEAN Region"

From February 2013 to March 2015, JICA, in co-operation with the ASEAN Coordinating Centre for Humanitarian Assistance (AHA Centre), implemented a projected called "Natural Disaster Risk Assessment and Area Business Continuity Plan Formulation for Industrial Agglomerated Areas in the ASEAN Region" to support the areas in the ASEAN region in order to reduce losses that might occur as a result of major natural disasters. This was especially focused on the industrial areas. The study of this project gathered data on risk and basic information of the 10 member countries of ASEAN. The outcomes of the Study were Area BCM Guidebooks, Country Reports on the 10 ASEAN Member States and Risk Profile Reports on the 3 pilot areas, namely Indonesia, the Philippines and Vietnam. These 3 pilot countries were chosen initially to develop the Planning Guide for Area Business Continuity. The implementation plan of the project is shown in table 1.1 and the project took 2 years and 2 months to finish.

Table 1.1: Project plan of Natural Disaster Risk Assessment and Area Business Continuity Plan Formulation for Industrial Agglomerated Areas in the ASEAN Region



Source: Japan International Cooperation Agency, JICA

1.1.1.1 Prior Area BCM pilot projects in other countries

JICA selected the following three industrial areas in Indonesia, the Philippine and Vietnam as project pilot areas;

- An industrial agglomerated area in Bekasi and Karawang regencies in Indonesia
- An industrial agglomerated area in Cavite and Laguna and the southern part of Manila in the Philippines
- An industrial agglomerated area in Haiphong city in Vietnam

The purpose of the Area BCM projects in pilot areas was to propose and develop the concept of Area BCM, which is a new approach of business continuity in order to mitigate damage on the economy and society of the affected area and propose the procedure of collaborative implementation of Area BCM in establishing Area Business Continuity Planning (Area BCP)[1].

[1] As of June 2016, Bangkadi Industrial Park contains a total of 38 factories.

Following the steps of the Area BCM cycle, the stakeholders in the pilot areas prepared the Area BCP with support from JICA and AHA Center. These 2 organizations helped organizing a series of workshops and conferences to establish a working committee and holding meetings to develop the plans in the areas.

(1) Establishment of a working group

The JICA study team and AHA Center helped coordinate meetings twice to lead the working group and the working group for the pilot areas. It can be summarized as follows.

- **The leader of Working Group:** In Vietnam and Indonesia one leading organization was assigned in the preparation of the plan while in the Philippines five organizations were assigned to co-lead the process.
- **Working Group**: the stakeholders were divided into three: leader(s) (who own the Area BCM/ Area BCP and have a key role in promoting, implementing and maintaining the Area BCM/Area BCP such as local governments, members (stakeholders in the pilot area who participate in Area BCP such as operators of infrastructure and lifeline utilities, private sector and communities) and supporters (who support the smooth implementation of the process such as ministries and agencies of the national government, research institutes, universities). In any case, the supporter must be encouraged to promote adoption of Area BCM in the countries.

Since the pilot study in three industrial agglomerated areas of Indonesia, Vietnam and the Philippines had no committees to drive Area BCM at the national level, the working team in pilot areas was established consisting of leading members and supporters shared by many members of the working group. The organizations that were involved in the working group are shown in Table 1.2.

Table 1.2: Participating Organizations in the working group in 3 pilot countries

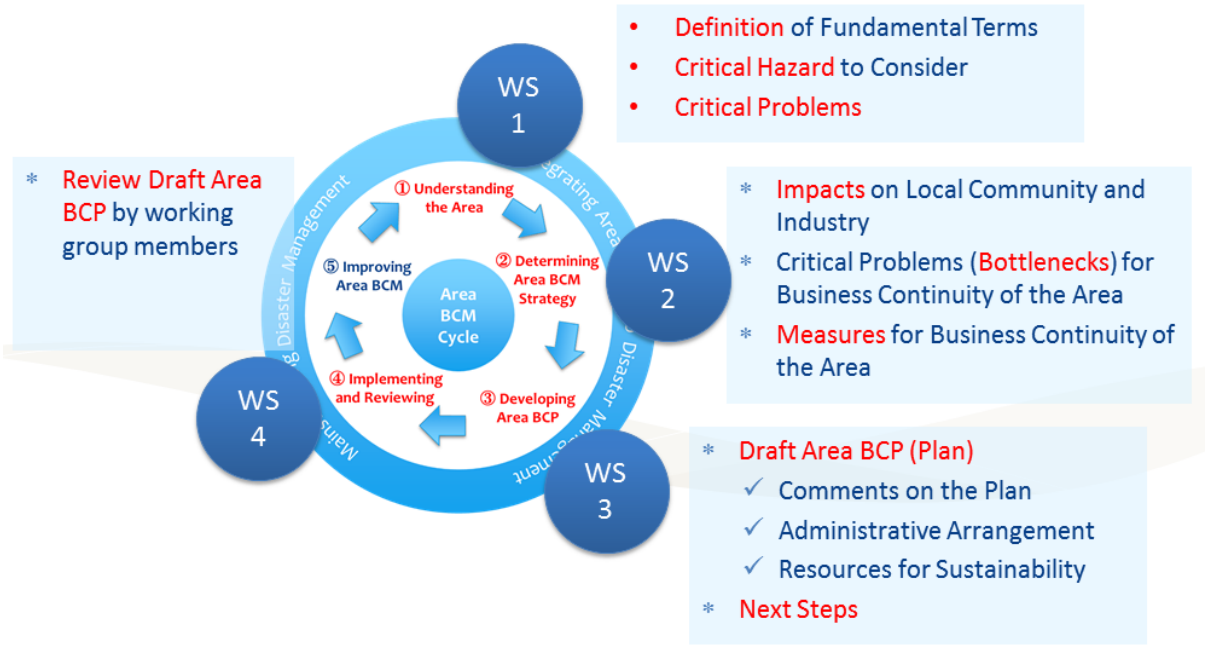
	Leaders	Members	Supporters
Indonesia, (54 members)	1	39	14
Philippines (43 members)	4	30	9
Vietnam (38 members)	2	25	11

Source: Japan International Cooperation Agency, JICA

(2) Organization of meeting to plan development in the area

In order to develop the Area BCP, each pilot area organized 4 workshops, namely 1. Understanding the area, 2. Determining Area BCM strategy, 3. Developing Area BCP, and 4. Reviewing Area BCP. The topics in each workshop are described in Figure 1.1 and Table 1.3 respectively.

Figure 1.1: Workshops according to cycle of Area BCM process



Source: Japan International Cooperation Agency (JICA)

Table 1.3: Objectives and topics of the 4 workshops in the past 3 pilot areas

Workshop	Objectives of Workshop	Topics at group works
1	* Hazards affecting the industrial agglomerated area * Business environment during disaster situation * Limitations of individual BCPs	* Fundamental policy relevant to Area Business Continuity * Critical hazards to be considered in Area BCP/BCM * Critical problems for business continuity

Workshop	Objectives of Workshop	Topics at group works
2	* Impact of disasters on industries in the industrial agglomerated area * Identify challenges facing the industrial agglomerated area * Measures to address the problems	* Impacts on the local community and industry by disasters * Critical problems (bottlenecks) for area business continuity * Measures for area business continuity
3	* Draft Area BCP * Improvements of Draft Area BCP and previous workshops * Future activities	* Do you think that this plan is useful for the continuity of industry in the area? * Do you think which contents of this plan will be improved? * Which organization is suitable for the owner/maintainer to promote Area BCP in the area? * Which resources and system are needed to continue Area BCM? * What activities do you expect in the next step of Area BCM?
4	* Review Area BCM cycle and * Review Area BCP * Lessons learned and next step of implementation in each country	* From the review of the plan, how should the plan be improved? * Which responsibility should the involving organizations have in Area BCM cycle? * For this area, which activities should be done next?

Source: Japan International Cooperation Agency (JICA)

However, since this Area BCP was developed for the first time, the current plan is still only a conceptual framework that still needs to be reviewed at the operational level in the area. The JICA study team has identified that many components of Area BCP in the pilot areas still do not have enough details and possess only qualitative information at this point. This plan can be improved to

become more quantitative if it is repeatedly implemented following the cycle of Area BCM. Furthermore, Area BCP developed from the workshops in each pilot area has not been published or still has not received formal approval from the local government. This is because, at this phase, the plan is only agreed among those who participated in the project. In addition, a leader organization (owner) should be clearly identified in order to effectively develop and update the Area BCP in the 3 locations.

1.1.2 Area BCM pilot project in Thailand

As mentioned above, JICA and AHA Center jointly prepared a report assessing risks in the 10 ASEAN countries, including Indonesia, Myanmar, the Philippines, Thailand, Vietnam, Brunei, Cambodia, Laos, Malaysia, and Singapore. The report offers a compilation of important information such as information about natural disasters risks, industrial agglomerated areas / estates / industrial parks, transport infrastructure and lifeline utilities, legal framework regarding disaster risk management and BCP and the current state of implementation of BCP. The analysis of the report found out that, in Thailand, the development of the BCP only exists in the banking sector and financial institutions. However, BCP still has not been clearly implemented or supported in the manufacturing sector.

1.1.2.1 Dialogues between Japan International Cooperation Agency (JICA) and National Economic and Social Development Board (NESDB)

NESDB conducted a study of BCP in 2011 and classifies the implementation of the BCP into 3 levels: the national, regulatory and business enterprise levels and identifies that at:

- **The national level:** Thailand has no clear plan in business continuity. There is only an agency which manages and handles emergency situations, and the agency only focuses on the implementation and management of disasters that affect the lives and property of citizens. The lack of clarity regarding the participation of the public and a procedure to protect critical infrastructure of the country is because there has not been any official establishment of the grouping of important infrastructure.
- **The regulatory level:** This is an agency that links the implementation of the BCP between the national level and the business enterprise level. Currently, regulators encourage the development of BCP by some financial institutions. The group actively promotes and pushes the development of more robust BCP measures. The Industrial Estate Authority of Thailand

also promotes the development of BCP in their industrial and entrepreneurial networks together with exercise of a drill at least once a year.

- **The business enterprise level:** Large enterprises have been implementing business continuity management (BCM), which is caused by the awareness of the organization itself and because it is also regulated. This has influenced some sectors such as a banking sector to comply with the regulations. In some organizations, even if they manage and plan for BCP, they still have not understood its concept well, which hinders co-operation with the national level. Additionally, the main objective of current BCP in Thailand is to keep businesses operating even during crisis, which is not adequate. This is because business continuity requires involvement from various sectors such as government agencies responsible for infrastructure in the area as well as neighboring communities where they operate.

Although many organizations are aware of disaster preparedness, including recovery from the incident, these organizations still have limited capacities to deal with serious disasters which affect their transportation services, facilities and infrastructure. These are basic resources for the operation of the organization. For example, the flooding in Thailand in 2011 caused a temporary suspension of lifeline utilities and infrastructure. This impacted the disruption of the manufacturing sector, which is the sector which was most damaged by the disaster. This resulted in a decrease in exports and private sector confidence. The World Bank estimated the loss and damage of this disaster at a total value of 1.36 billion baht.

Meanwhile, JICA representatives discussed with the NESDB in the preparation of the Area BCP in the first pilot three countries? Business Continuity Plan in June 2014 and discussed further regarding the preparation of a strategy for Thailand's National Area BCP in Thailand in October 2014. As a result, they jointly organized a symposium inviting relevant agencies such as the Department of Disaster Prevention and Mitigation (DDPM), Department of Water Resources, Department of Local Administration, Metropolitan Electricity Authority, Provincial Electricity Authority, Metropolitan Waterworks Authority, Provincial Waterworks Authority, Department of Highways, Department of Rural Roads, Industrial Estate Authority of Thailand, Communication Authority of Thailand Plc., TOT Public Company Limited, Airport Authority of Thailand, Bank of Thailand and The Federation of Thai Industries (FTI) to listen to the ideas and the experience of implementing a pilot project to improve the economy in the three countries. (See section 1.1.1.1) and to propose requirements of the agency to promote development of a BCP at the national level and Area BCP in the country on December 17, 2014.

From the results of the study by NESDB and the experience of the major floods in 2011, the benefit of Area BCM was acknowledged by JICA as it is in line with the concept of Area Business Continuity Management System (Area BCMS) in the region and the proposal of the pilot project in Thailand was approved by Dr. Hitoshi Baba, the advisor of JICA, who is an expert in the field. The NESDB granted approval to obtain technical assistance from JICA including support for the preparation process of BCP nationally (BCP approach at the national level) for Thailand in accordance with the National Disaster Prevention and Mitigation Plan and has supported the implementation of the concept of Area BCP and BCM in Thailand.

1.1.2.2 Disaster in Thailand

In order to indicate the importance of implementing area-wide BCM, since the region has a possibility of encountering a disaster, it is necessary to study about disasters in Thailand to assess and recognize the impacts that may occur.

With regard to the evaluation and analysis of the overall disasters, the project on Strengthened Disaster Management Strategies in Thailand in 1994 in cooperation with the Government of Thailand, the Asian Disaster Preparedness Center (ADPC), the Asian Institute of Technology (AIT) and the United Nations Development Program (UNDP) conducted a study of disasters. The analysis took place in terms of potential threats, vulnerabilities to disasters, disaster management and the risks that will cause serious disasters. The analysis indicated that flooding is a major problem for the country, followed by the danger of explosion and accidents as shown in Table 1.4

Table 1.4: Relationship between types of disaster and probability, vulnerability to disasters, Disaster Management Capacity, and risk level

Type of disaster	Probability	Vulnerability to disasters	Disaster Management Capacity	Risk Level	Risk Ranking
Flood	High	Medium	Medium	High	High
Explosion	High	Medium	Low	High	High
Accident	High	Medium	Low	High	High
Typhoon	High	High	Medium	Medium	Medium
Earthquake	Low	Low	Low	Medium	Medium
Drought	High	Medium	Medium	Medium	Medium
Landslide	Medium	Low	Low	Medium	Medium
Fire	High	Medium	Medium	Medium	Medium
Contamination or insect infestation	Medium	Low	Low	Medium	Medium
Alien workers	Medium	Low	Medium	Medium	Medium
Epidemic	Low	Low	Medium	Low	Low

Adapted from the Department of Disaster Prevention and Mitigation, Thailand Country Profiles (2011)

When analyzing the natural disaster, Thailand is located in an area vulnerable to risks from weather or water (Hydro-meteorological phenomena), such as flooding, mudslides, storm, drought, etc. Thailand has faced flooding almost every year. Table 1.5 shows the average damage per year (Average Annual Loss: AAL) from disasters. The threat of flooding caused the most damage to the country, which is 98% of the average annual damage of all disasters.

Table 1.5: Average damage per year (Average Annual Loss: AAL) from disasters and probabilistic risk results

Type of disaster	Amount (Million US Dollars)	Capital stock (%)	GFCF (Gross Fixed Capital Formation) (%)	Social Expenditure (%)	Total reserves of financial institutions (%)	Gross savings (%)
Earthquake	32.56	0.002	0.031	0.057	0.020	0.029
Wind storm	0.02	0.000	0.000	0.000	0.000	0.000
Storm surge	0.10	0.10	0.000	0.000	0.000	0.000
Tsunami	0.53	0.000	0.001	0.001	0.000	0.000
Flood	2586.19	0.188	2.498	4.509	1.603	2.338
Total	**2619.40**	**0.190**	**2.530**	**4.567**	**1.624**	**2.368**

Source: http://www.preventionweb.net/countries/tha/data/, Retrieved on 29 June 2016

In addition, the report of risk assessment study by JICA and AHA Center found that natural disasters in Thailand are caused by flooding, which is 58%, followed by storms, which is 29%. In any case, flood and drought disasters affected people as much as 58 percent and 37 respectively. In terms of fatality, however, this study found that the Indian Ocean earthquake and tsunami in 2004 caused the most deaths from disaster in Thailand historically, followed by the flood in 2011. Nevertheless, the results of this study indicated that in Thailand flooding caused the most catastrophic impact on the economy and majority of damages was caused by the 2011 flood.

1.1.2.3 Selection of Area BCM pilot project in Thailand

NESDB held a meeting to discuss cooperation among various agencies in January 2015 at the office of the NESDB in order to determine a qualified pilot area for the Area BCM project. There were 50 participants from 22 agencies from public sector, public enterprises and private sector representatives. The meeting reached a consensus that the pilot area should have the following characteristics:

- It should be an area with a significant concentration of manufacturing industry;
- There is an essential lifeline utility such as electricity and waterworks, roads, power stations and ports for transportation;
- It should be an area that is vital to economic and social development;
- It should be a vulnerable area and could greatly impact on the country if serious disasters such as floods, tsunamis, earthquakes occur; and.
- It should be an area with an investment from overseas so that the project can build confidence for both domestic and international investors.

From these selection criteria, the participants of the meeting proposed the following 5 pilot areas:

(1) Industrial agglomerated area in Ayutthaya province, which is large and diverse. The area was flooded in 2011 and the World Bank estimated that the damage to the factories in the industrial estates was about 1.44 billion baht and damage to the factories outside the industrial estates was more than 9.3 billion baht.

(2) Industrial agglomerated area in Pathumthani province, which is large and contains many industrial parks that are operated by the private sector. Many of them also experienced flooding in 2011. It was estimated that the damage to the factories in the industrial estates was about 9.3 billion baht and damage to the factories outside the industrial estates was about 6.3 billion baht.

(3) Area in Phuket province (In case of the tsunami), which is the region's tourism industry that is important to Thailand. The impact of the tsunami in the year 2004 caused a loss of many lives and properties. 5,365 people died and 8,457 people injured with more than 2,800 people missing.

(4) Area in Chiang Rai province (In case of earthquakes and floods), which is an area where earthquakes occur more and more frequently. Also, the floods have occurred regularly over the past years.

(5) Area of Map Ta Phut industrial district or Hemaraj in the Eastern region. This is a region where a lot of factories and industrial estates are located and many factories have moved their production facilities from the Chao Phraya river wetlands due to flood in 2011 to its present location.

In addition to the selection of pilot areas, since the Area BCM project is a project carried out in the industrial agglomerated areas most of which are located outside the special administrative area (such as Bangkok. And Pattaya City), the meeting participants agreed that the governor of the areas should be responsible for supervising the project, including supporting and monitoring the preparation of Area BCP. In addition, the local authorities, such as local government, administrators of industrial

parks, Provincial Disaster Prevention and Mitigation, utility agencies and private companies should be key stakeholders in preparing Area BCP.

Later in the same month, NESDB and JICA jointly organized a seminar about the pilot Area BCP (on Direction and Pilot Project of Thai Area BCP) at the Royal Princess Hotel in Bangkok to present the results of selected pilot areas and the involving organizations and to exchange views on this issue with experts from JICA for action in this regard. The seminar participants agreed to select the industrial agglomerated area in Pathumthani province as a pilot project area since there are many large industrial plants. Many of the industrial plants are operated by the private sector. Many of the areas in Pathumthani province was submerged in the 2011 flood which damaged Nava Nakorn and Bangkadi industrial park up to 86,511 and 6,696 million baht, respectively. In 2013, Pathumthani had a population of 1,048,665 people, 3,298 industrial plants, capital investment of 403,408 million baht and employment of 282,180 people.

1.1.3 Preparatory meetings of the pilot project

In March 2015, NESDB and JICA delegation met with the provincial governor of Pathumthani to request cooperation to implement the pilot project of Area BCM. The results of the meeting can be summarized as follows.

1.1.3.1 Preparatory of Pilot Area

The meeting participants agreed to select Bangkadi Industrial Park, which is located in Tambon Bangkadi, Amphoe Muang of Pathumthani province to be the pilot area because of the following:

- This area supports many manufacturing plants in a variety of industries, especially key electrical and electronics plants which are parts of major supply chain networks. From the major flood experience in 2011, the disruption of electrical and electronics plants created wide impacts to the market, both domestically and internationally. This industrial park is the site of key electrical and electronics plants such as Toshiba and Sony. Furthermore, the area outside this park is also the location of the many other major plants, such as Ajinomoto, who is one of the leading companies in food industry.

- 70% of all plants in the Bangkadi industrial park are foreign investments[2]. This consists of investments from Japan and other countries accounting for 60% and 10% respectively. Therefore, implementation of Area BCM in the area would raise confidence of foreign investors in the preparation of the area to recognize and adapt to potentially catastrophic situations. Incidentally, it is noteworthy that the number of factories in this industrial park in 2016 has decreased in comparison to the situation before the flood in the year 2011[3]. Moreover, 3 of the factories were closed or relocated immediately after the floods[4].
- Although Bangkadi Industrial Park established a committee for the management of flooding, including the establishment of structures to respond to emergency situations effectively, the surrounding area and the park itself were damaged by the flooding significantly in 2011. The maximum flood level was 4.3 meters and the duration of the floods in the area lasted over 1 month.
- The area possesses strong availability of infrastructure and lifeline utilities. And transportation system contains a variety of import and transit modes in order to support raw materials and finished products to markets outside the industry.
- The area possesses strong communities and local governments such as municipalities of Bangkadi. Moreover, the surrounding area is not very large, which implys the likelihood of the achievement of the project.

1.1.3.2 Responsible Agencies

The authority of Pathumthani province has established a coordinating team (Focal Point) to coordinate the implementation of the project, in which the Deputy Governor of the province was assigned to spearhead strategic work as a team leader. There is a provincial chief secretary to coordinate the project together with public agencies involved in the management of the industry as a pilot area and the agency responsible for infrastructure and transportation and communication. In addition, JICA has provided support in terms of expertise and activities in the Area BCM which and contracted ADPC as coordinator to carry out activities to facilitate the implementation of the project.

[2] As of June 2016, Bangkadi Industrial Park contains a total of 38 factories.
[3] Before the great floods of 2011, Bangkadi Industrial Park contained a total of 44 factories.
[4] Fiscal Policy Office, Ministry of Finance (2012), Analysis of the industry recovery after the Great Flood of 2011.

Later in October 2015, a joint meeting between representatives of JICA, ADPC and NESDB was held at the Central Bureau of Economic and Social Development in Nonthaburi province. The topic of the meeting was on the establishment of a committee to carry out the pilot project of Area BCM as well as to arrange an appointment to meet with the provincial governor of Pathumthani to report on progress in the establishment of the committee for implementation. The purpose was to ensure that the project would proceed effectively and achieve its objectives. In addition, in order to promote a strategic plan for national capacity building in preparedness and disaster response, the meeting participants agreed to set up a committee at the national, provincial and local levels[5], as follows:

- **At the national level**, there was an establishment of a National Steering Committee on Area BCM project (NESDB later issued an appointment no. 247/2558) to facilitate the supervision and monitoring of the project of Area BCM and to publish the results of the pilot study. Also, the purpose of the establishment was to develop a model for promoting the approach for BCP at the national level to support BCM at the area basis and the national level, in which NESDB secretary was appointed as the chairman of the committee.
- **At the provincial level**, there was an establishment of a Provincial Area BCM Board of Committee (Pathumthani Province later issued an appointment no. 143/2559) for directing and coordinating the work of Area BCM project smoothly. This is also to provide important information on the preparation of Area BCP, in which the governor of Pathumthani province was appointed as the chairman of the Board of Director.
- **At the local level**, there was an establishment of a Working Group for Area BCM project (Pathumthani Province later issued an appointment no. 143/2559) to implement Area BCP starting by understanding the industrial park area, suggesting comments and analyzing the information required to plan. The purpose was to define strategies and measures to help the area operate continuously and restore operations quickly if disaster strikes. In addition, it was to organize workshops, rehearsals, review and monitoring of the Area BCP by the mayor of Bangkadi Municipality who is appointed as the chairman of the Working Group.

In October 2015, there was a joint meeting among JICA, ADPC, NESDB officials, Pathumthani officials, Bangkadi district official and representatives from Bangkadi Industrial Park. The purpose of the meeting was to inform the background of the project and the need of Pathumthani province to establish a working group at the provincial and local level to implement the Area BCM project. In

[5] Official documents are shown in Appendix A

November 2015, there was another formal meeting among ADPC, NESDB officials, Pathumthani officials, Bangkadi district official and representatives from Bangkadi Industrial Park at the town hall in Pathumthani in order to make sure that the understanding of the implementation of the Area BCM pilot project was on track and to launch meetings and workshops under the Area BCP project, which is to operate for 11 months from October 2015 to September 2016[6]. In addition, ADPC also undertook translation of the Planning Guide for Area Business Continuity from English into Thai so that the working group and the relevant authorities can use this translation as a guide for the implementation of the project. This Planning Guide for Area Business Continuity was initially developed from the prior pilot project Area BCM in 3 countries and the translation was done in close consultation with the NESDB officials.

1.2 Goals and Objectives

The goals of Area BCM project are in line with the principle of the Sendai Framework for Disaster Risk Reduction 2015-2030, which is focused on disaster risk management. Starting from the local to prevent and mitigate disasters that may occur, this project would help the local people to effectively perform adaptation and recovery operations in the area after a disaster. Its approach focuses on creating a partnership of all sectors including government, private and community sectors. Particularly, the focus will be on the strengthening of the private sector to enhance the role of risk management in order to increase their ability to adapt at the time of an emergency or disaster to restore the operations back to normal conditions in a short period of time.

The pilot Area BCM project has the following objectives:

(1) To encourage understanding of the concept of Area BCM/BCP by project members;
(2) To facilitate and lead the discussions, consideration and elaboration of Area BCM/BCP; and
(3) To support NESDB in implementing the project from technical aspects.

[6] The duration of the project has been extended from Oct 2015 - Jul 2016 to Oct 2015 - Dec 2016.

1.3 Terminology and steps of Area BCM cycle

In order to understand the concept and implementation process of a pilot project of Area BCM in the same direction, relevant terms and details of the process of project implementation are explained as follows.

1.3.1 BCM / BCP and Area BCM / Area BCP

The difference between Business Continuity Management (BCM) and Business Continuity Plan (BCP) can be explained by the definition of ISO 22301: 2012 standard for business continuity management system as follows.

Business Continuity Management (BCM) is a holistic management process that identifies potential threats to an organization and the impacts to business operations those threats, if realized, might cause, and which provides a framework for building organizational resilience with the capability of an effective response that safeguards the interests of its key stakeholders, reputation, brand and value-creating activities.

Business Continuity Plan (BCP) is documented procedures that guide organizations to respond, recover, resume, and restore to a pre-defined level of operation following disruption. Typically this covers resources, services and activities required to ensure the continuity of critical business functions.

In addition, the Planning Guide for Area Business Continuity has defined the Area BCM and Area BCP as follows.

Area Business Continuity Management (Area BCM)[7] is a cyclic process of understanding risks and impacts, determining common strategy of risk management, developing the Area BCP, implementing planned actions and monitoring to continuously improve the Area BCM System, in coordination among stakeholders including individual enterprises, industrial area managers, local authorities and administrator of the infrastructures as well as communities, in order to improve the resilience of the local economy to disasters.

[7] Source: Hitoshi Baba (2014) Area Business Continuity Management, a new opportunity for public-private partnerships. Proceedings of the International Disaster and Risk Conference Davos 2014, Pp.74-78

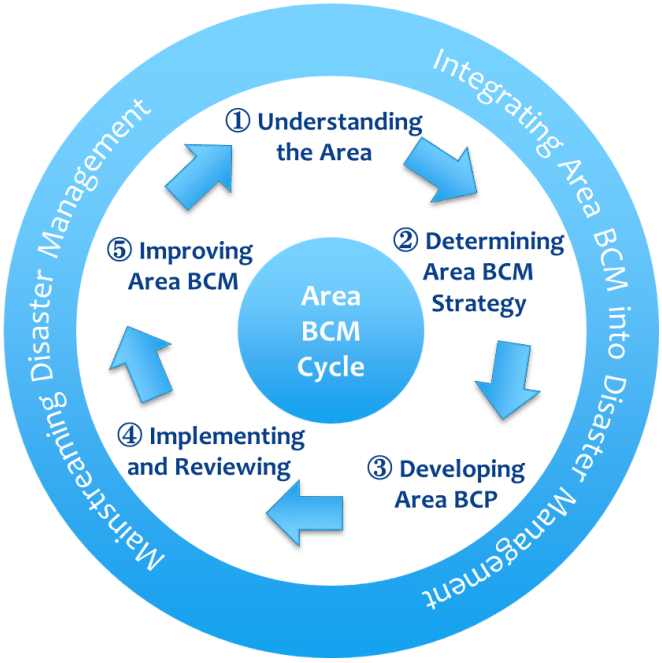
Area Business Continuity Plan (Area BCP)[8] is a document describing a framework and direction of actions of disaster risk management by stakeholders as well as cooperation and coordination among them to facilitate business continuation of the industrial agglomerated area as a whole.

1.3.2 Area BCM Cycle

Area Business Continuity Management (Area BCM) is a cooperative approach by stakeholders who wish to improve capacity for continuity and/or early recovery of businesses in their area in the event of emergency such as natural disasters that affect the entire area. The Great East Japan Earthquake and Tsunami in Japan and the Flood of the Chao Phraya River in Thailand both occurring in 2011 showed us the high risks of business disruption. These disasters reminded us that, in the event of a large scale natural disaster, organizations are limited in their abilities to cope with the disaster without the cooperative approach taken by the stakeholders of the public and private sectors in those areas. Regardless of the amount of effort put into an organization, it struggles to continue business, mainly due to the malfunctioning of transport infrastructure, shortages of basic supplies such as electricity, water and information, and disrupted supply chains. Therefore, the stakeholders of the area, both from public and private sectors, should join in the Area BCM to share information on disaster risks, problems of the area, and ways to solve the problems for continuity and early recovery of businesses of the area in the cooperative and integrative approach. The 5 elements of Area BCM cycle are "Understanding the Area", "Determining Area BCM Strategy", "Developing Area BCP", "Implementing and Reviewing", and "Improving Area BCM".

[8] Source: Baba, H; Itsu, Adachi; Hiroshi, Takabayashi; Noriaki, Nagatomo; Shiro, Nakasone; Hideaki, Matsumoto and Toshiyuki, Shimano (2013). Introductory study on Disaster Risk Assessment and Area Business Continuity Planning in industry agglomerated areas in the ASEAN. Journal of Integrated Disaster Management (IDRiMJournal), Vol.3 No.2, Dec. 2013, pp184-195.

Figure 1.2: Area BCM Cycle



Source: Japan International Cooperation Agency (JICA)

1.3.2.1 Understanding the Area

The first step in the Area BCM cycle is to understand the area of concern or target area. Information required includes the list of stakeholders, businesses to protect, and essential transport infrastructures and lifeline utilities for the businesses of the area as well as problems and sensitivities in the area and the risk of disasters, including the assessment of impacts that could occur in the area.

The target area may cover an industrial agglomerated area where it is necessary to reduce disaster risks on business continuity, and also locations where transport infrastructures and lifeline utilities, which are essential for business continuity, are located. The area affected by hazards is variable. Earthquakes or tsunamis affect wider area than floods or landslides, even when considering the same industrial agglomerated area.

1.3.2.2 Determining Area BCM Strategy

After understanding the area of concern, the next step is Determining Area BCM Strategy in order to improve the capacity for continuity and early recovery of the economy or businesses of an area as a whole (or area business continuity) against the assumed disasters, and it is composed of deciding the

objectives of area business continuity and directing the activities of improvement for area business continuity as follows.

- Disaster Scenario Creation
- Individual/Area Business Impact Analysis (Individual/Area BIA)
- Identifying Bottlenecks of the Area or the critical factors which exacerbate damage of the area or delay the recovery of society and businesses of the area.
- Determining Objectives of Area Business Continuity
- Planning Activities of Improvement. In this activity, the adequate measures are chosen and the activities of improvement are planned in order to address bottlenecks and manage their progress. The progress is shared among all members, and the improvement activities are promoted continuously.

1.3.2.3 Developing Area BCP

The Area BCP is based on the work results of "Understanding the Area" and "Determining Area BCM Strategy". Area BCP is a document set of procedures and information that is necessary to promote continuity and/or early recovery of businesses of an area in an emergency such as natural disasters that affect the entire area. The plan should be shared among the stakeholders in the area. Area BCP is formulated via the following steps, in consideration of different situations depending on country or region.

- Step 1 - The concept and schedule of the plan is indicated by the steering committee. The workshops (WSs) will be organized by the leader, in which the working group (WG) members will participant and develop the plan.
- Step 2 - In WSs, the contents of the plan will be discussed. The information to fill the contents will be collected by sharing the plan among the leader and WG members.
- Step 3 - The draft plan will be developed by the WG members.
- Step 4 - The plan will be reviewed by the steering committee and approved officially by the leader or the local government.
- Step 5 - The activities of Area BCM will be carried out by all members according to the plan.
- Step 6 - After the activities, the steering committee will review and improve the plan as is appropriate and practical.

The contents of Area BCP should include the following items.

(1) Purpose and Scope: The purpose and scope of Area BCM are described explicitly.

(2) Document Owner and Maintainer: The organization, name of the document owner, and maintainer of Area BCP are described. In addition, list of members of steering committee and working group are attached.

(3) Roles and responsibilities: The roles and responsibilities of organizations to participate in Area BCM are described. These organizations are classified as leaders, members and supporters.

(4) Description of the area: A brief overview of the area is described based on "Understanding the Area", including the following items.

- General information regarding the local economy of the area
- The characteristics of the industrial park
- Local administration(s) where the industrial park are located
- Transport infrastructures that the industry in the area is dependent on
- Lifeline utilities that the industry in the area is dependent on
- The experiences of natural disasters that have affected the area

(5) Description of Area BCM strategies: The strategies are described based on "Determining Area BCM Strategy", including the following items.

- Results of hazards and risks assessments
- Results of business impact analysis and bottlenecks for area business continuity
- Objectives of area business continuity
- Activities to improve the capability of area business continuity

(6) Issues for improvement: Lessons and issues for improvement of Area BCM are described. These will be considered in the next cycle of Area BCM.

1.3.2.4 Implementing and Reviewing

Area BCP is a set of documents that provide a common and agreed direction of measures. The stakeholders have a responsibility to plan and implement measures for the organization. In addition, an activity report should be prepared by each organization to describe the achievements, experiences and lessons learned. The experiences and lessons learned should be provided to improve the Area BCM. Summing up the achievements would lead to enhancement of the resilience of businesses of the area as a whole.

1.3.2.5 Improving Area BCM

Area BCM arrangements and Area BCP established cannot be considered feasible until they are exercised and tested. Continuous improvement is required to keep the Area BCP and Area BCM up to date. Both of them can be described as follows.

- **Improvement of Area BCP**

This can be achieved by building capacity of key staff from the organization, integrating the plan with individual BCPs and/or disaster risk management plan, and awareness raising of other stakeholders in the area.

- **Improvement of Area BCM**

After putting Area BCM system in place, it is required to improve Area BCM arrangements by repeating the cycle in order to cope with the changing conditions of the area such as:

- changes in the composition of stakeholders;
- changes in the target area of Area BCM;
- new natural disaster risk(s) emerged;
- following lessons learned from exercising and reviewing;
- following lessons learned from natural disasters in the area and other locations; and
- other necessary occasions.

1.4 Project Contribution

Benefits to be gained from the pilot Area BCM project in the Bangkadi Industrial Park in Pathumthani can be divided into two levels as follows.

1.4.1 Local area level

(1) It is to promote strategic cooperation of stakeholders in the area together with building disaster resilience with fast and effective performance. The collaboration between local organizations is to focus on the important issues as follows.

- To mitigate damage and expedite recovery of critical business resources such as energy, water and transport infrastructure in the event of a disaster

- To protect lives and properties in the area as much as possible and to allocate limited resources appropriately in the event of disasters
- To share information about the area and to make decision together with regards to disaster risk in the particular area

(2) It is to strengthen the relationship among the participants of Area BCM project implementation and to strengthen the trust between each other by increasing corporate accountability in the implementation of a business continuity management system in the area and to encourage the private sector to cooperate with the public sector to invest more in infrastructure.

(3) It is to enhance the knowledge gained to adapt and revive the economy in the area. The Area BCM project is an opportunity to combine the efforts of private sector with the public sector in order to enhance operations even during normal times and to reduce the impact that may be caused by various disasters, which lead to disaster prevention and sustainable growth.

(4) It is to enhance the continuity management of the organization (Individual BCM) to manage the risk of disasters in the area and the project creates more opportunity to gather more information about the area. Organizations that are in the area, especially the smaller organizations such as SMEs can adopt data from a project to develop an action plan for preparation for and managing ongoing business enterprise (Individual BCP) efficiently and effectively.

(5) It is to increase investment opportunities to the area. Although it may be too early to evaluate the full benefits of Area BCM, the embarking on a project has created more confidence for foreign investors through the knowledge gained. The ability for adaptation and restoration of the areas can create positive impacts for investment and may lead to increasing rate of employment and growth of the local economy.

1.4.2 National level

As this is a pilot project to manage business continuity in the area of Bangkadi Industrial Park, it aims to help the NESDB expand and develop the impacts of the project into a national level approach for BCP. The achievements can be used as a model for the preparation of Area BCM in other industries as well. The benefits from the pilot project of Area BCM are as follows.

(1) It is to use the achievements as planning framework and guidelines for the management of business continuity at the area level of many industries at the country level.

(2) It is to use the achievements as a good practice or role model to encourage cooperation between the public and private sectors, including the networks at the local level to strengthen the ability of communities to adapt and cope with disasters.

(3) It can generate achievements of the study that connect regulators with private and public sectors to encourage their participation to protect critical infrastructure of the country in a tangible fashion.

Chapter 2 - Bangkadi Industrial Park Area Analysis

2.1 Area Profile (Provincial Level)

Bangkadi Industrial Park in Pathumthani has been chosen as a pilot area for the Area BCM project. In order to understand the characteristics of the pilot area, the background of the area should be well understood, including the environment and importance of the area around the industrial park.

Figure 2.1: Location Map of Pathumthani Province

2.1.1 Project location

Pathumthani is located in the central part of Thailand. The area comprises 1,525.856 square kilometers bordered by the following neighboring provinces.

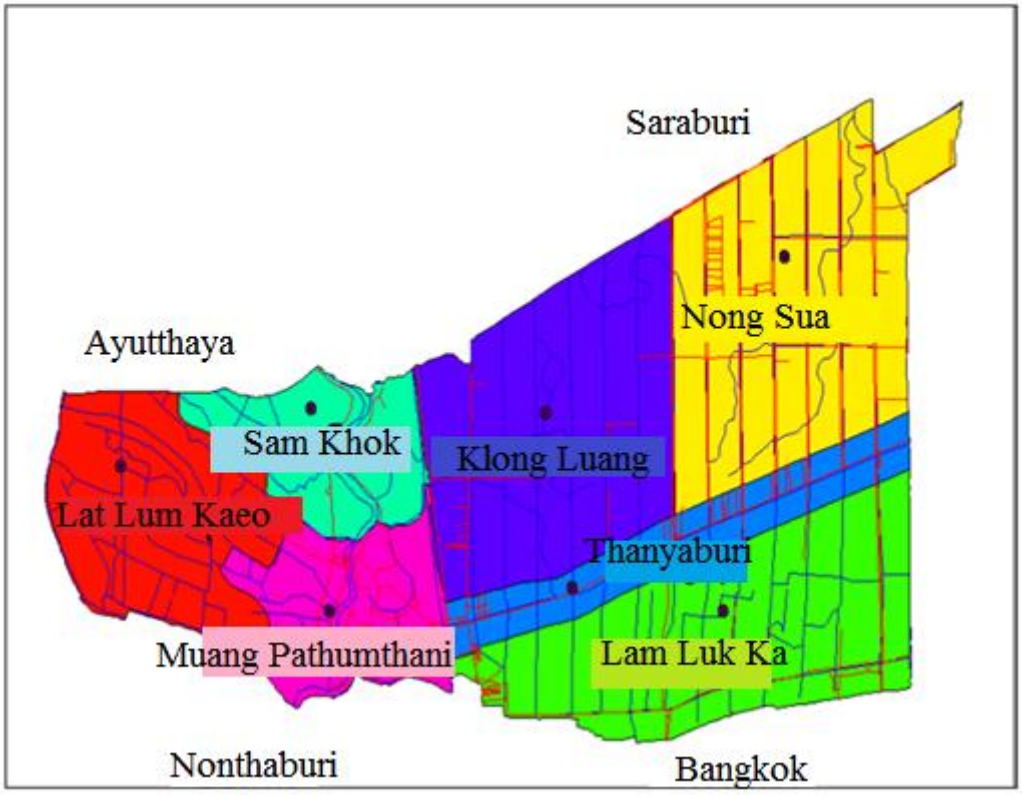
North: Bang Sai district, Bang Pa In district and Wang Noi district, Ayutthaya.
Nongkae District and Wihan Daeng district, Saraburi

East: Ong Ka Rak district, Nakonnayok
Bangnamprieo district, Chachoengsao

West: Lat Bua Luang district, Ayutthaya.
Bang Len district, Nakhon Pathom
Sai Noi district, Nonthaburi

South: Khlongsam Wa, Nong Chok, Bang Khen, Sai Mai and Don Mueang district, Bangkok
Pakkred and Bangbuathong district, Nonthaburi

Figure 2.2: Map showing the boundary of Pathumthani Province



Source: Pathumthani Provincial Administration Office in August 2015, briefing of Pathumthani Province (Revised April 2016)

2.1.2 Factual basis of Pathumthani province

Currently, the regional authority of Pathumthani is divided into 7 districts, 60 sub-districts and 466 villages. The local administration consists of 1 provincial administrative organization, 1 city municipality, 9 town municipalities, 17 sub-district municipalities, 37 sub-district administrative organizations. 7 of the districts in Pathumthani province are Muang Pathumthani, Thanyaburi, Klong Luang, Lam Luk Ka, Lat Lum Kaeo, Sam Khok, and Nong Sua district (see figure 2.2)

Most parts of the Pathumthani province are located on flat plains where the Chao Phraya River runs through the heart of the city in Muang and Sam Khok districts. This means the province is located on the both sides of the river. The area west of the province or on the right bank of the river consists of Lat Lum Kaeo district, part of Muang Pathumthani district and Sam Khok district. The areas east of the province or on the left bank of the river consists of Thanyaburi district, Klong Luang district, Nong Sua district and Lam Luk Ka district, with some part of Muang Pathumthani district and Sam Khok district. During rainy seasons, the water level in the river rises by about 50 centimeters, which causes flooding in the plains along the banks of the Chao Phraya River. Since the area consists of many canals, the water level can be controlled partially.

2.1.2.1 Population

The total number of population and foreign workers in Pathumthani is 1,274,387 people, with the number of the registered population totaling 1,085,652 people and the number of foreign workers of 188,735, accounting for 14.8% of the total population.

Pathumthani's registered population can be divided into 515,910 males and 569,742 females and 539,076 households. The registered population and households in each district of Pathumthani are as follows.

Table 2.1: Registered population of Pathumthani Province

District	Male population	Female population	Total population	Number of households
Muang Pathumthani	91,906	101,108	193,014	95,102
Khlong Luang	121,916	139,169	261,085	139,735
Nong Sua	25,879	26,311	52,190	15,997
Lat Lum Kaeo	30,844	32,528	63,372	30,374
Lum Look Ka	125,216	137,298	262,514	133,157
Sam Khok	26,263	27,745	54,008	21,077
Thanyaburi	93,886	105,583	199,469	103,614

Source: Pathumthani Provincial Administration Office in August 2015, briefing in Pathumthani Province (Revised April 2016).

According to data from the Employment Office of Pathumthani (April-June 2015) it was found that 105,081 of the foreign workers in Pathumthani have received national verification. 58,228 of which have completed the required citizenship procedure and 18,481 of which are temporarily imported.

In addition, the province has an estimated number of 470,996 of unregistered persons, which consists of 227,456 men and 243,530 women who are employed in labor in places such as factories, construction sites and markets etc.[9]

2.1.2.2 Gross Provincial Product and GPP-to-National GDP Ratio

From preliminary data, the Gross Provincial Product (GPP) (Table 2.2)[10] of Pathumthani in 2014 totaled 321,886 million baht, consisting of 7,059 million Baht for the agricultural sector and 314,826 million Baht for non-agricultural sectors. This can be calculated as 2.2% and 97.8% of GDP in Pathumthani province, respectively.

Compared to the year 2013, it was shown that the Gross Provincial Product (GPP) in 2014 increased by 3.9 percent as the non-agricultural products sector rose 4.6 percent. However, it was estimated that

[9] Data from the 2014-2017 Provincial Development Plan of Pathumthani
[10] Office of the National Economic and Social Development Board, Office of The Prime Minister, Gross Provincial Product of Pathumthani, 2005-2014 from http://service.nso.go.th/nso/web/statseries/statseries15.html

the value of products in the agricultural sector decreased by 19 percent. In addition, the per capita gross provincial product (GPP per capita) of 2014 rose by 2.2 percent to 226,173 baht from the year 2013.

For the non-agricultural product sector, it is found that the manufacturing sector has the highest gross value of 188,011 million baht in 2014, which is a 2.5% increase from the year 2013. It is clear that the potential of the manufacturing sector is quite high due to the relatively high potential of expanding industry to neighboring provinces. The industries with high value in Pathumthani include electrical and electronic component industries, which have been expanded to meet the needs of the global market and domestic market. Pathumthani has 2 private investors which operate 2 industrial estates, which are Nava Nakorn Public Company Limited located in Klong Luang district and Bangkadi Industrial Park Co., Ltd. located in Muang Pathumthani district. There are 3,104 factories in Pathumthani province with a total of 286,066 workers[11].

[11] Pathumthani Provincial Statistical Office, Provincial Situation Analysis report, 2014

Table 2.2: Gross Provincial Product at current market prices by Industrial Origin of Pathumthani

Industrial Origin	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Agriculture	**3,676**	**4,223**	**4,612**	**5,606**	**5,805**	**5,557**	**5,629**	**7,760**	**8,724**	**7,059**
Agriculture, Hunting and Forestry	3,243	3,864	4,236	5,304	5,380	5,121	5,194	7,309	8,176	6,448
Fishing	433	359	377	302	425	436	435	452	548	611
Non-Agriculture	**211,629**	**235,664**	**240,616**	**275,212**	**302,821**	**345,550**	**296,024**	**291,096**	**300,999**	**314,826**
Mining and Quarrying	24	36	35	34	32	33	37	37	36	98
Manufacturing	132,311	147,143	146,769	169,371	190,965	224,342	191,798	179,257	183,361	188,011
Electricity, Gas and Water Supply	7,743	7,857	7,628	7,226	8,175	8,733	8,062	8,138	9,343	9,776
Construction	8,016	8,483	7,506	7,726	8,643	8,316	6,656	9,538	9,117	9,120
Wholesale and Retail Trade; Repair of Motor Vehicles, Motorcycles and Personal and Household Goods	29,488	32,639	35,512	41,712	46,583	44,938	39,317	40,149	42,170	45,296
Hotels and Restaurants	2,502	2,335	2,427	2,574	2,291	9,479	3,644	3,096	3,442	3,666
Transport, Storage and Communications	5,276	5,902	6,440	7,082	6,565	6,399	6,001	5,962	5,913	6,533
Financial Intermediation	4,437	5,282	6,104	6,521	7,046	7,452	8,588	10,125	11,608	13,049
Real Estate, Renting and Business Activities	10,701	13,831	15,680	16,433	15,836	17,392	12,557	13,653	13,688	16,347
Public Administration and Defense; Compulsory Social Security	3,368	3,441	3,357	6,527	6,699	7,102	6,915	7,037	7,070	6,729
Education	3,558	4,412	4,893	5,253	5,085	5,649	6,478	7,447	7,867	8,280
Health and Social Work	2,709	2,734	2,854	3,071	3,201	3,810	4,024	4,268	4,570	4,761
Other Community, Social and Personal Services Activities	1,417	1,286	1,227	1,496	1,578	1,679	1,853	2,205	2,571	2,688
Private Households with Employed Persons	79	284	184	186	123	226	95	184	243	472
Gross Provincial Product (GPP)	**215,305**	**239,887**	**245,229**	**280,818**	**308,626**	**351,107**	**301,652**	**298,856**	**309,723**	**321,886**
GPP Per capita (Baht)	**224,162**	**233,949**	**224,126**	**240,631**	**248,068**	**264,850**	**223,316**	**217,321**	**221,343**	**226,173**
Population (1,000 persons)	**960**	**1,025**	**1,094**	**1,167**	**1,244**	**1,326**	**1,351**	**1,375**	**1,399**	**1,423**

Source: National Statistical Office http://service.nso.go.th/nso/web/statseries/statseries15.html

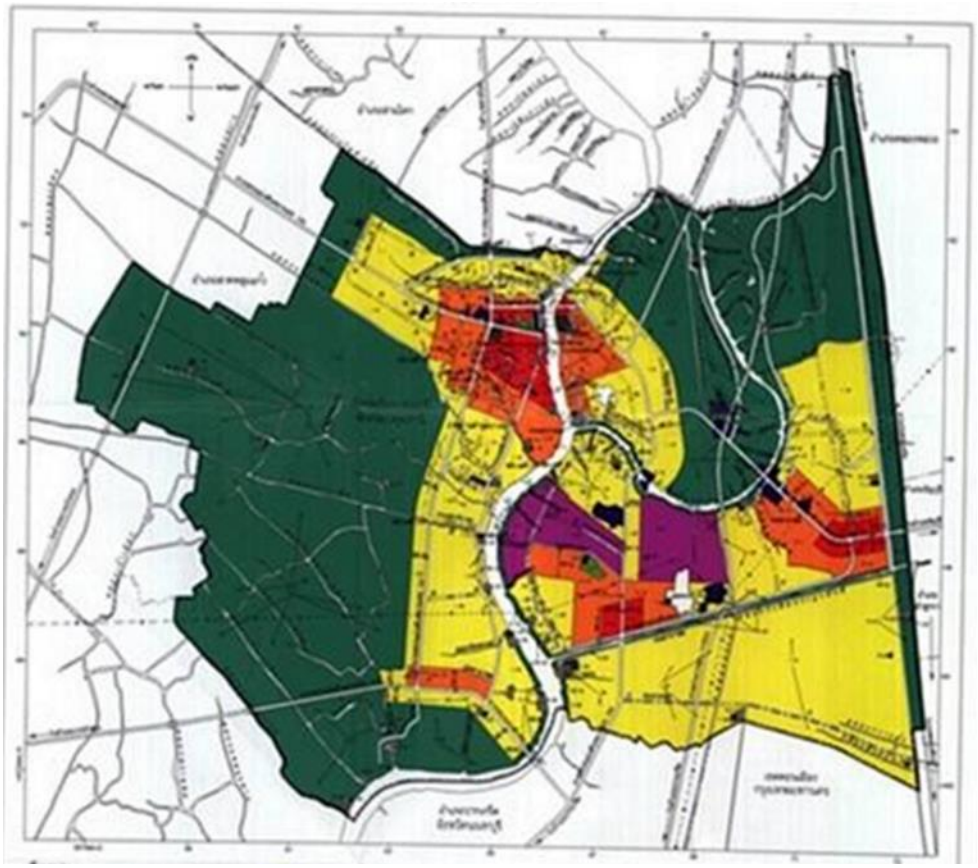
2.1.2.3 Infrastructure

The majority of Pathumthani province is in the green (agricultural) zone on the west bank or the right side of the river. The yellow (Residential) zone is located towards the center of the province to the east and south, which is adjacent to Bangkok. The purple zone (Industrial Area) is mostly located in the Muang Pathumthani district in the Bangkadi Industrial Area, which is the major industrial area of the province of Pathumthani.

The district is divided by zoning color, which can be described briefly as follows:

- The yellow zone is a residential area with low population density. Its focus is on land use for housing or government or public institutions.
- The orange zone is a residential area with medium population density. Its focus is on land use for housings or government or public institutions. This area has a greater population density than the yellow area.
- The red zone is land used for commercial and residential properties, government institutions, and utilities.
- The purple zone is land utilized for industrial sector, warehousing and utilities.
- The green zone is land utilized for rural and agricultural use, government institutions and utilities.
- The blue zone is land utilized for government organizations and utilities.

Figure 2.3: City plan map of Pathumthani



Source: Office of Public Works and Town Planning of Pathumthani

- **Transportation**

According to the development plan of Pathumthani No. 2014-2017 (revised edition), ground transportation is critical to Pathumthani since Pathumthani has only one port (Pier Head Road, Soi Baan Klang, Muang Pathumthani) and no air transportation. Pathumthani has major transportation routes as follows.

(1) Highway 1 (Phahon Yothin Road) highway linking Bangkok to the north and northeast through Lum Look Ka and Klong Luang district.

(2) Highway 346 (Pathumthani - Lat Lum Kaeo) linking Pathumthani province with Nakhon Pathom and Suphan Buri province through Muang Pathumthani and Lat Lum Kaeo district.

(3) Highway 347 (Bang Phun - Bang Sai Arts and Crafts Centre) is the main highway. The northward route is linked to Ayutthaya and Pathumthani, through Muang Pathumthani and Samkhok district.

(4) Highway 345 is the main highway network in the south of the main highway ring road. It connects with the Southern, the Western and the Northern regions of Thailand.

(5) Highway 306 is the main highway in the north-south direction. It connects Nonthaburi province through the industrial and trade areas of the province, with high traffic volumes and traffic congestion problems.

(6) Highway 307 is the main highway in the city area, including the north-south direction. It connects important periphery networks, including Highway 345, 346, and 306 through the industrial, commercial and government areas of the province, with high traffic volumes and a lot of traffic problems.

(7) Udon Ratthaya[12] express way (Bang Pa-in - Pak Kret) is an express way that facilitates people who travel to different provinces in the north and northeast and those who travel to Bangkok with connections to the Si Rat Expressway. Udon Ratthaya is connected to Pathumthani through Rangsit and Chiang Rak connection spots.

(8) Don Muang Tollway[13] is a project under Don Muang Tollway Public Company Limited (PLC) connecting Din Daeng to National Memorial and is managed by the Department of National Memorial to Rangsit. Don Mueang Tollway starting point is located near the Din Daeng junction at the Chalerm Mahanakorn Expressway and it allows users to access the Viphawadi road easily. Don Mueang Tollway is connected to Pathumthani through Annusornsatan, Rangsit and Pathumthani- Nakhon Nayok connection spots.

Due to the rapid economic growth in the metropolitan area around Bangkok, Pathumthani has faced a lot of traffic issues that impact the economy, society and environment with more and more intensification. To shorten the distance and add roadways in Pathumthani province, on July 2, 2013 the Cabinet approved a master plan for the development and integration of network traffic and road bridge across the river in Bangkok and its vicinity. For the area in Pathumthani, the Highways Agency is responsible for the Pathumthani III bridge project, which is a highway bridge that connects Rangsit - Pathumthani - to join the Western Ring Road. The 600 meter long bridge that crosses the river along the road connects the 10.5 kilometer road which will link the western ring road Rangsit - Pathumthani around Siam St. Carlos hospital and another prominent bridge project that starts from Route 347 (Pathumthani - Bang Sai Arts and Crafts Centre) to cross the river to connect to Pathumthani - Sam Khok - Sena road. The project is planned to be implemented by the year 2021[14].

Meanwhile, the current roadways to the North Central and Northeastern region face a great volume of heavy traffic along the route. To alleviate traffic congestion of road networks and highways and to ease travelling and transportation between Bangkok and North Central and Northeast and to develop

[12] Expressway Authority of Thailand (2015) Expressway Service Manual
[13] www.tollway.co.th/th/services/routes
[14] http://www.pathum3-bridge.com/

the areas in Pathumthani, Nakhon Nayok and Saraburi Province to help connecting the area's economy, the Expressway Authority of Thailand plans to initiate the Chalongrat - Nakhon Nayok - Saraburi Expressway project. The starting point of the project will connect Chalongrat at Outer Ring Road intersection to the east (Kanchanapisek Road) and the ending point of the project is located near Highway 2 (Mittapap Road) near the intersection of Highway 3222 Mittapap Road in Kaeng Khoi district of Saraburi province. The final construction for this project will pass through Pathumthani which covers 3 districts and 11 sub-districts, including Lum Look Ka district (Lum Look Ka sub-district, Bungtonglang sub-district, Lam Sai sub-district, Peud Udom sub-district and Bueng Kho Hai sub-district), Tanyaburi district (Lampakgud sub-district, Bueng Sanan sub-district and Bueng Nam Rak sub-district) and Nong Sua district (Buengba sub-district, Nong Sam Wang sub-district and Salakhru sub-district), which is currently in the process of a feasibility study in terms of potential engineering, economic, financial and environmental impacts[15].

In addition to road transportation, Pathumthani also has a rail line passing through its north and northeast area. The parking spots are located at Rangsit and Chiang Rak train stations. It also has a short-term parking shuttle route which allows passengers to travel to Bangkok and neighboring provinces. A survey according to the strategic plan by the Ministry of Transportation of 2011 - 2015 (Revised) has found that the construction project of a red line commuting train in Pathumthani at Bang Sue – Rangsit section and the Green Line at the Sapanmai – Khukhot and Khukhot – Lamlookka sections would help increase options for public transportation to the city center from the suburbs and enhance convenience of travelers and partially resolve traffic problems.

- **Water supply**[16]

Pathumthani has 4 water supply offices; Pathumthani office, Rangsit office, Klong Luang office and Thanyaburi office. In addition, the Provincial Waterworks Authority has implemented a project that allows private sector investment to expand and improve water supplies to Rangsit which is a joint venture between a private company (Pathumthani Water Co., Ltd.) and the Provincial Waterworks Authority. The province aims to have sufficient quantities of water to use and support the growth of the province. Water produced by the project will be sold to the Provincial Waterworks Authority to be sold to the public and industry in the project area over a period of 25 years and may be extended no more than 2 times. Each potential extension consists of a 10 year period. The project was launched in 1998.

[15] http://www.chalongrat-saraburi-expressway.com/%E0%B9%81%E0%B8%99%E0%B8%B0%E0%B8%99%E0%B8%B3%E0%B9%82%E0%B8%84%E0%B8%A3%E0%B8%87%E0%B8%81%E0%B8%B2%E0%B8%A3/

[16] ECO Industrial Town, Department of Industrial Works (2016), Basic Information of Pathumthani province

- **Electricity**

The Provincial Electricity Authority has 6 branches in Pathumthani to distribute electricity at 233.87 MW / hour. The supply stations are evenly distributed and electricity is accessible for all households.

- **Telecommunications system**

The telecommunications system in the province consists of several private companies providing telecommunication networks in most areas of the province. However, there are some areas in the province that are not fully covered, which result in the public being unable to use the Internet and prevent them from receiving instantaneous information.

- **Waste management system**[17]

Waste in Pathumthani province can be divided into 2 categories: (1) waste from industrial plants, and (2) household waste.

In the 2014 report of permission to bring waste to area outside the plant, Pathumthani has 865,719.94 tonnes of waste, which can be classified as 201,026.72 tonnes of hazardous waste, representing 23.22%, and 664,693.22 tonnes of non- hazardous waste, representing 76.78%. By the amount and type of waste, the top three types are materials unsuitable for consumption or processing, scrap steel from the filings, grinding or machining and sludge resulting from the water clearing procedure. There is an ongoing issue concerning disposal of hazardous waste from industrial activity as the vicinity of the industrial park is not large enough to handle all hazardous waste.

For solid waste, Pathumthani has a solid waste transfer station in Rangsit, the waste disposal treatment in Sawai of Tanyaburi district, a privately owned waste disposal treatment in Klong Luang district, municipal waste disposal site under Muang Pathumthani district and solid waste disposal site in the area of the municipality of Khukhot district. However, the amount of municipal solid waste per day in Pathumthani is over the capacity of waste disposal by landfill per day, resulting in public complaints which might render the site unable to operate. The local governments in the region have resolved this issue by taking the garbage disposal to be processed in Ayuttaya province. Meanwhile, there has been opposition from residents in the area against the waste disposal area of the municipality Khukhot. Therefore, the province has faced a lot of problems regarding waste disposal. However, infectious waste by hospitals are mostly disposed properly by using sanitary infectious waste incinerators except for waste from small medical facilities, such as clinics, which has restrictions on the disposal of infectious waste. Thus, some of the infectious waste is mixed with ordinary garbage.

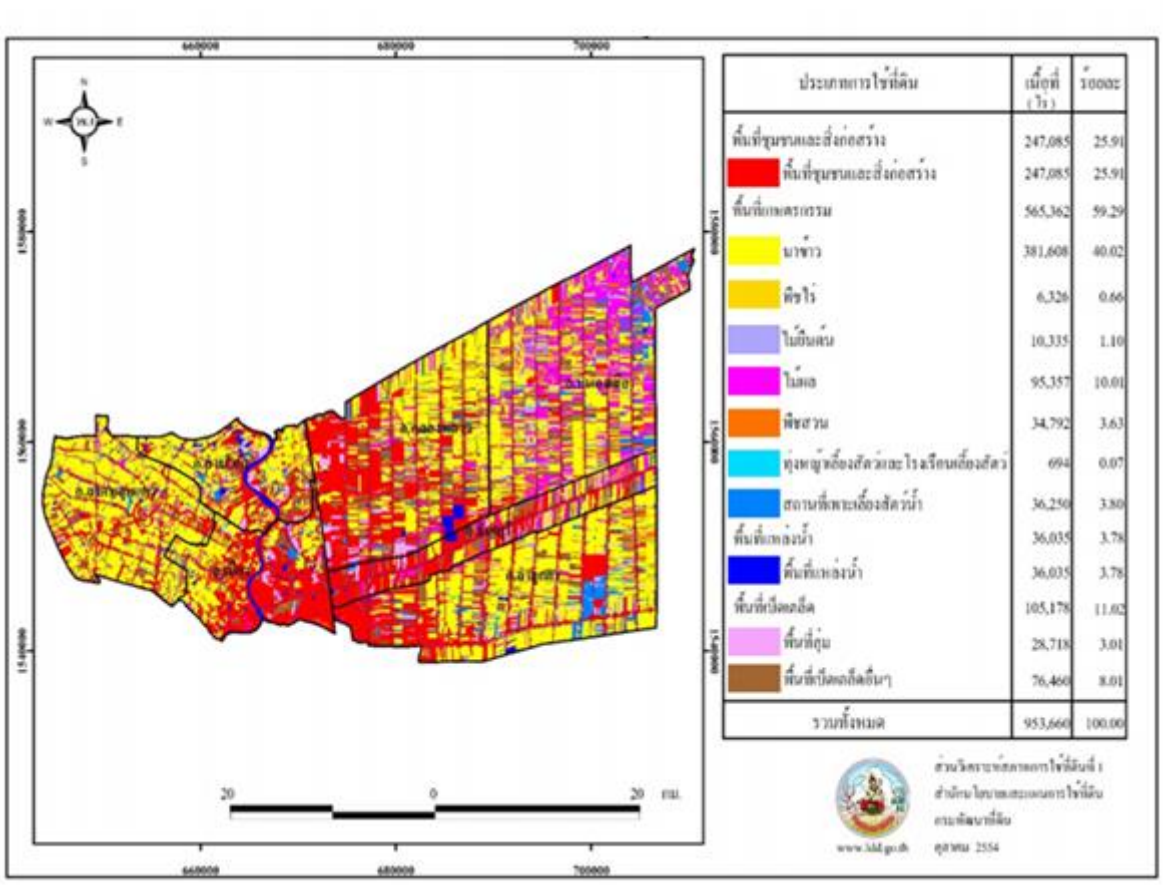
[17] ECO Industrial Town, Department of Industrial Works (2016), Basic Information of Pathumthani province

2.1.3 Significance of Bangkadi Industrial Park Area

JICA and the NESDB selected Bangkadi Industrial Park area to implement the Area BCM pilot project as this industrial park is one of seven industrial estates / zones / industrial parks that was severely affected by floods in 2011. Moreover, Bangkadi Industrial Park is located in Pathumthani province, which is one of the 8 provinces that was severely affected by the flood as well. Statistically, the damage in the industrial sector in Pathumthani province is only second to the one in Ayutthaya province[18].

Considering the nature of land use of Pathumthani, Bangkadi Industrial Park is surrounded by orange zone and yellow zone, which shows that the population density of a residential community is high and normal, respectively. And considering the benefits of land use, it is obvious that the area surrounding Bangkadi Industrial Park is a community space and various buildings.

Figure 2.4: Map of Pathumthani land use



Source: First Sector of Land Use Analysis, Office of Land Management Plan and Policy, Land Development Department, October 2011

18 Wongsakorn Trakulhiranpadung (2012), "When industries choke on water", Trend for Quality, Vol.18 (171)

Moreover, the nature of Bangkadi Industrial Park, the investment data, factory infrastructure, surveillance and the emergency response system as well as prevention and emergency response measures in Bangkadi Industrial Park are the reasons why Bangkadi Industrial Park was an area of interest for the Area BCM pilot project. Further details are shown as follows.

2.1.3.1 Location and land allocation

Bangkadi Industrial Park is located along Tiwanon Road, Bangkadi sub-district, Muang Pathumthani district of Pathumthani province, which was founded in 1987 with starting capital of 66 million baht, with the total area of 1,222 rai and it is located +1.10 above Mean Sea Level (MSL). Bangkadi Industrial Park is located about 2 kilometers away from the Chao Phraya river.

The surrounding environmental conditions that can influence the risk of flooding include:

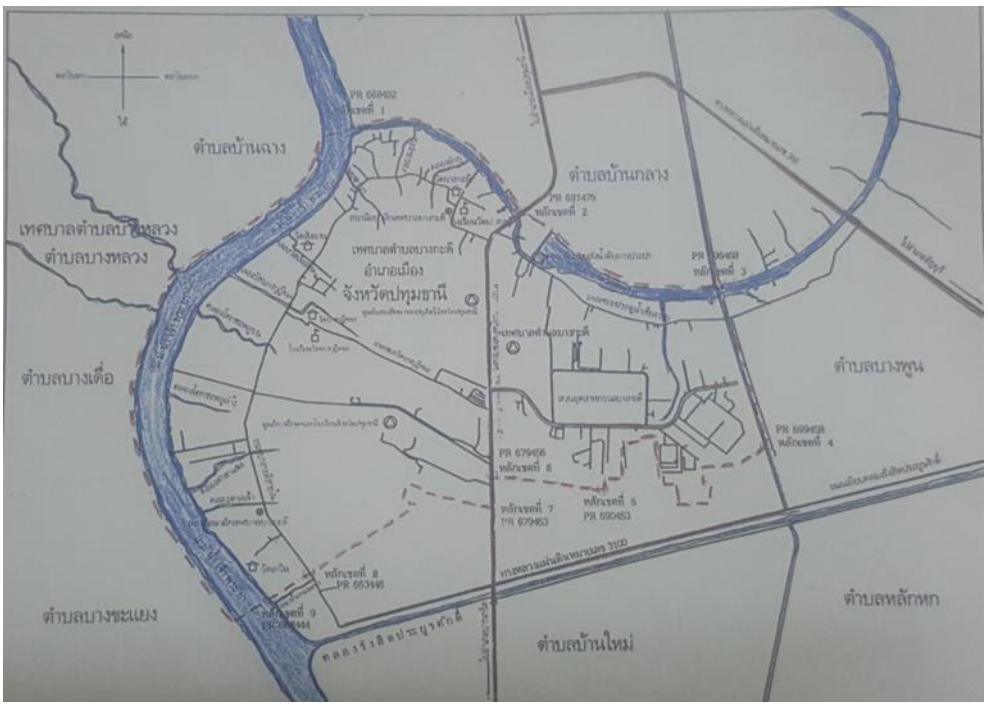
North side: 200 meters away from Chiang Rak canal

East side: 10 meters away from the MWA canal

West side: 2 kilometers away from Chao Phraya river.

South side: 400 meters away from Rangsit Prayoon Sak canal.

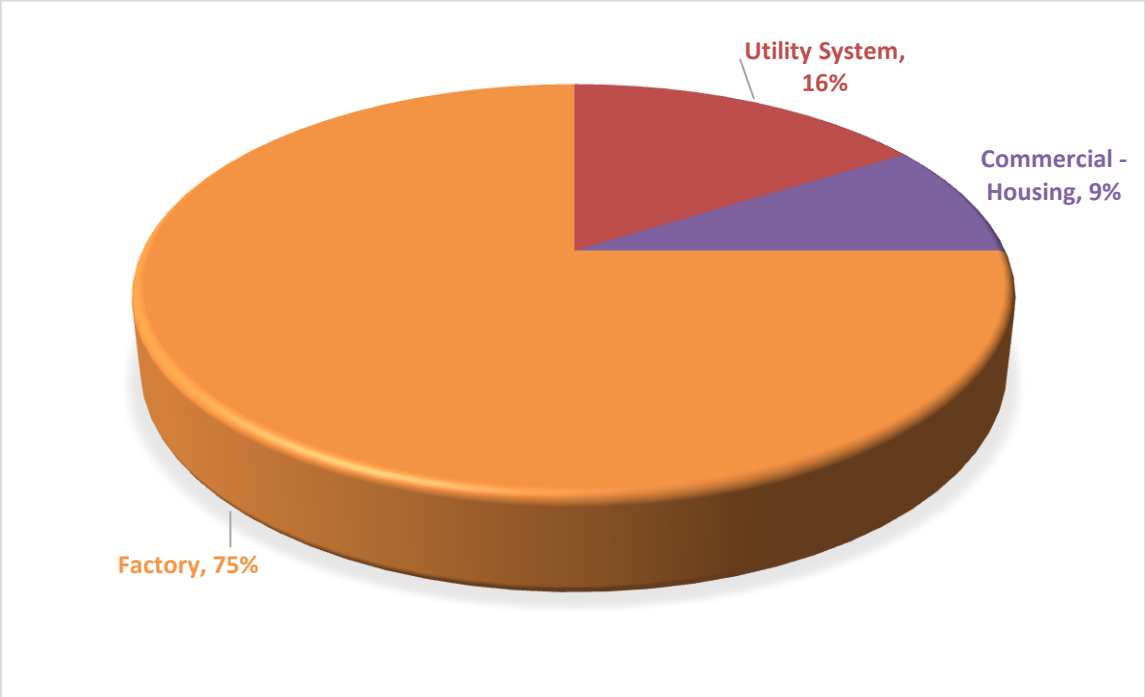
Figure 2.5: Map of Bangkadi Industrial Park, Pathumthani



Source: Bangkadi Industrial Park, 2015

The allocation of space within the 1,222 rai of Bangkadi Industrial Park is divided into 3 parts: factory zone representing 75% of the total area, utility system zone of 16% and commercial housing zone comprising 9% (Figure 2.6).

Figure 2.6: The allocation of space within Bangkadi Industrial Park (1,222 Rai)



Source: Bangkadi Industrial Park, 2016

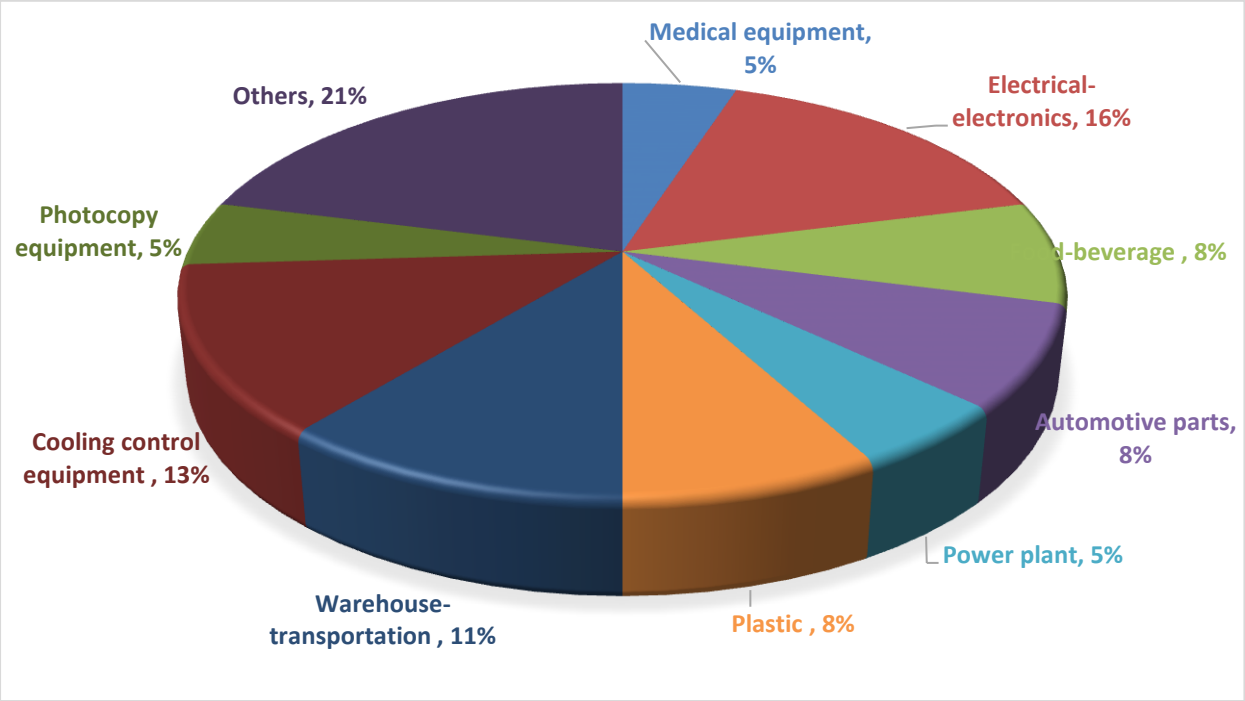
2.1.3.2 Bangkadi Industrial Park members

As of June 2016, Bangkadi Industrial Park had a total of 38 plants with a total plant investment of 12,000 million baht, the portion of production and distribution of goods exports accounted for 60% of the total production while the domestic distribution accounted for 40% of the total production.

Bangkadi Industrial Park consists mostly of production plants engaged in the electrical/electronics industry, which accounted for 16% of the space allocated by the factories in the area, followed by the production of cooling control equipment of 13%, warehouse and transportation of 11%, followed by automotive parts, plastic and food/beverage industry of 8% each.

Incidentally, it is notable that the number of plants in Bangkadi Industrial Park has decreased from the previous year due to the flood in 2011, when there was a total of 44 factories.

Figure 2.7: The allocation of space within Bangkadi Industrial Park by industry types



Source: Bangkadi Industrial Park, 2016

2.1.3.3 Foreign investment

Bangkadi Industrial Park contains 60% of factories with investment from Japanese investors and 30% of factories invested by Thai investors. The remaining 10% are invested by other foreign investors.

2.1.3.4 Employment

Bangkadi Industrial Park employs about 19,000 workers, 5% of which are foreign workers.

2.1.3.5 Infrastructure

- **Transportation**

Bangkadi Industrial Park utilizes ground transportation service as the main mode of transportation. Tiwanont road is used as the main road for transporting goods which connects to the internal roads within the industrial park. The main roads in the park have a width of 32 meters and the small roads in the park have a width of 24 meters.

In case of emergency, Bangkadi Industrial Park has an evacuation route that includes two channels, which are the front street that connects to Tiwanon road and the back street that connects to Leab Klong Prapa road.

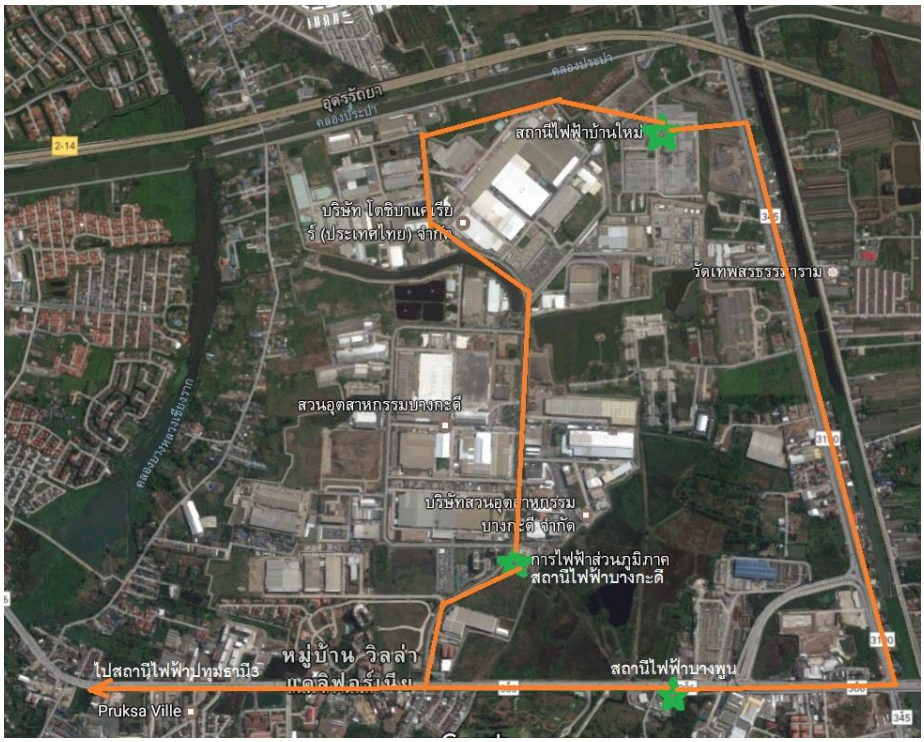
- **Water supply**

Bangkadi Industrial Park uses water from the Metropolitan Waterworks Authority. The station that provides the water supply to Bangkadi Industrial Park has a production rate of up to 18,000 cubic meters of water per day which meets the expected quality standards.

- **Electricity**

Bangkadi Industrial Park has electricity source provided by Provincial Electricity Authority – Bangkadi Power Station located in Bangkadi Industrial Park, which has electric power transmission line with system voltage of 115 kV and 3.5 Kilometers distance that is connected to Banmai Electricity Station as the main line. Moreover, it has electric power transmission line with system voltage of 115 kV and 20 Kilometers distance that is connected to Banpoon Electricity Station and Pathumthani III station as supplementary lines. It also gets electricity from B.Grimm BIP Power, a private electricity company in the area.

Figure 2.8: Electric power transmission line system in Bangkadi Industrial Park



Bangkadi Power Station has 2 of 50-MVA transformers that convert electricity to 22 kV voltage level in order to distribute electric power to factories that are located within Bangkadi Industrial Park into 10 circuit systems.

- **Natural Gas**

Some factories in the Bangkadi Industrial Park use natural gas in the production line via the natural gas transmission pipeline operated by PTT Natural Gas Distribution Company Limited to connect natural gas supply to the plants that are located within the Bangkadi Industrial Park.

- **Waste Management System**

Wastewater Treatment Plant of Bangkadi Industrial Park comprises an area of approximately 25 rai and can accommodate around 14,000 cubic meters of waste water per day.

2.2 Disasters in the Area

According to the Prevention and Mitigation Plan of Pathumthani provided by the Office of Disaster Prevention and Mitigation of Pathumthani, Pathumthani Province is at risk of disaster from the following:

1) The hazard from transportation (Road traffic accident)
2) The hazard from fire
3) The hazard from flooding
4) The hazard from windstorm

2.2.1 Previous disasters in the Area

The Office of Disaster Prevention and Mitigation of Pathumthani conducted disaster risk assessment of the province as follows.

Table 2.3: Disaster risk assessment of Pathumthani Province

Type of risk	Areas and level of risk			Key factors	Capacity
	Low risk	Medium risk	High risk		
Transportation			All districts	There are several main routes that go through the province with high traffic volume.	Related agencies and Civil Society Organizations have provided significant cooperation and support.
Fire			All districts	There are a lot of slums and factories.	Local government is strong and has the capacity to deal with situations quickly.
Flooding		Muang district and Samkhok district		Chao Phraya river runs through the center of the province. During flood season, people who live outside the dike area are affected.	More roads have been added as dikes to prevent flooding along the river. Floodgates and sewer facilities at the mouth of all canals have been repaired.
Windstorm		All districts		The province is located on a flat plain and most houses are old and farmlands are open fields.	Local government is strong and can be of effective assistance.

Source: 2015 Disaster Prevention and Mitigation Plan of Pathumthani, The Office of Disaster Prevention and Mitigation of Pathumthani

Statistical data from the Office of Disaster Prevention and Mitigation of Pathumthani in 2010-2014 as in Table 2.4 has indicated that the hazard from transportation (Road traffic accident) is the most

frequently occurring hazard. Although ***flooding is the least frequently occurring hazard, it has the greatest impact of all listed hazards***. This will be explained in the next section. The Office of Natural Calamity and Agricultural Risk Prevention, Land Development Department has indicated that the majority of the area in Pathumthani province is a flood prone area that encounters up to 3 flood incidents in a period of 10 years (Figure 2.9).

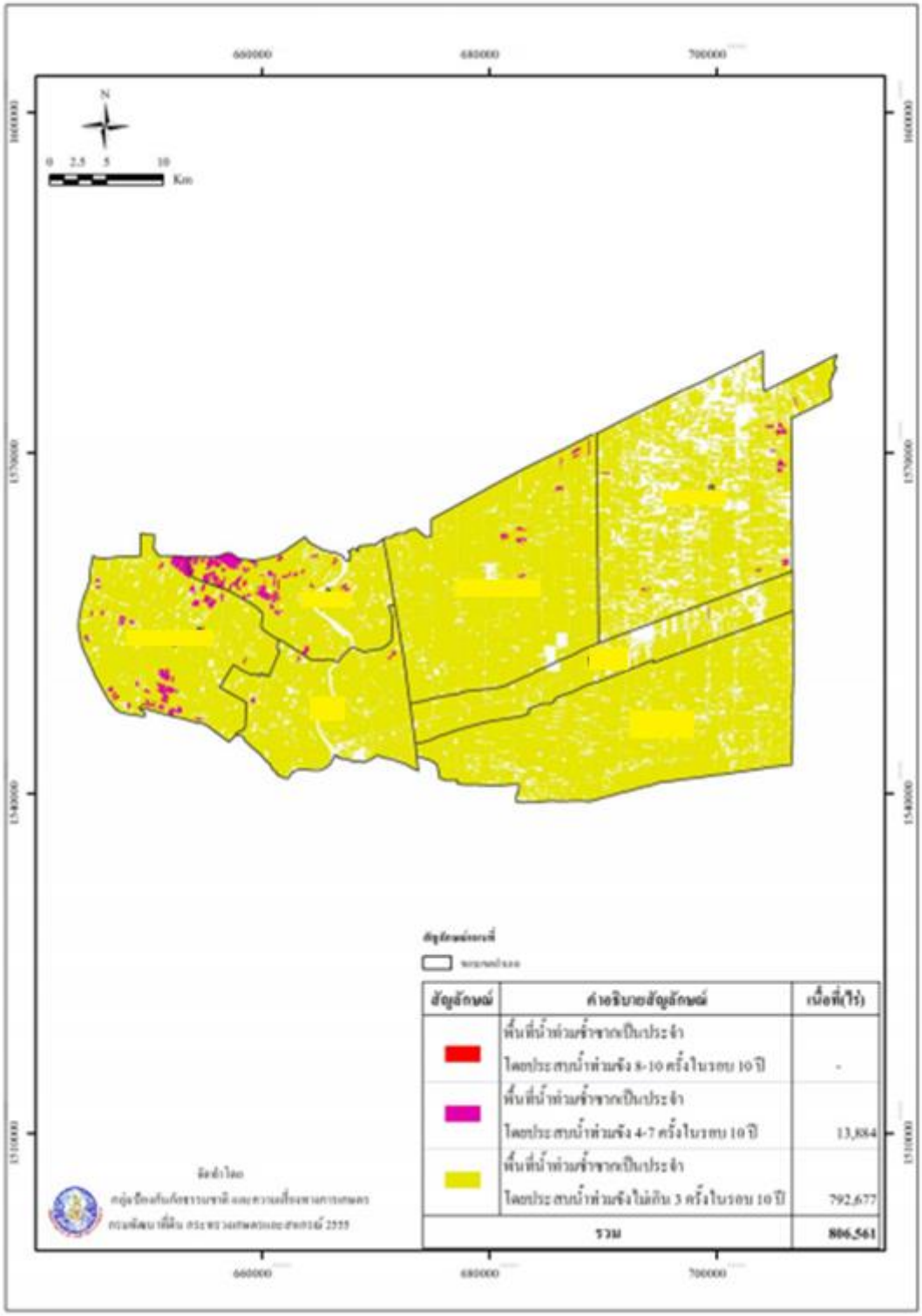
Table 2.4: Impact from hazards occurring in Pathumthani during 2010 - 2014

Year	Impact from transportation hazard					Impact from fire				
	Number of occurrences	Number of occurring locations	Number of deaths	Number of injuries	Number of damaged houses	Number of occurr-ences	Number of occurring locations	Number of deaths	Number of injuries	Number of damaged houses
2010	624	n/a	204	300	n/a	3	2	0	0	20
2011	718	n/a	169	366	n/a	4	4	0	0	4
2012	624	n/a	117	394	n/a	4	3	0	0	107
2013	998	n/a	172	441	n/a	19	6	0	1	19
2014	354	n/a	125	264	n/a	12	4	1	1	12

Year	Impact from flooding					Impact from windstorm				
	Number of occurr-ences	Number of occurring locations	Number of deaths	Number of injuries	Number of damaged houses	Number of occurr-ences	Number of occurring locations	Number of deaths	Number of injuries	Number of damaged houses
2010	1	7	0	0	n/a	2	n/a	n/a	n/a	47
2011	1	7	114	0	78,624	4	n/a	n/a	n/a	156
2012	0	0	0	0	n/a	14	n/a	n/a	n/a	874
2013	1	3	1	0	n/a	8	n/a	n/a	n/a	1
2014	0	0	0	0	n/a	4	n/a	n/a	n/a	326

Source: Disaster Prevention and Mitigation Plan of Pathumthani, Office of Disaster Prevention and Mitigation of Pathumthani

Figure 2.9: Map of flood prone areas in Pathumthani province (prepared in 2012)



Source: The Office of Natural Calamity and Agricultural Risk Prevention, Land Development Department, 2012

2.2.2 Flood situation in 2011: experiences and impacts

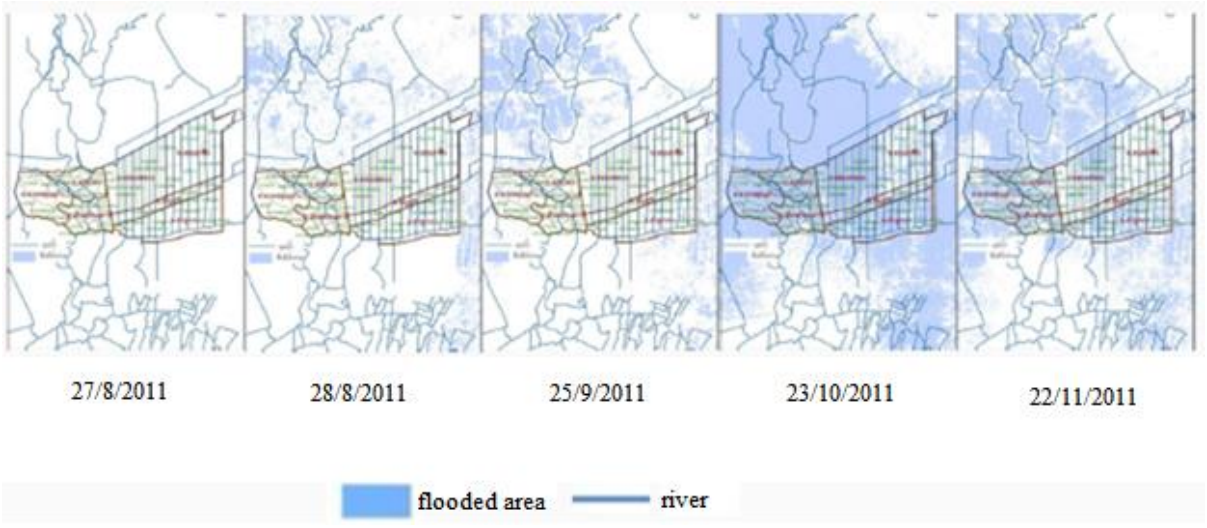
The influence of the southwest monsoon and tropical storm Haima, Tropical Storm Nock-ten, Tropical Storm Haitang, Tropical Storm Nesat and Tropical Storm Nalgae ranged across Thailand from late June to October in 2011. As a result, the amount of cumulative water in the lower areas of the north exceeded the capacity of the drainage system, which resulted in flooding in many locations. Consequently, the amount of water in the river became much higher. On September 21, 2011, the amount of water overflowing from the banks eroded many dikes along both sides of Chao Phraya River, resulting in extensive flooding in the region, including Chai Nat, Sing Buri, Ang Thong, Suphan Buri, Ayutthaya, Lopburi, Saraburi, Nakhon Pathom, Pathumthani and Nonthaburi.

Pathumthani was flooded on September 5, 2011 due to two factors: (1) the amount of water that drained from the north into the Chao Phraya River was too much, causing flash floods and (2) the overflowing water along Chao Phraya River banks in many districts. The water level of the Chao Phraya River at C45 gauging station measured the maximum water level as of October 10, 2011 at +5.730 meters above Mean Sea Level (MSL).

2.2.2.1 Affected areas in Pathumthani province

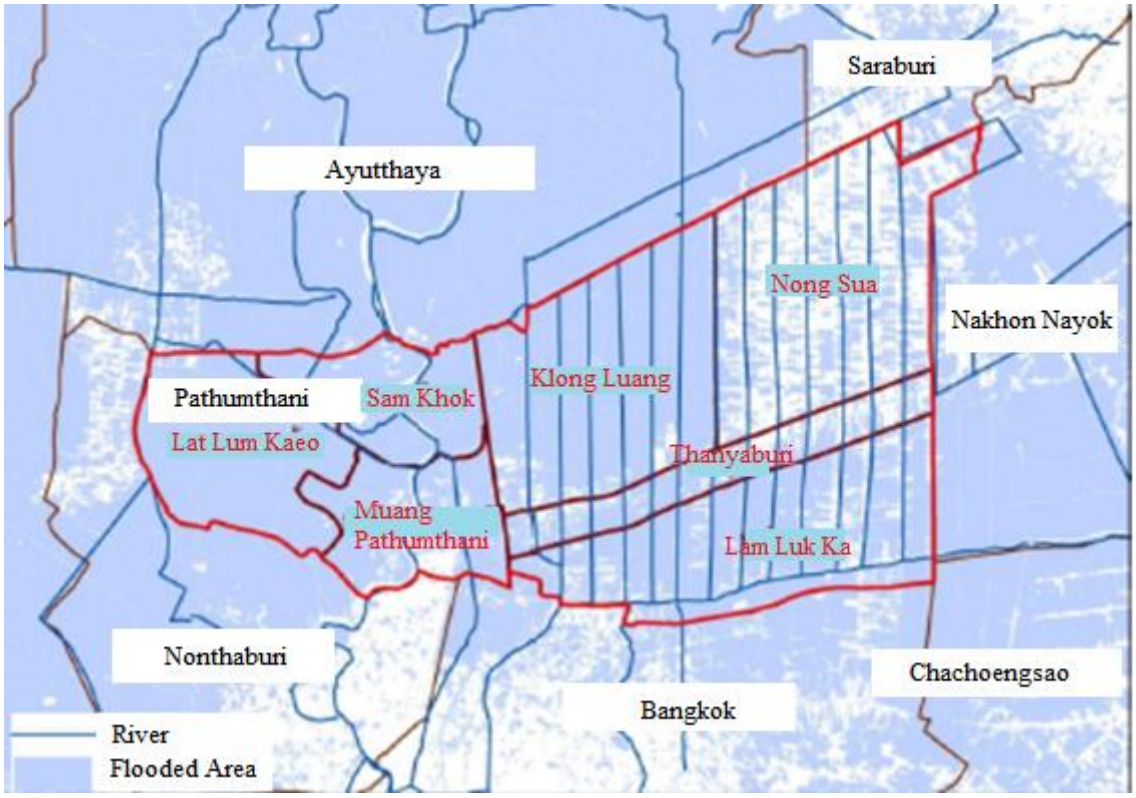
In 2011, there was 1 major flood disaster that occurred in the province of Pathumthani. Due to the impact of the flood in 2011, the governor of Pathumthani declared a state of emergency in Pathumthani province. In September 2011, the flood covered all 7 districts of Pathumthani.

Figure 2.10: Flooded areas over the period of August 2011 through November 2011



Source: GISTDA, Thailand Flood Monitoring System from http://flood.gistda.or.th/

Figure 2.11: Flooded areas in Pathumthani in 2011



Source: National Statistical Office, Flooded areas in Pathumthani, http://service.nso.go.th/nso/nsopublish/flood/pathum.pdf

The impact of the flood in 2011 was catastrophic damage to society, communities, environment and the economy, including damage to infrastructure.

2.2.2.2 Impacts to communities and society

Due to the flood in Pathumthani province in 2011, 114 people were reported dead as well as widespread disruption and impact on the general public, covering all 7 districts as in the following table.

Table 2.5: Damages from the flood in Pathumthani province in 2011

	Number of districts	Number of sub-districts	Number of households	Number of population
Total number before the flood*	7	60	529	1,326,509
Instances of damages by the flood 23/11/2011**	7	60	522	749,349
% of damages	100%	100%	98.7%	56.5%

*From the census in 2010

**From Emergency Operation Center, Department of Disaster Prevention and Mitigation, Ministry of the Interior

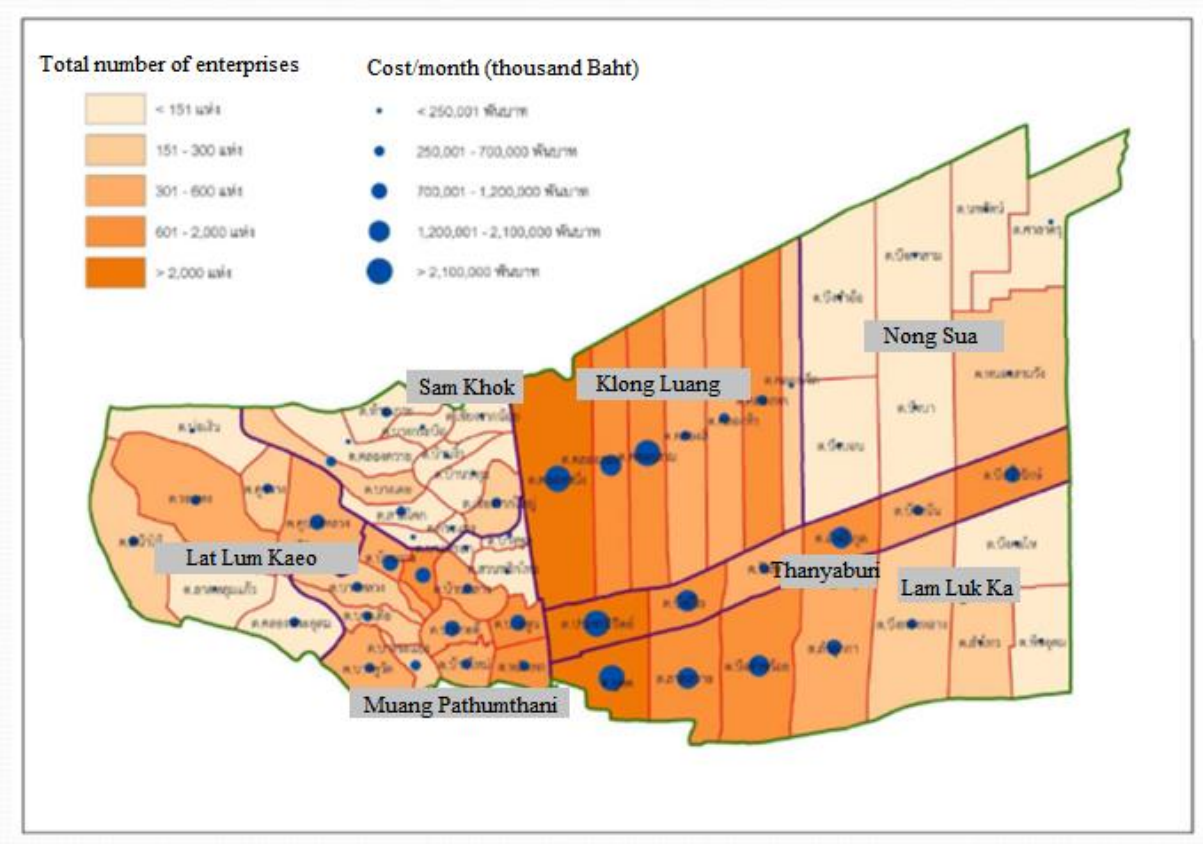
Source: National Statistical Office, Flooded areas in Pathumthani, http://service.nso.go.th/nso/nsopublish/flood/pathum.pdf

From the data in Table 2.5, 522 households (98.7% of total) and 749,349 people (56.5% of total) of Pathumthani residents suffered from the flooding. From the survey by the University of Thai Chamber of Commerce, it was found[19] that 48.3 percent of the population planned to store necessary goods for preparation, such as instant noodles, drinking water, food, etc. In addition, the flooding affected the way of life of most people. Stress level was increased. Savings were depleted. There were temporary and permanent employment layoffs after the flood. There were shortages of goods and difficulty for communication and travel. Most public dissatisfaction concerned the issue of the ability of government to provide necessary information during the disaster, followed by the early warning system and monetary compensation, respectively.

Moreover, Figure 2.12 shows the map and location of business enterprises affected by the floods of 2011. From the figure, 4 districts were affected quite significantly, including Klong Luang district, Muang Pathumthani district, Thanyaburi district and Lam Luk Ka district.

[19] Satit Vonganannon (2011) Thailand's Flood Crisis 2011 and The Economic Impact http://library.senate.go.th/document/Ext3130/3130432_0003.PDF

Figure 2.12: Map of business enterprises affected by the flood in 2011



Source: National Statistical Office, Flooded areas in Pathumthani,
http://service.nso.go.th/nso/nsopublish/flood/pathum.pdf

From an environmental standpoint, the flood caused problems related to solid waste and sewage as water flooded the transfer and disposal of solid waste facilities of Pathumthani in the Rangsit municipality, Muang district, Thanyaburi district and Khukhot district. The height of water level due to the flood was about 30 centimeters. This damaged the facility and some of the waste management facilities had to be temporarily closed for over 2 months.

Moreover, the quality of the water was randomly checked by the Pollution Control Department of the Ministry of Natural Resources and Environment in November 2011 at the water sources(s), such as Rangsit canal and Chiangrak canal[20]. The results rate the water from insanitary to highly insanitary due to the flood. However, the inspection of chemicals contamination of water from pollutants in the Nava Nakorn Industrial Estate and Bangkadi Industrial Park from October to November found that although the water quality deteriorated, it found no contamination by heavy metals exceeding the standard defined by the Pollution Control Department of the country.

[20] Pollution Control Department, http://www.pcd.go.th/info_serv/pol_flood54.html#s1

2.2.2.3 Impacts on the economy

Pathumthani was 1 of the 8 provinces that experienced severe flooding in 2011. In fact, 2 industrial estates/parks in the province out of the total of 7 sites in the country were directly affected by the flood, including Nava Nakorn Industrial Estate and Bangkadi Industrial Park. The value of the damage from the direct impact was 86,511 million baht and 6,696 million baht, respectively. When putting to cost of the damage from two industrial zones together, it shows the total losses of the two accounted for 39.3 percent of the total losses in all industrial estate/zone/park in the country which were damaged due to this single flood event (Table 2.6). In addition, the total cost of damage of factories outside the industrial estate/zone/park, both big and small, in Pathumthani province was about 62,925 million baht, which is the second most damaged location after Ayuttaya province.

Table 2.6: Direct damage loss in industrial estates/zones/parks due to the 2011 flood*

Industrial estate/zone/park	Value of land, property, and equipment	Value of damaged machinery	Value of damaged raw materials and finished goods inventory	Total losses
Saharattananakorn	9,106	5,099	2,973	8,072
Rojana	86,986	48,712	25,913	74,625
High-tech	33,294	18,645	13,434	32,079
Bangpa-in	30,215	16,920	10,612	27,532
Factoryland	2,160	1,210	686	1,896
Nava Nakorn	92,614	51,864	34,647	86,511
Bangkadi	6,525	3,654	3,042	6,696
Total	**220,900**	**146,104**	**91,306**	**237,410**

*Unit: Million Baht

Source: Department of Business Development, Ministry of Commerce, Wongsakorn Trakulhiranpadung (2012), "When industries choke on water", Trend for Quality, Vol.18 (171)

For the losses of both large and small factories that were located outside the industrial park in Pathumthani province, the total damage totaled approximately 62,925 million baht, where about

35,187 million baht of which was the value of damaged machinery and about 27,738 million baht of which was the value of damaged raw materials and finished goods inventory[21].

2.2.2.4 Impacts to infrastructure

Since a large portion of Pathumthani were flooded for months, the majority of the streets and pathways in the province collapsed to potholes. Some streets and pathways were cut off due to water erosion. Barriers and floodgates were damaged due to the pressure of the water. The quality of raw water sources used in the production of supply water also deteriorated due to the damage of water canal embankments. Cables and equipment for the station and power poles were damaged, making these difficult and dangerous to use. As a result, various agencies were involved in infrastructure rehabilitation and reconstruction. This included local governments such as Pathumthani Provincial Administrative Organization, Municipal authorities in the province, Provincial Waterworks Authority, Metropolitan Waterworks Authority, Electricity Generating Authority of Thailand, Provincial Electricity Authority, Royal Irrigation Department and the Department of Rural Roads. These organizations contributed to rehabilitation and restructuring of the infrastructure after the flood by elevating equipment and control panel circuits to higher ground, erecting barrier walls to prevent flooding, conducting road repairs and improving the performance of pumping stations and floodgates.

2.2.2.5 Flood Management in 2011

According to Pathumthani's Disaster Prevention and Mitigation Plan of 2010-2014, water and flood management has been practiced as follows.

- **Warnings for hazard**

The Office of Disaster Prevention and Mitigation of Pathumthani is responsible for informing people by sending notification to the relevant authorities. This provides early warning to those who will be affected in areas prone to disaster and to monitor the situation and be prepared to evacuate people to safety. The Director of the Division of Prevention and Mitigation Pathumthani district, municipal and sub-district Administration Organization operates the following warning procedure: (1) monitoring the situation to observe the change of the weather situation, rain water levels in dams, canals, rivers, and sea level, including drainage (2) notifying the early warning agencies to monitor, analyze data and

[21] Wongsakorn Trakulhiranpadung (2012), "When industries choke on water", Trend for Quality, Vol.18 (171)

provide information to the public and the units once they expect to have an impact and give early warning of execution units (3) notifying the authorities and the public through the media and practical tools and resources cooperating partners and establishing a temporary shelter and canceling the warning when necessary and (4) conducting necessary mitigation operations

- **Handling the situation and commanding (Single Command)**

Under the Disaster Prevention and Mitigation Act 2007 in Pathumthani, disasters are categorized into 4 levels: level 1 (small) level 2 (medium) level 3 (large) and 4 (very serious). The 2011 flooding was categorized as being level 4 severity, with serious consequences. This crisis level meant there was a profound impact on life and property as well as well-being and morale of many citizens. The director of the Department of Disaster Prevention and Mitigation and Commander of the National Disaster Prevention and Mitigation (Minister of Interior) could not control the situation / issue / threat and so the Prime Minister or the Deputy Prime Minister was eventually assigned as the Commander to take control of the situation. This Commander had an authority to carry out protection and mitigation operations as well as to provide assistance to people in affected areas.

Operational steps in response to flooding are as follows.

(1) Facilitating and coordinating the operation of monitoring, analyzing, warning, allocating and tracking of resources. Conducting legal actions, communicating, receiving complaints, mitigating situations, conducting laboratory and medical operation, protecting public safety and transportation routes. Conducting agricultural relief and managing industrial workers shelters. Supporting logistics and communication. Supporting budget allocation and coordinating donations from various organizations, including the private sector. Monitoring warning systems (tracking and summarizing the situation and victim assistance)
(2) Conducting emergency declaration of disaster areas, which must contain details and type of the disaster, location, starting and ending date of the disaster, starting time and ending time to assist the victims.
(3) Processing public notification and public relations.
(4) Operating the protection and assistance of the flood victims.
(5) Distributing consumer goods to the victims.
(6) Organizing emergency action.
(7) Conducting Post-Disaster Needs Assessment (PDNA)
(8) Processing and distributing donations.
(9) Managing the situation after the disaster in terms of providing assistance to victims, pets and wildlife as well as conducting restoration of damaged public facilities and infrastructure.

Since the 2011 flood created severe and widespread impact, many organizations at the national level required different measures to help mitigate and rehabilitate those affected to recover back to normal operations as quickly as possible. Table 2.7 shows the summary of relief and rehabilitation measures for the victims.

Table 2.7: Relief and rehabilitation measures for flood victims in 2011

Measures	Details
Finance	**Bank of Thailand** encouraged financial institutions to assist the debtors as appropriate in terms of the debt itself and the interest. This includes the provision of increasing credit limit to help facilitating for rehabilitation after the flood, in which many commercial banks had various measures and procedures to help both individuals and corporations.
Tax and Insurance	**Revenue Department** provided tax exemption for the insurance equivalent to the amount of damage for flood victims who had registered with the government as well as extension of the filing to taxpayers for the flood victims. **Customs Department** established a 24-hour service center to respond to inquiries and there were special measures to assist entrepreneurs in the industrial free zone and bonded warehouse, including exemption of duties for the import to help the victims. **The Office of Insurance Commission** established the center for notification and made recommendations for claims as well as provided tax exemption from compensation received from insurance to compensate for damage caused by the floods.
Social and Welfare	**Department of Local Administration** encouraged public and private owned shops to lower interest rates and provide a grace period of 6 months for outstanding payments. **Department of Disaster Prevention and Mitigation** provided welfare to disaster victims whose homes were flooded for at least 7 consecutive days equivalent to 5,000 Baht per household. **Ministry of Public Health** provided special measures for patient care (such as drug delivery) and assisted in transferring patients from affected hospitals as well as providing mental health restoration healing to victims through the Department of Mental Health hotline. It also provided 200 medical and public service teams as

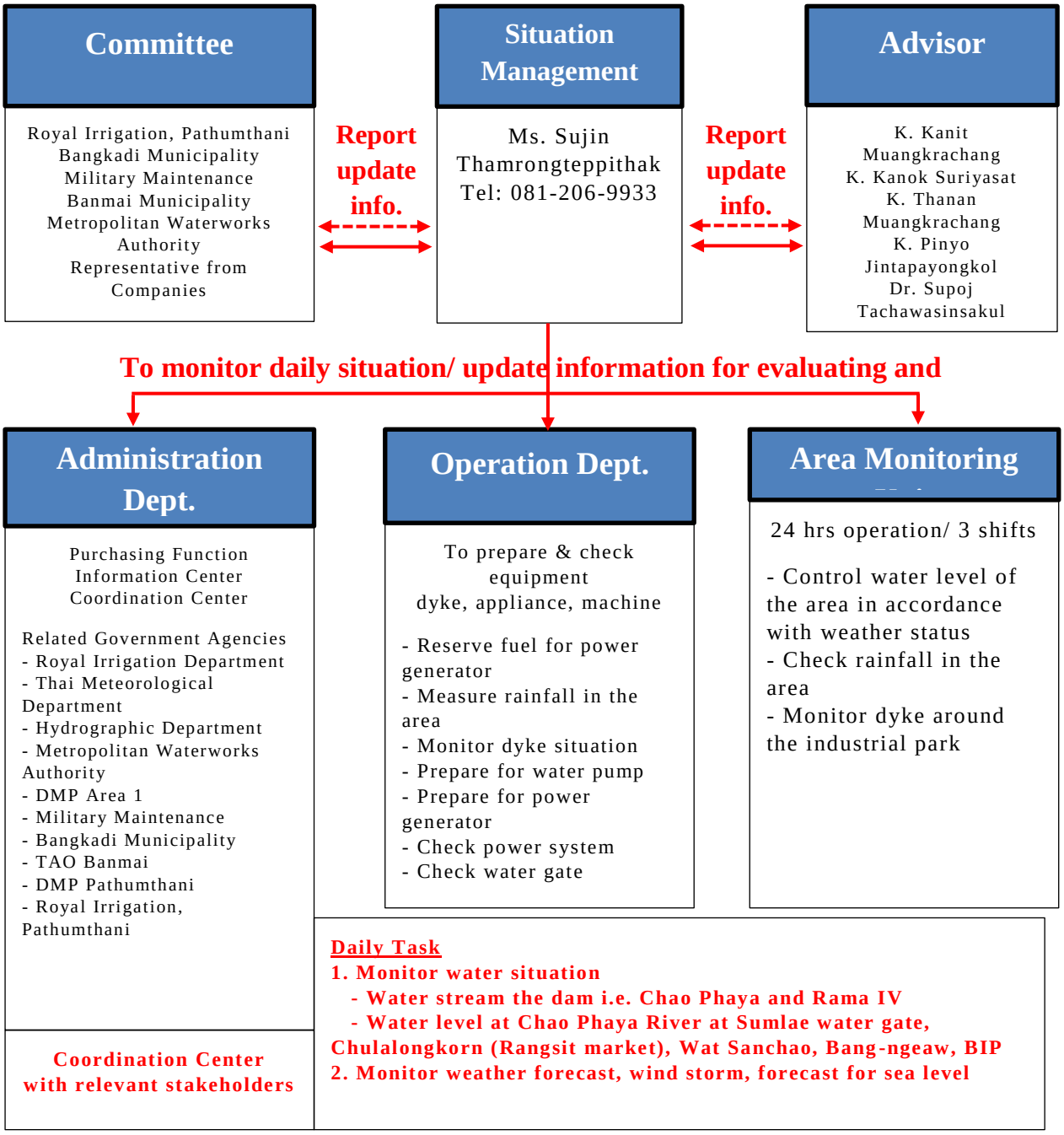
Measures	Details
	well as flood shelters, including advice on hygiene. **Ministry of Social Development and Human Security** provided services in developing quality of life in different provinces as temporary shelters for victims and strengthen support for victims through counseling, vocational training and recreational activities. **Pollution Control Department** established Pollution Relief Centers in flooded areas. In particular, it had conducted surveys in the area to inspect water quality and to alleviate wastewater and solid waste disposal problems.
Restoration of business industries and facilitation support for entrepreneurs and workers	**Office of Small and Medium Enterprises Promotion** opened counseling centers and clinics called SME Ambulance Unit which was a fast moving unit to assist victims immediately after the flood. **Department of Industrial Works** exempted the annual fee and renewing fee to enterprises for 5 years. **Office of the Board of Investment** facilitated enterprises that had been promoted in relocating machineries and raw materials out of the affected establishments. It also helped facilitating specialists from abroad to help companies to rushing procedures, including coordination with the immigration checkpoint on the audit work permit. **Office of the Cane and Sugar Board** provided monetary assistance of 3,150 baht per rai to the victims who reported the damage within a specified period. It also assisted in the inspection process of the crops after the flood. **Rice Department** provided monetary assistance of 239.6 baht per rai to farmers who registered and owned a farm engaged in rice cultivation that whose land was damaged by more than 50 percent (maximum of 10 rai). It also provided 72,000 tons of high quality grains to farmers to help accelerating food crisis recovery after the flood. **Department of Internal Trade** provided selling of consumer goods via cars and boats to the areas affected by the flood. **Department of International Trade Promotion** established an international trade coordination center to help victims to provide consulting services in healing and restoration. **Social Security Office** provided a loan assistance to insurers for home repair and

Measures	Details
	also loan assistance to business enterprises for up to 1 million baht. **Department of Labor Protection and Welfare** established Peer for Peer Program to help employers and employees who were affected as a central coordination between workers and employers. **Thai Chamber of Commerce and Board of Trade of Thailand** provided documentation issuing services as a guarantee of victimization to the flood victims. The evidence was used for presenting to relevant stakeholders and authorities. They also issued documents for export and provided service of issuing certification of agricultural standards. In addition, they established a coordination center to oversee the network consulting and gathering point proposal to the government, private agencies and relevant organizations.

2.2.2.6 Flood Management of Bangkadi Industrial Park in 2011

Bangkadi Industrial Park set up a committee to administer flood management. The committee includes people from the organizations and factories in the Bangkadi Industrial Park as well as relevant external agencies. The objective was to prepare for information tracking, coordinating, hazard warning, handling prevention and mitigation for flood management, protecting assets, mitigating damage that might occur in the area and reassuring investors in the area.

Figure 2.13: Structure of Bangkadi Industrial Park Committee for Monitoring Flood Risk



Source: 2016 Flood Action Plan, Bangkadi Industrial Park

Moreover, during the 2011 flooding, Bangkadi Industrial Park established a “Flood Fighting” team to respond and resolve the issue with the following team members:

- Managing Director of Bangkadi Industrial Park Company Limited is a commander to control emergency situations with the authority to decide upon and order necessary actions.
- Senior Manager of Bangkadi Industrial Park Company Limited is a deputy commander to control emergency situations and is responsible for assisting the commander to control emergency situations as well as to facilitate coordination.
- Assistant Operations Manager of Bangkadi Industrial Park Company Limited is a controller of emergency situation and serves as a front commander to operate in emergency situations.
- The various operations are divided into 4 main divisions, which are the division of information and coordination, division of operations, division of security and traffic, and division of support.

During the flood, Bangkadi Industrial Park informed on and monitored the situation daily. It also notified factories in the industrial park to transfer machines and hazardous chemicals away from the expected water level. It assisted in preparing sandbags and conducted executive meetings to prepare for the situation. It notified factories to stop production in case the severity of the flooding reached a crisis level. In addition, Bangkadi Industrial Park not only prepared for flooding in their areas but also helped the surrounding communities and government agencies in the preparation of sandbag barriers along key points, such as floodgates and pumping stations. In addition, it also cooperated with the Pollution Control Department to inspect water quality in the industrial park before commencing water pumping out of the park in order to prevent contamination of the chemicals in the water and to ensure chemical presence did not exceed levels stipulated by the Pollution Control Department.

2.2.2.7 Bottlenecks in 2011 flood management

A particular challenge to the management of floods in the year 2011 at Pathumthani, which the stakeholders in the area, including the community, the private sector, the industries and local governments are concerned about, is the transmission of early warning data from the government which can be quite slow. This is due to a lack of coordination between government agencies, which caused a delay in the management of the flooding . Nevertheless, the study of Dr. Titus Mala et al (2014) on "The role of local governments in Pathumthani province" has found that local organizations such as the Local Municipality of Bangkadi, which was one of the subjects studied, are the primary

agencies for managing flooding in the area, which is legally justified. The Local Municipality of Bangkadi carried out a satisfactory mission even though there were limited resources with which assist the victims. Thus, local governments should be the primary agency to manage flooding in the area in order to address the needs of the sociey in the area. The study concludes that coordination of flood related information between agencies is very important and this should to be planned carefuly enable efficient response to emergency.

2.2.2.8 Post-2011 flood impacts

The way of life of the people during the floods in October 2011 encountered many difficulties as many people had to travel by boat, and some people had to migrate out of the area because of high flood level. The main road was cut off almost entirely. As a result, the governemnt encoutered great difficutly in extending assistance to these affected persons with many people having to support themselves. Even after the flood, many people suffered from more issues of wastewater treatment and difficulty of eliminating the putrid floodwater smell in the area. This resulted in an inrease in stress for affected persons.

The labor force in Pathumthani province was affected after the floods during the period of October to November of 2011 due to a number of problems caused by the fact that many employers announced layoffs due to termination of operations or the relocation of work to other provinces which were not accesible for employees. Moreover, there was no clear information about the employment situation. Data from the Office of Labour Protection and Welfare of Pathumthani Province in December 2011 found that over 400,000 workers and 10,000 business enterprises were affected. In December 2011, over 300,000 returned to work whilst 6,407 people were layed off from 14 business enterprises.
In addition, in regards to the gross provincial product (GPP) data, which is a measure of the economic wellbeing of the province, the 2011 GPP dropped 14.1 percent from the year 2010. And the 2012 GPP fell 1 percent from the year 2011, which demonstrates the impact from the floods. For the non-agricultural sector, the industrial sector had a total value in the year 2011 and 2012 of 191,798 million baht and 179,257 million baht, which is a decrease from the year 2010 of 14.5 percent and 20.1 percent, respectively. Many factories in Pathumthani are a base for the automotive parts for manufacturing industry as well as appliances, electronics, food and beverages, which caused a great impact on supply chain operations both domestically and overseas. As of June 2012, it was found that many of the factories in Nava Nakorn Industrial Estate and Bangkadi Industrial Park were unable to return to a normal operational level. 8 factories in the Nava Nakorn Industrial Park and 3 factories in Bangkadi Industrial Park had to dissolve, respectively (see Table 2.8).

Table 2.8: Status of factories in Nava Nakorn Industrial Estate and Bangkadi Industrial Park as of June 2012

Industrial Estate/Park	Number of factories	Restoration to resume business operations			Factories that was not restored after the flood		Factories that went out of business	
		Completely restored	Partially restored	% of restoration	Total number	%	Total number	%
Nava Nakorn	227	55	107	71	57	25	8	4
Bangkadi	36	7	17	67	9	25	3	8

Source: Sukegawa S. Nikkeikigyo (2012). Levee construction in SahaRattananakorn Industrial Estate, in Tsusho Koho. Bangkok Thailand: JETRO; 2012

Chapter 3 - Flood Management Policies and Plans

3.1 National policies

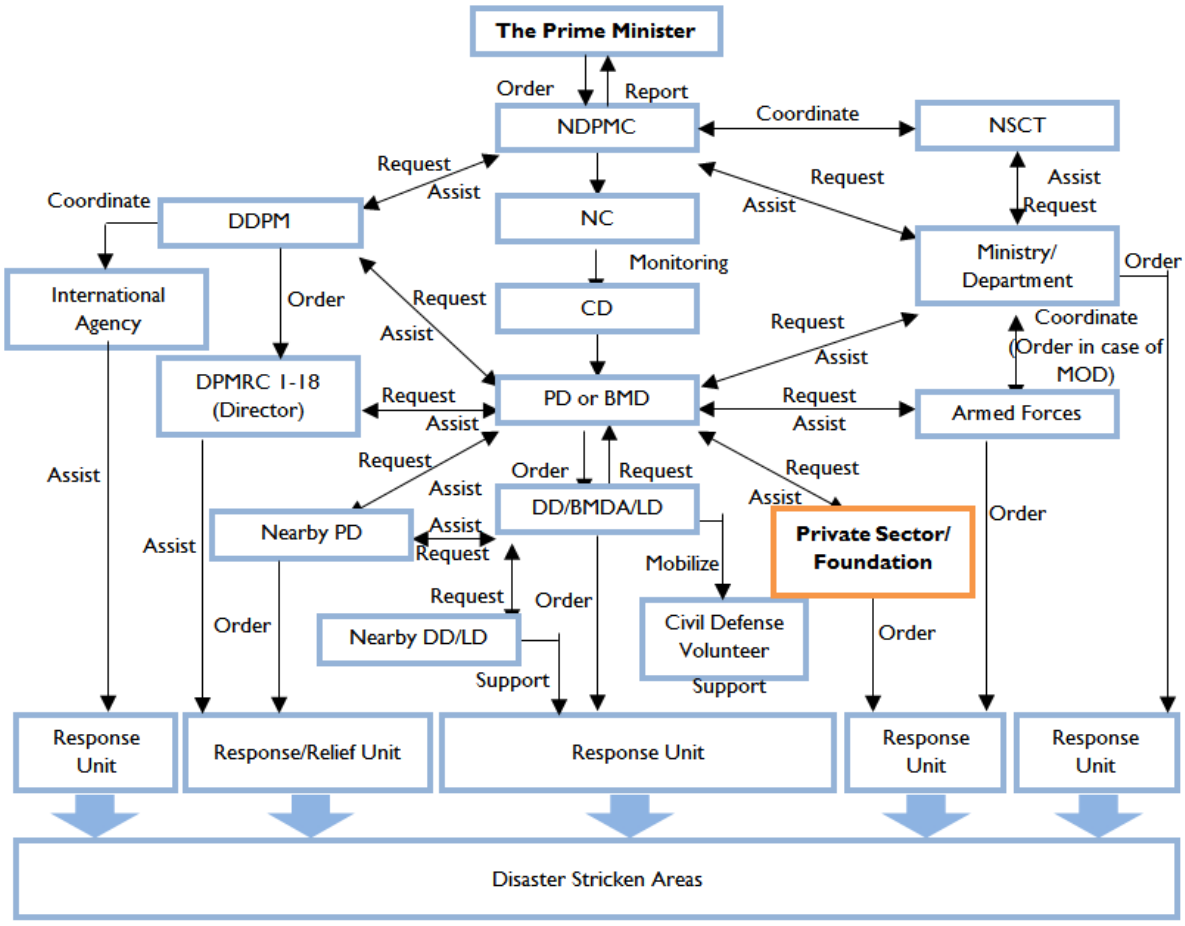
There are 2 existing national disaster management policies in Thailand, which are: (1) National Disaster Prevention Act 2007 and (2) National Disaster Prevention and Mitigation Plan 2015. These 2 policies can be summarized as follows.

3.1.1 National Disaster Prevention and Mitigation Act (2007)

The government has acknowledged the importance of disaster management, and subsequently enacted the Disaster Prevention and Mitigation Act (2007) as a basic legal mechanism for current disaster management in Thailand. The Act came into force on November 6, 2007 and has designated the DDPM as a responsible agency to carry out disaster management activities in the country.

The 2007 Act has clearly stipulated and clarified disaster management arrangements that encompass types of disaster, policy guidelines, operating procedures as well as coordinating procedure from national to local levels as illustrated in Figure 3.1. The disaster management system in Thailand has 4 levels of functions from top to bottom. At the top or policy level, the National Disaster Prevention and Mitigation Committee (NDPMC), chaired by Prime Minister (PM) or Deputy Prime Minister appointed by the PM, consists of 22 members from relevant ministries and government agencies. The Secretariat of the Committee is the Director-General of DDPM. At strategic level, the DDPM serves the national committee on policy development and implementation. The third level which is strategic/tactical level is the 76 provinces headed by provincial governors appointed by the Ministry of Interior (MOI) who are the key actors in disaster management system. Lastly at the operational level to undertake actual work on the ground is the provincial and local governments. Civil Society Organisations (CSOs) and the private sector are included within the disaster management system, coordinating with the Provincial Governor/ Bangkok Metropolitan Administration (BMA) to assist in disaster response. The Act directly contributes to the Strategic Component of the ASEAN Agreement on Disaster Management and Emergency Response (ADDMER) Work Programme in Prevention and Mitigation for implementing the National Action Plan on Disaster Risk Reduction and Strengthening Institutional and Legal Framework.

Figure 3.1: Disaster Management Systems in Thailand (DDPM, 2009)



Source: Assessment of plans, policies and operations in disaster management in Thailand (2013), ADPC

3.1.2 National Disaster Prevention and Mitigation Plan 2015

On 31 March 2015, the Cabinet endorsed the 2015 National Disaster Prevention and Mitigation Plan and enforced related sectors of all levels to conduct the following:

- It assigned ministries, departments, organizations and government agencies, state enterprises, provincial, district local governments, the private sector and other sectors to operate according to the National Disaster Prevention and Mitigation Plan 2015.
- It assigned the Budget Office, related agencies and local governments to consider the importance of allocating funds to prevent and reduce the impact of disaster as well as to prepare for emergency response, crisis management and disaster resilience.

- It assigned to each level of agencies to prepare action plans for strategic programs and to incorporate the plans and projects related to disaster prevention and mitigation into the governmental annual action plans as well.

The current National Disaster Prevention and Mitigation Plan 2015 has embraced the concept of implementation of national disaster risk management by using the notions of "Disaster Risk Reduction" and "Build Back Better and Safer" to ensure that people and communities at risk are well prepared for all types of hazard in line with international principles of strengthening Resilience.

In addition, this serves as a framework that is drawn from experiential knowledge, feedback from all sectors and international and national actions that can be used as a standard for national disaster risk management. This is also in line with the 11th National Economic and Social Development Plan (2012-2016), National Disaster Prevention Act 2007, and the statement by the Prime Minister at The Sendai Framework for Disaster Risk Reduction on March 14, 2015 at Sendai, Japan.

The Strategies for Disaster Risk Management consists of 4 key points as follows.

1) Disaster risk reduction oriented: The focus is to prevent disaster and mitigate its impact through reducing vulnerabilities and exposure and at the same time enhancing disaster preparedness capabilities as well as to develop countermeasures and operational procedures for more effective disaster prevention, mitigation and preparedness by constructing the standardized disaster risk assessment system, developing measures for disaster risk reduction, and encouraging all sectors at all levels to develop their own disaster risk reduction procedures.

2) Integrated emergency management: This is to ensure systematized, standardized and unified emergency management system that allows all-sector engagement in an effective and efficient manner, and rapid, inclusive and timely relief support to disaster affected people. This also minimizes people's losses of lives and properties from disasters by standardizing emergency response, developing system/tools to support emergency response operations, and strengthening disaster relief system and implementing procedures.

3) Effective recovery and resilience building: This is to ensure that the disaster affected areas will be revived to its normal function and where possible built back better and safer as well as to ensure that disaster affected people will be provided recovery together with reconstruction and rehabilitation programs in a timely, continued and equitable manner, and ultimately able to resume their normal life by establishing a Post Disaster Needs Assessment system, developing a common approach for recovery operation and management as well as promoting and strengthening a principle of build back better and safer in recovery process.

4) Strengthened international cooperation: This is to strengthen a coordination mechanism with international organizations and communities in disaster risk management as well as to improve and maintain the standards of collaboration on disaster risk management with sub-regional, regional and international partners by developing a more unified coordination mechanism for humanitarian response and recovery work, raising the standards of humanitarian operations, encouraging disaster-related knowledge sharing and learning, and as well as promoting Thailand's leadership on disaster risk management in the region.

3.1.3 Flood management before the year of 2011

Before 2011, there were some plans on flood management, namely the flood mitigation plan for medium term and long term (endorsed by the cabinet on March 27, 2006) and the irrigated area development plan of 60 million rai (endorsed by the cabinet on December 18, 2007)[22]. The flood mitigation plan for medium term and long term is the plan to tackle flooding and drought problems in terms of integrating the relevant authorities and stakeholders. However, the overall goal of the plan was not achieved as expected due to a change of government that led to a lack of funding to continue and the fact that the management of the plan was not integrated[23].

As for the direction of water management in the National Economic and Social Development Plans (NESDPs), it was found that the 9th plan (2002-2006) and the 10th plan (2007-2011) focused on water resources management. In particular, the 10th plan focused on reformation of water resources development system and water usage optimization by encouraging public engagement in sustainable development under the Sufficiency Economy philosophy. Moreover, the 10th plan mostly focused on efficiency of related projects rather than structural measures. Nevertheless, both plans did not focus on topics regarding flood management.

3.1.4 Flood management after the year of 2011

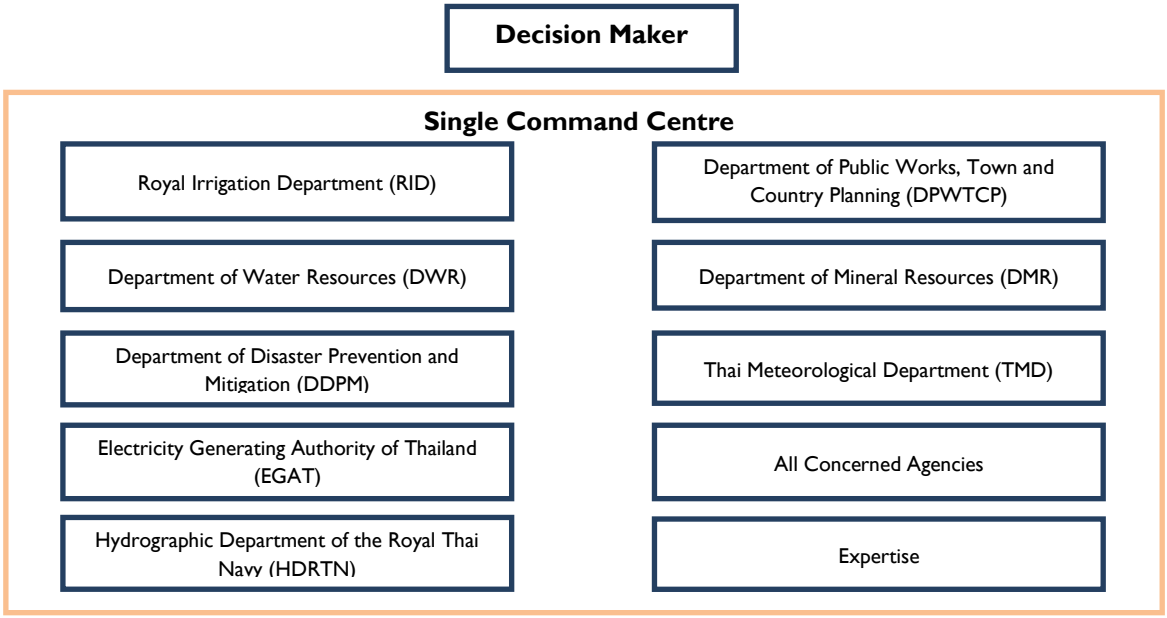
The 11th National Economic and Social Development Plan (2012-2016) focuses on preparedness, namely prevention and mitigation of natural disasters such as flooding that may occur

[22] Water Resource Policy and Management Committee (2015) Strategic Plans for Managing Water Resources (May 2015) Page 3-3
[23] Water Resource Policy and Management Committee (2015) Strategic Plans for Managing Water Resources (May 2015) Page 1-6

as well as restoration of water resources and integrated water management. The integrated components to be considered include water pathways, water quantity (flooding/drought) and water quality, both in normal and critical situations. The purpose of integrated water management is to develop an integrated approach. In Thailand, there are more than 40 government agencies working on water and flood management, which has led to coordination gaps in flood response. Based on this, the Master Plan on Water Management was developed after the flood crisis in 2011 in line with the NSEDP and announced on 10 January 2012. The Master Plan consists of 8 major work plans and 2 action plans which are 1) Action Plan for Water Management in the Emergency Period (short-term) and 2) Action Plan for Integrated and Sustainable Flood Mitigation in the Chao Phraya Floodplain (long-term).

The Master Plan aims to prevent and minimise losses and damage from medium- to large-scale floods, improve existing flood prevention system, emergency flood management, increase capacity in the early warning system, build confidence and stability in flood prevention in communities, agricultural areas, industrial sites, and important economic zones, and integrate participation of stakeholders from all sectors for effective water management. The operation under a Single Command authority on water management (Figure 3.2) will be in place during crisis for effective planning and timely response. All concerned agencies should work under the Single Command System while adhering with the 2P2R i.e. policy on prevention, preparedness, response and recovery. Participation of all concerned agencies is the key to achieve sustained disaster management in the country.

Figure 3.2: Single Command Centre for Water and Flood Management



Source: Assessment of plans, policies and operations in disaster management in Thailand (2013), ADPC

According to the Emergency Period Action Plan to be implemented in 2012-2013 with a budget of 22,626.04 million baht, a National Water Information Center would be set up in order to develop effective and unified information, forecast and early warning systems, using modern technology, such as satellite and remote monitoring systems. In watershed areas management, emphasis would be placed on reforestation in line with His Majesty the King's concept for the harmonious coexistence between humans and nature. Water drainage management focuses on major dams such as Bhumibol, Sirikit, Pa Sak Jolasid, and Chainat. About 100 canals would be dug and more dikes would be constructed. As for water management in industrial estates, more embankments, sluice gates, and pumping stations would be built and reinforced. Soft loans would be offered to industrial estates to help them develop their own flood prevention systems.

In addition, an integrated water management organisation in the form of "single command" would be established to handle the entire water management system and improve the early warning system and response to an emergency. Related laws and regulations would be improved, while public participation would be promoted. The most challenging issues are how to create effective coordination of more than 40 government agencies with overlapping responsibilities, and what is the appropriate combination of single command authority and decentralisation of power. Centralised flood and water management may impact on timely decision making and response at the local level. Therefore, promoting self-resilience to cope with disasters could be an appropriate option.

Apart from the short-term Action Plan, the Action Plan of Integrated and Sustainable Flood Mitigation in Chao Phraya River Basin, comprising 8 work plans with a budget of 300 billion baht, will also be implemented including work plans for restoration and conservation of forest and ecosystem; management of major water reservoirs and formulation of water management; restoration and efficiency improvement of current and planned physical structures; information warehouse and forecasting and disaster early warning systems; focus on specific areas aiming at building the capacity in prevention and mitigation of impacts from flood by developing the systems of flood prevention and mitigation in key locations; assigning water retention areas and recovery measures; improving water management institutions; and creating understanding, acceptance, and participation of all stakeholders in large scale flood management. All these projects are expected to minimise the effects of flood damage in the future.

Nevertheless, the Master Plan on Water Management as endorsed by the cabinet on January 10, 2012 has not been managed and efficiently disseminated amongst relevant networks. This is due

to the lack of participation of stakeholders in the implementation of the plan[24] to resolve the country's water management issue as part of a unified and integrated approach across all dimensions. Therefore, the Water Resource Policy and Management Committee has gathered information from government agencies, experts in water management, involving sectors and public opinion through a forum to prepare a strategic plan for managing water resources and to resolve the issue of water resources sustainably according to the needs of the target groups and the public.

On May 7, 2015, the cabinet voted in approval of the plan in order to allow relevant organizations to use it as a guide for water resources management in the country under the vision of the strategic plan for water resources management for the years 2015-2026 as follows:

"Every village should have clean water supply for consumption. Water supply for production should be stable. Damages from flood should be reduced. Water quality should meet the standards. Water management should be sustainable under balanced development by a participation of all sectors"[25].

The Water Resource Policy and Management Committee has presented 6 strategic plans[26] for managing water resources as follows.

1. Management of water consumption should be focused on managing surface water and groundwater for water supply in villages without clean water for consumption. Also, this existing system should be improved to become more efficient.

2. The stability of the production sector (agricultural and manufacturing industries) should be made by focusing on improving the infrastructure for water storage in accordance with the demand for water consumption. This can be done by assessing the principle of water balance between the economic growth and maintaining functioning and healthy ecosystems and environment.

3. Flood management should be focused on improving the efficiency of the main paths of water as well as irrigation and drainage basin areas. It should also focus on protecting flood prone communities and local economies as well as supporting adaptation to, and prevention of, disasters.

4. Water quality management should be focused on management of waste water from the source and controlling the salinity of the water not to exceed the standards of the industry, agriculture and water supply.

[24] Water Resource Policy and Management Committee (2015) Strategic plans for managing water resources (May 2015) Page 1-7
[25] Water Resource Policy and Management Committee (2015) Strategic plans for managing water resources (May 2015) Page 3-11
[26] Water Resource Policy and Management Committee (2015) Strategic plans for managing water resources (May 2015) Page 3-12

5. The conservation and rehabilitation of degrading forest and the prevention of soil erosion should be focused on increasing forest areas in the country.

6. General administration should be focused on improving the organizational structure at the national level as well as the local level. This includes encouraging participation of the community, water related organizations and relating domestic and international networks in order to strengthen water resources management. The draft of Water Resources Act for the purpose of resolving issues regarding water resources should also be more integrated.

3.1.5 Agencies of water resource management

After experiencing heavy flooding in Thailand in the year 2011, there has been establishment of organizations for the prevention and mitigation of national flood disaster according to the Office of the Prime Minister on 2011 Strategic Management of Water Resources and the Office of the Prime Minister on National Flood and Water Management Act 2012 as follows.

- **National Water and Flood Policy Committee** is responsible for setting policies and action plans for water management to prevent and resolve flooding in a systematic way that allows government agencies to follow their guidance.
- **Water and Flood Management Committee** is responsible for preparing action plans and implementing water management and flood policies as set by the National Water and Flood Policy Committee. It is also responsible for setting operational procedures for the government agencies in order to prevent and resolve water problems and flooding appropriately and in line with the action plan as well as conducting other operations for water management such as flood preparation and protection.
- **National Office of Flood Policy and Management** is responsible for coordinating with involving government agencies in gathering information about the climate, the condition of water and dams in the watershed or catchment, the condition of the area around the water flow as a guideline for early warning system in order to manage water and flood and to prepare for public assistance
- **National Bureau of Disaster Prevention and Mitigation** is responsible for supervising, deciding, controlling and coordinating in the management of disaster at the severity of level 3 and level 4.
- **National Cooperation Center of Disaster Prevention and Mitigation** is responsible for, (1) during a normal condition, coordinating and integrating information and operation of the relevant authorities in order to prepare for disaster prevention and mitigation as a whole system, (2) during a near-disaster condition, preparing to respond, monitoring the situation,

reporting and recommending the commissioner to decide on how to deal with disasters that may occur, (3) during an occurrence of disasters, directing and integrating the coordination of operations in an event of severity of level 1 and level 2 as well as monitoring the situation to offer opinions to the commander in deciding whether to raise the severity of the situation of the disaster to level 3 and level 4.

However, as the National Council for Peace and Order (NCPO) has announced to take over power in the country, in order to reduce redundant work and develop and manage water resources of the country faster and more efficiently to prevent and mitigate drought, flood and disaster for the public, NCPO has issued an order No. 85/2557 in appointing the Water Resource Policy and Management Committee as well as terminating the order of the Office of the Prime Minister on 2011 Strategic Management of Water Resources and the Office of the Prime Minister on National Flood and Water Management Act 2012. Nevertheless, the National Office of Flood Policy and Management was not terminated but set as an agency under the Deputy Prime Minister Office to be responsible for coordinating state agencies that involves in collecting climate data and the condition of water and dams in the watershed or catchment. The data is analyzed and presented to the National Council for Peace and Order.

Its responsibilities[27] are as follows:

- Setting policies and plans for managing water resources as well as preventing and solving flood, drought and water quality issues in the country so that the management of water resources of the country is unified and integrated.
- Proposing projects and measures related to water resources management for approval in order to achieve integrated management under the guidance of the National Council for Peace and Order.
- Encouraging public participation and strengthening of public understanding of water resource management in the country.
- Integrating operations for water management of the country by commanding government agencies to operate and manage the country's water resources, especially in times of crisis, in order to coordinate with the Disaster Prevention and Mitigation Committee as indicated in the Disaster Prevention and Mitigation Act of 2007.
- Monitoring and supervising the implementation of policies, plans, programs and measures as approved.

[27] NCPO order No. 85/2557 in appointing the Water Resource Policy and Management Committee http://www.thaigov.go.th/index.php/th/ncpo-order/item/84662-id84662

- Appointing sub-committees, working groups and advisory boards in order to assist the Water Resource Policy and Management Committee as assigned.
- Inviting people or organizations involved in water resources management to provide facts and opinions as well as managing relating documents for consideration of the committee.
- Performing any other action necessary to manage the water resources of the country and reporting results of operations as well as performing any other duties as the Head of National Council for Peace and Order assigns.

The Water Resource Policy and Management Committee has appointed a sub-committee made up of of the following[28].

1. The sub-committee for development and management of resources in the Northern, Central and Eastern regions where the Permanent Secretary of the Ministry of Agriculture is appointed as the President and the Director General of the Royal Irrigation Department is appointed as the Secretary General.

2. The sub-committee of development and management of resources in the Northeastern and Southern region where the Permanent Secretary of the Ministry of Environment and Natural Resources is appointed as the President and the Director General of the Department of Water Resources Department is appointed as the Secretary General.

3. The sub-committee of management information systems and decision support where the Director of the Hydro and Agro Informatics Institute is appointed as the President and the Director of the Hydro Informatics is appointed as the Secretary General.

4. The sub-committee of Water Resources Development and Management regarding organization and rules where the Secretary General of the National Economic and Social Development Board (NESDB) is appointed as the President and the Deputy Secretary General of NESDB is appointed as the Secretary General.

5. The sub-committee of publicity and participation where the Director General of Public Relations Department is appointed as the President and the Director of Public Relations Bureau is appointed as the Secretary General.

[28] Water Resource Policy and Management Committee (2015) Strategic plans for managing water resources (May 2015) Page 1-12

3.2 Local plans

3.2.1 Pathumthani Disaster Prevention and Mitigation Plan 2015

According to the Disaster Prevention and Mitigation Plan of Pathumthani 2015, the strategies for disaster risk management have been adjusted to be in line with the National Disaster Prevention and Mitigation Plan of 2015 based on the concept of encouraging local communities to take part in dealing with disaster management in a sustainable manner. This is also in line with the 11th NESDB (2012-2016) and the statement by the Prime Minister at The Sendai Framework for Disaster Risk Reduction in March 2015 based on strategic disaster risk management as follows.

1) To focus on mitigating disaster risk and its impacts through reducing vulnerabilities and exposure and enhancing disaster preparedness capabilities as well as to develop countermeasures and operational procedures for more effective disaster prevention, mitigation and preparedness
2) To integrate systematized, standardized and unified emergency management system that allows all-sector engagement in an effective and efficient manner and to ensure rapid, inclusive and timely relief support to disaster affected people as well as to minimize people's losses of lives and properties from disasters
3) To improve efficiency by ensuring that the disaster affected areas will be revived to its normal function and where possible built back better and safer as well as to ensure that disaster affected people will be provided recovery together with reconstruction and rehabilitation programs in a timely, continued and equitable manner, and ultimately able to resume their normal life
4) To promote the country's leadership by strengthening a disaster risk management coordination mechanisms with international organizations and communities as well as to improve and maintain the standards of collaboration on disaster risk management with sub-regional, regional and international partners

3.2.2 Masterplan on water resource management under Pathumthani Disaster Prevention and Mitigation Plan 2010 – 2014

Considering key lessons after the country's major flooding in 2011, the National Disaster Prevention and Mitigation Committee has added a chapter on water management and flood in the National

Disaster Prevention and Mitigation Plan of 2010-2014. As a result, Pathumthani had to revise its disaster prevention and mitigation plan to be consistent with the national plan so that the command system and the operating system can integrate seamlessly and the performance of all sectors can operate more efficiently. The command system consists of 4 parts as follows.

1) In case of a minor disaster, the Head of the local administration can handle the situation independently as far as existing capacity allows without the need for external support.

2) In the event of a medium intensity level of disaster where the local administration cannot control the situation, the Provincial Director of Disaster Prevention and Mitigation can establish a provincial emergency operation center to manage the situation specifically.

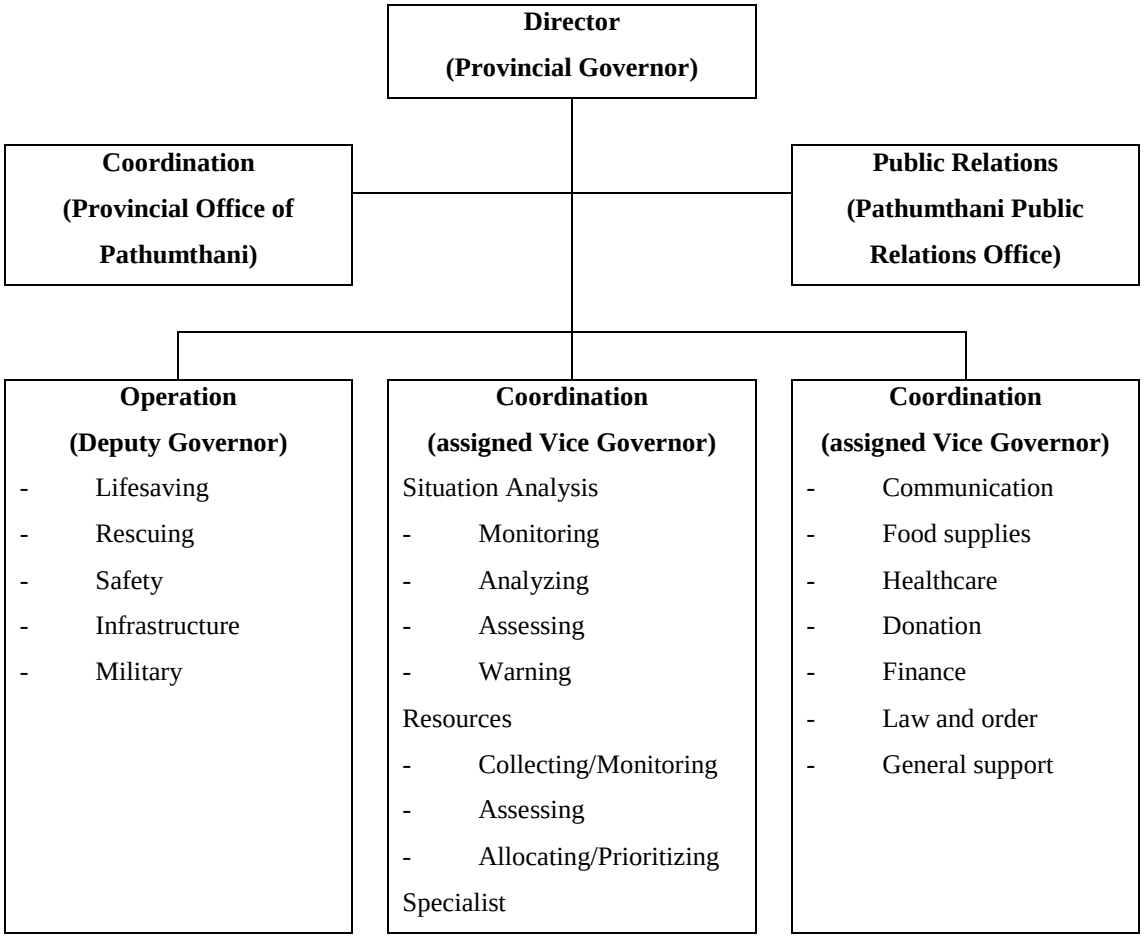
3) In case of disaster (including floods with large intensity) where the provincial emergency operation center cannot control the situation, the province can request specialists / special equipment / support from all sectors to respond to the emergency situation.

4) In case of extremely serious flooding, where the central director (Director General of the Department of Disaster Prevention and Mitigation) and the Commander of the National Disaster Prevention and Mitigation (Minister of Interior) cannot control the situation or suspend the disaster, a restructuring of the provincial command center can be made for flexibility depending on the headquarters of Disaster Prevention and Mitigation as appointed by the Prime Minister or the assigned Deputy Prime Minister as a commander to take control of the situation.

In addition to the restructuring of the command structure to provide increased flexibility, the report of situation, weather forecast, water level forecast, warning system and effective communication networks for the transmission of information are another important factor.

The structure of Incident Commanding Center (First Respondent) of Pathumthani is shown in Figure 3.3 below.

Figure 3.3: The structure of Incident Commanding Center of Pathumthani



Source: Office of Disaster Prevention and Mitigation of Pathumthani, Disaster Prevention and Mitigation Plan of Pathumthani, 2010-2014 "Water and flood management"

3.3 Water resource management in Pathumthani province

3.3.1 Offices of local water resource management

The Bureau of the Budget allocates an annual budget for Pathumthani based on its action plan. The management of water resources is one of the activities supported by the Royal Irrigation Department, Ministry of Agriculture and Cooperatives after the flooding in 2011 in order to attain plans that promote integration of water management. The management of water resources can be divided into (1) irrigation water management (2) the support of royal development projects, and (3) the prevention and mitigation of flood. Pathumthani has received budget allocation for the management of water resources as in Table 3.1.

Table 3.1: Annual allocated budget for managing water resources in Pathumthani for 2012-2016

Topics	Annual allocated budget (Baht)				
	2016	**2015**	**2014**	**2013**	**2012**
Total allocated budget	17,591,656,427	12,030,981,253	7,733,183,485	7,714,460,533	5,168,326,158
Plans to promote integration of water management					
Irrigation water management	220,107,900	178,318,000	132,000,000	80,000,000	143,072,000
Support of development projects due to royal initiative	69,000	-	-	-	-
Prevention and mitigation of flood	456,379,600	182,400,000	-	110,420,500	3,604,300
Total	676,556,500	360,718,000	132,000,000	190,420,500	146,676,300
Percentage of total allocated budget (%)	3.85	3.00	1.71	2.47	2.84

Source: Bureau of the Budget, Annual budget allocation plans for each province
http://www.bb.go.th/bbweb/?page_id=7398

3.3.2 Water resource management projects in Pathumthani

Pathumthani is located in the flat plain at the Chao Phraya River basin area. It contains systems of irrigated canals and natural canals such as Kwai canal, Chiang Rak Noi canal, Bang Toei canal, Bang Po canal, Menam Oom canal, Bang Luang canal, Hokwa canal, Rangsit Prayoonsak canal, and Rapeepat canal, which receive water from Chainat dam, Pasak river, and Rama VI dam[29].

Moreover, Pathumthani contains 4 irrigation projects in the area (Figure 3.4) as follows.

• Praya Banlue Irrigation and Maintenance Project (light pink)

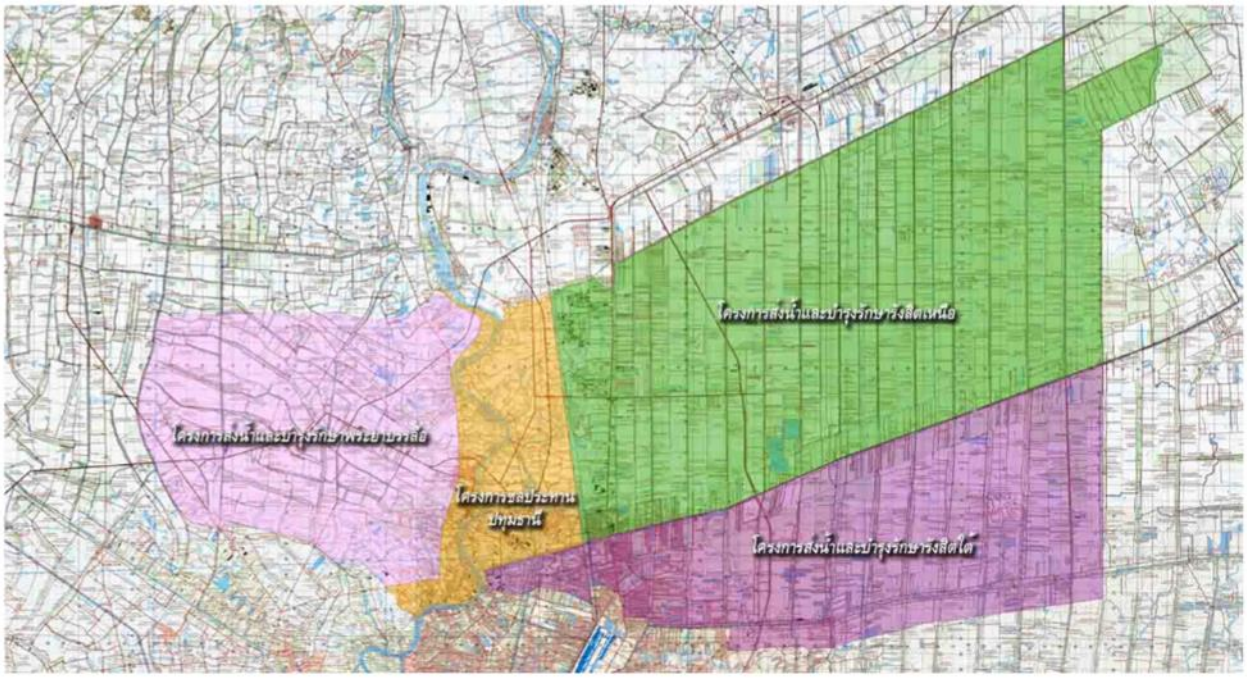
• Pathumthani Irrigation Project (yellow)

[29] Eco Industrial Development Center, Department of Industrial Works (2016), Basic information of Pathumthani at provincial level, From http://ecocenter.diw.go.th

• North Rangsit Irrigation and Maintenance Project (green)

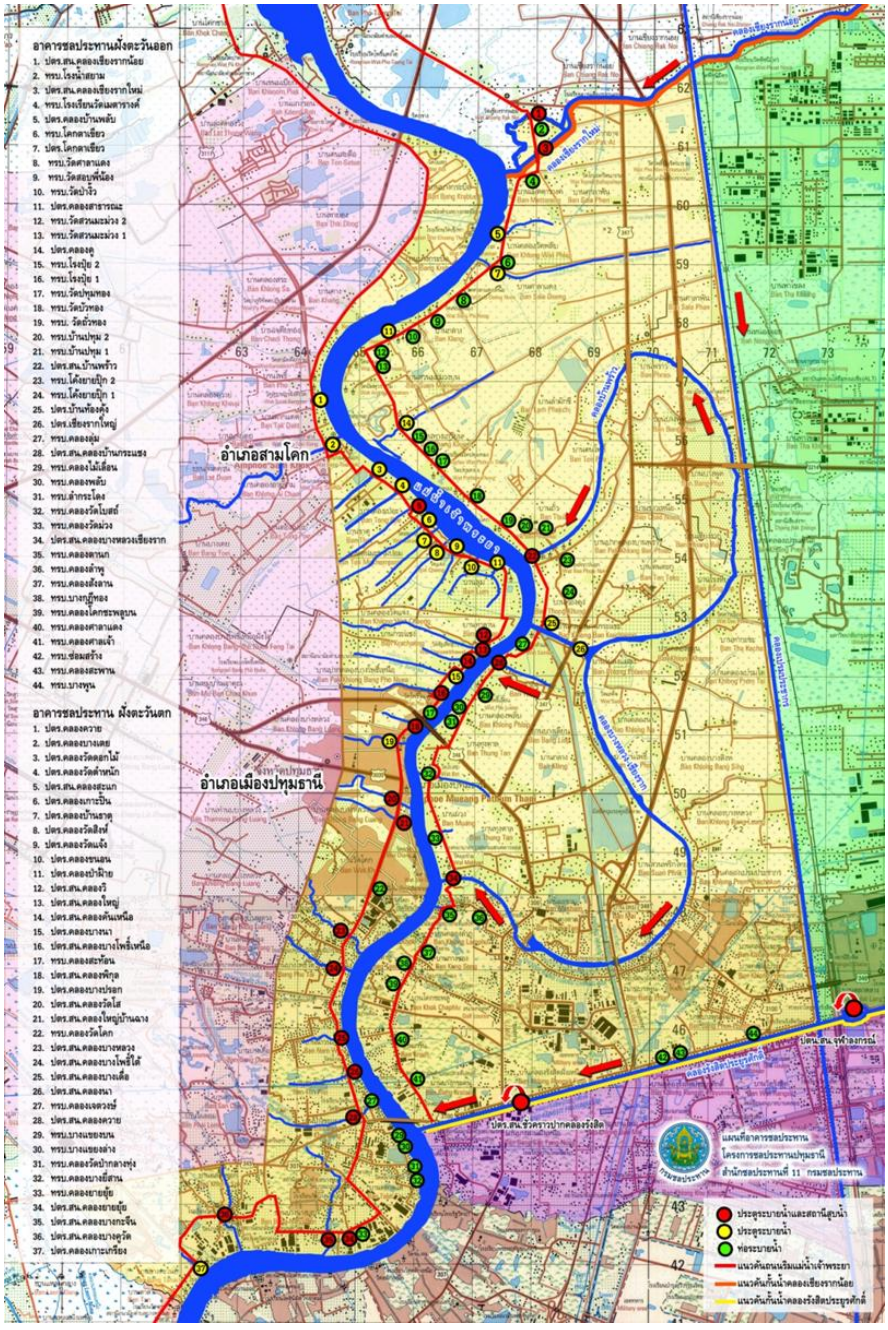
• South Rangsit Irrigation and Maintenance Project (dark pink)

Figure 3.4: Map showing the areas of irrigation projects in Pathumthani Province



Source: Pathumthani Provincial Irrigation Project, Royal Irrigation Department
from http://ridceo.rid.go.th/pathum/map.html

Figure 3.5 Map showing the Pathumthani Irrigation Project (yellow area)



Source: Pathumthani Provincial Irrigation Project, Royal Irrigation Department, 2016

Note: Red circles represent locations of floodgates and pumping stations.

Yellow circles represent locations of floodgates.

Green circles represent locations of draining sites.

Red lines represent flood barriers along Chao Phraya River.

Orange line represents flood barrier along Chiang Rak Noi Canal.

Yellow line represents flood barrier along Rangsit Prayoonsak Canal.

Chapter 4 - Area BCM cycle: Understanding the Area

4.1 Criteria for determining area boundary

As NESDB and JICA discussed with the Governor of Pathumthani to request cooperation for the implementation of the pilot Area BCM project, consensus was reached on selection of Bangkadi Industrial Park as the pilot area since this area experienced flooding in the past and the size of the area is suitable for the implementation of the pilot project. This area is also a location for key industries that operates on foreign investments as well. In addition, the availability of infrastructure and utilities, together with strong surrounding communities, makes it a very appropriate area for the pilot project.

The working group has implemented the Area BCM pilot project according to the order number 143/2559 of Pathumthani, which was led by Bangkadi Municipality as the leader of the working group. The workshop on the topic of "Understanding the Area" was held on February 4, 2016 at Bangkok Golf Club Hotel in order to discuss the implementation modality of the project in the Bangkadi Industrial Park area. Eventually, the working group members reached a consensus that in order for the all sectors to understand the characteristic of the area of the pilot project as well as for being able to collect necessary data for analysis in the same direction, the boundary of the project area should be clearly defined, depending on the type of hazard that has been studied. For example, the boundary of a project area on fire hazard should be limited to the area of Bangkadi Industrial Park and the surrounding area which may potentially be affected.

Since the working group members reached a common point of view regarding the risk of water management, specifically, the risk of flooding, they finally identified the geographic boundary of the pilot area as being determined by surrounding rivers and canals.

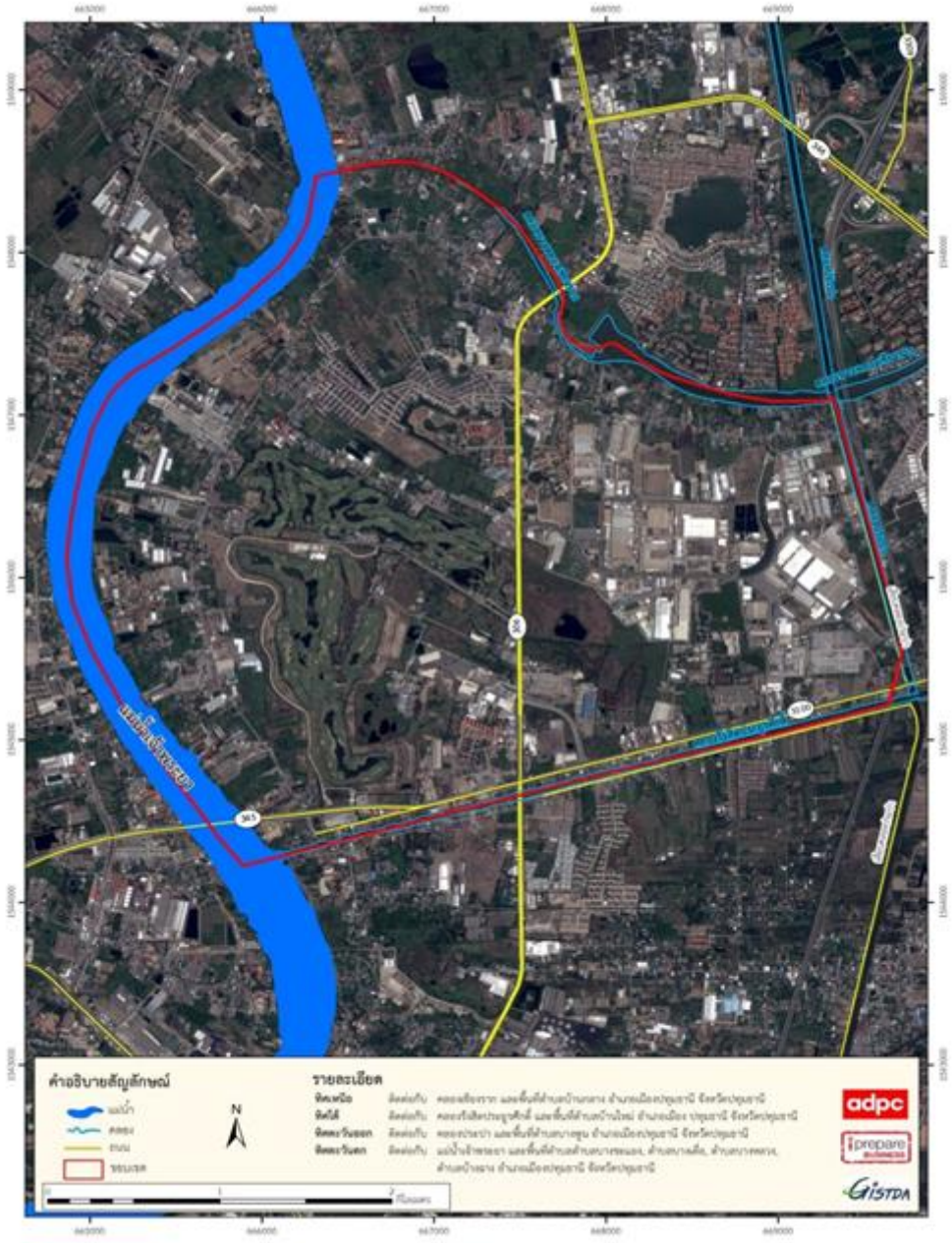
4.2 Location map

The working group has identified the boundary of the pilot area of this project covering 12.66 square kilometers based on water management aspects. The borders of pilot area are described as follows.

North connect to Chiangrak canal, Banklang sub-district, Mueang Pathumthani district
South connect to Rangsit Prayunsak canal, Banmai sub-district, Mueang Pathumthani district
East connect to Khlong Prapa, Bangphun sub-district, Mueang Pathumthani district
West connect to Chao Phraya River, Bangkhayaeng sub-district, Bangdua sub-district, Bangluang sub-district, Banchang sub-district, Mueang Pathumthani district

It should be noted that some participating organizations in the working group are not physically located within the set boundary of the project such as Banmai Municipality and the Provincial Waterworks Authority of Pathumthani. However, these organizations have an intention to create a joint effort together for the greater good of the initiative. In the meeting, it was pointed out that the boundary of the pilot project was set just to define the scope for implementation modality or pre-arrangement purposes only. Thus, if the vicinity of the project area experiences any disasters or emergencies, the working group is pleased to be a partner and support those areas as well.

Figure 4.1: Area map of the Area BCM pilot project



Note: The study area covers the whole area of Bangkadi Industrial Park and its surrounding area.

Red line represents the boundary of the study area.

Yellow lines represent highways and major roads.

Blue area represents rivers and canals.

4.3 Local administrations

The target site for the Area BCM pilot project covers the total area of Bangkadi sub-district of Pathumthani (approximately 8.3 square kilometers), in which Bangkadi municipality is the local government in charge. It also covers the area of Village 4 and 5 of Banmai sub-district of Pathumthani (approximately 4.36 square kilometers), in which Banmai municipality is the local government in charge.

4.4 Information on social and economic basis

4.4.1 Population

As the target site for the Area BCM pilot project covers the total area of Bangkadi sub-district and the partial area of Banmai sub-district of Pathumthani, the number of population in each area can be described as follows.

- Bangkadi sub-district contains a population of 11,242 people, 5,468 of which are male and 5,774 of which are female. It contains 3,797 households in 5 villages.
- Village 4 and 5 of Banmai sub-district contain a population of 1,647 and 3,207 people, respectively.

Since the pilot project area is in Pathumthani province where many manufacturing industries are located, it attracts a large number of unregistered populations, both Thai and foreigners, to come to work in the area. The largest number of the foreigners, both legally and illegally immigrated from Myanmar, Cambodia and Laos, respectively. According to the economic analysis report of the industry sector from the provincial industry office of Pathumthani in 2015, it was found that Muang district, where Bangkadi sub-district is located, contains 494 factories, which is the third of the total number in the province followed by Klong Luang district and Lam Luk Ka district. This number represents 13.55 percent of all the factories located in the province. In addition, according to the data in October 2005 from the provincial industry office of Pathumthani, it shows that Bangkadi sub-district ranks in the second sub-district in terms of number of employment in the province, only after Klong Neung sub-district of Klong Luang district where Nava Nakorn Industrial Estate is located.

4.4.2 Revenue

Since the nature of the project area is mostly comprised of community space and buildings, which does not include much space for agriculture, and since Bangkadi Industrial Park is located in this area, the source of revenue for the people in the area is mostly from private sector employment, followed by retail commerce and government service.

In addition, the area has no commercial tourism and no commercial livestock.

4.5 Flood risks

According to the workshop on Thursday, February 4, 2016 in order to understand the nature of the area, the working group conducted an analysis of the causes of flooding in the area as follows.

(1) Riverine flooding in the area

(2) Heavy rains in the area

(3) Significant amount of flood water flowing from the Northern region

(4) Blockage of natural water pathway system due to construction of houses, factories, and roads that causes drainage and flooding problems

In any case, riverine and heavy rain in the area are the most frequent causes of flooding in the area. However, since the pilot project area is geographically located on the lower east side of the upper basin of the Chao Phraya river (from Pasak river to Rangsit Prayunsak canal), where the area is highly sloped (approximately +6.5 MSL to +2.5 MSL), it is normal that flood water from the Northern region would move pass the area down to the south[30].

4.5.1 The 2011 flood experience in the area

One of the reasons why the working group focuses on the importance of water and flood management is due to the fact that this area experienced the 2011 great flood as well.

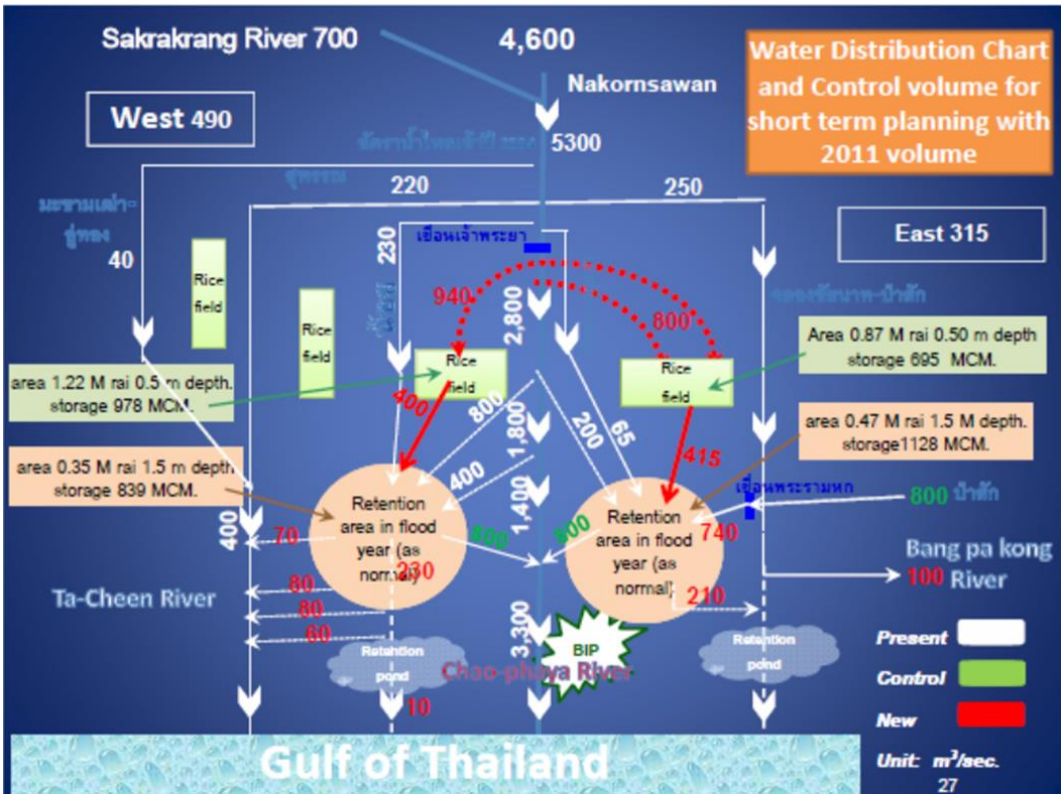
Every time that the amount of water draining from Chao Phraya Dam exceeds 2,800 cubic meters per second, it causes flooding in low- lying areas around the dam. In 2011, the influence of the wind and tropical storms that swept through the country caused the amount of water draining from Chao Phraya Dam to exceed 3,000 cubic meters per second for 54 days. This generated a huge mass of water since September 2011 that caused damages to Klongpafai Wat Tamnak water-gate barrier, Klong Banprao water-gate barrier and the dikes along the river in Pathumthani province. This caused water to flood into the residential area with great damages. In addition, in mid-October 2011, the mass of flood water flowed from the north into Bangkadi Industrial Park. The water was streaming along the embankments on Prapa canal located in the back of the park that caused the water level in the park to increase sharply. The highest flood level in Bangkadi Industrial Park was 4.3 meters and the duration of the flood in the park lasted more than one month. In addition, the data as of the year 2011 showed

[30] The report of study in suitability and analysis of environmental impact assessment of lower eastern Chao Phraya River drainage system, February 2016

that Bangkadi Industrial Park contained a total of 44 factories with a total workforce of 30,000 people. The total value of the investment in the park before the flood in which damage affected all of Bangkadi Industrial Park area was 22,000 million baht.

Most of the industries in Bangkadi Industrial Park are related to electronics and electrical instruments. The restoration of the factories to resume normal production took a long time because damaged machineries had to be replaced with new imported ones from abroad. In addition, it was reported that 3 of the factories had to be relocated or terminated permanently. Since the factories in Bangkadi Industrial Park experienced disruptions in operations from the 2011 flood, many industries in technology sector, particularly manufacturers of electronic appliances such as Sony and Toshiba, were greatly affected due to the interruption of their supply chain network. The impact was widespread in both domestic and foreign markets. Moreover, since some of the factories in the industrial park were direct suppliers to major manufacturers in the automotive industry, many activities in automotive production had to face disruptions again after the great earthquake in Japan earlier in the same year.

Figure 4.2: The amount of water flowing through Bangkadi Industrial Park in 2011 and short-term management of the flow of water



Source: Bangkadi Industrial Park (2012) Flood Prevention plan of 2012

Figure 4.3: Picture of Bangkadi Industrial Park before the flood on October 18, 2011

Source: Bangkadi Industrial Park (2012) Flood Prevention plan of 2012

Figure 4.4: Picture of Bangkadi Industrial Park during the flood

Source: Bangkadi Industrial Park (2012) Flood Prevention plan of 2012

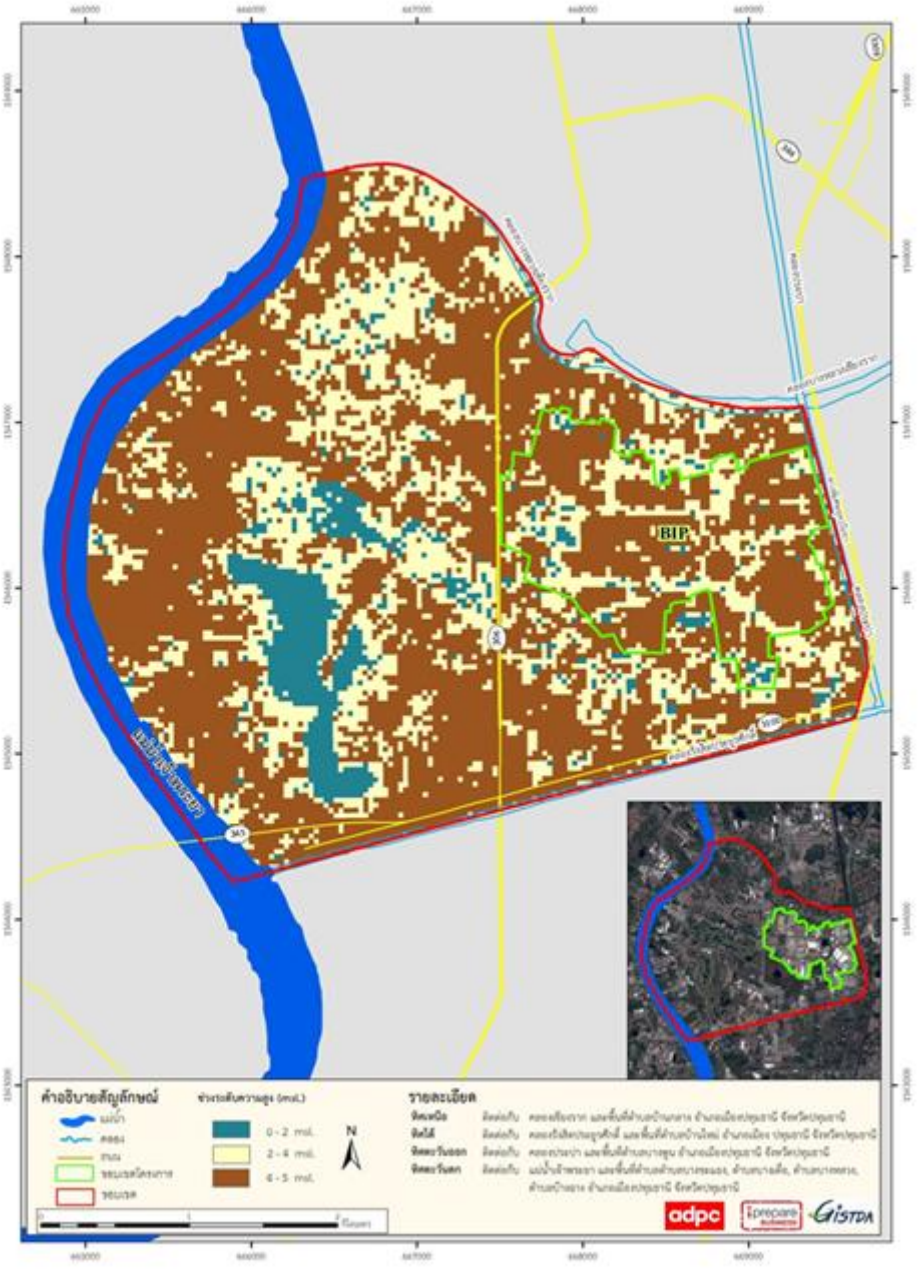
Figure 4.5: The direction of water flowing through broken dyke and strategy for diverting water out of Bangkadi Industrial Park

Source: Bangkadi Industrial Park (2012) Flood Prevention plan of 2012

4.5.2 Altitude of the area

According to the discussion during the workshop to understand the characteristic of the area on Thursday, February 4, 2015, the Area BCM working group agreed that there should be preparation of an elevation map of the area that shows mean sea levels (MSL) as a guideline for analysis of the problems and obstacles for Area BCM and flood management strategies. As a result, ADPC has coordinated with the Geo-Informatics and Space Technology Development Agency (GISTDA), a member of the working group responsible for the preparation of the elevation map of the area. In general, it was found that the majority of the pilot area is located between 4-5 MSL. Nevertheless, besides the riverbank area outside the dyke of Bangkadi road, there are also other areas of concern as follows: (1) the central area to the southwest side of Tiwanon road which is a low level area with 0-2 MSL, (2) the area around the Military Maintenance Center on the south side of Bangkadi Industrial Park, which is a low level area with 0-2 MSL, and (3) the upper west side of Tiwanon road, which is a residential community, location of schools and government facilities with 2-4 MSL, and (4) the area along Bang Luang Chiang Rak canal contact with 2-4 MSL.

Figure 4.6: Elevation map of the Area BCM pilot project



Note: Red line represents the boundary of the study area.

Green line represents the boundary of Bangkadi Industrial Park.

Yellow line represents highways and major roads.

Blue area represents rivers and canals.

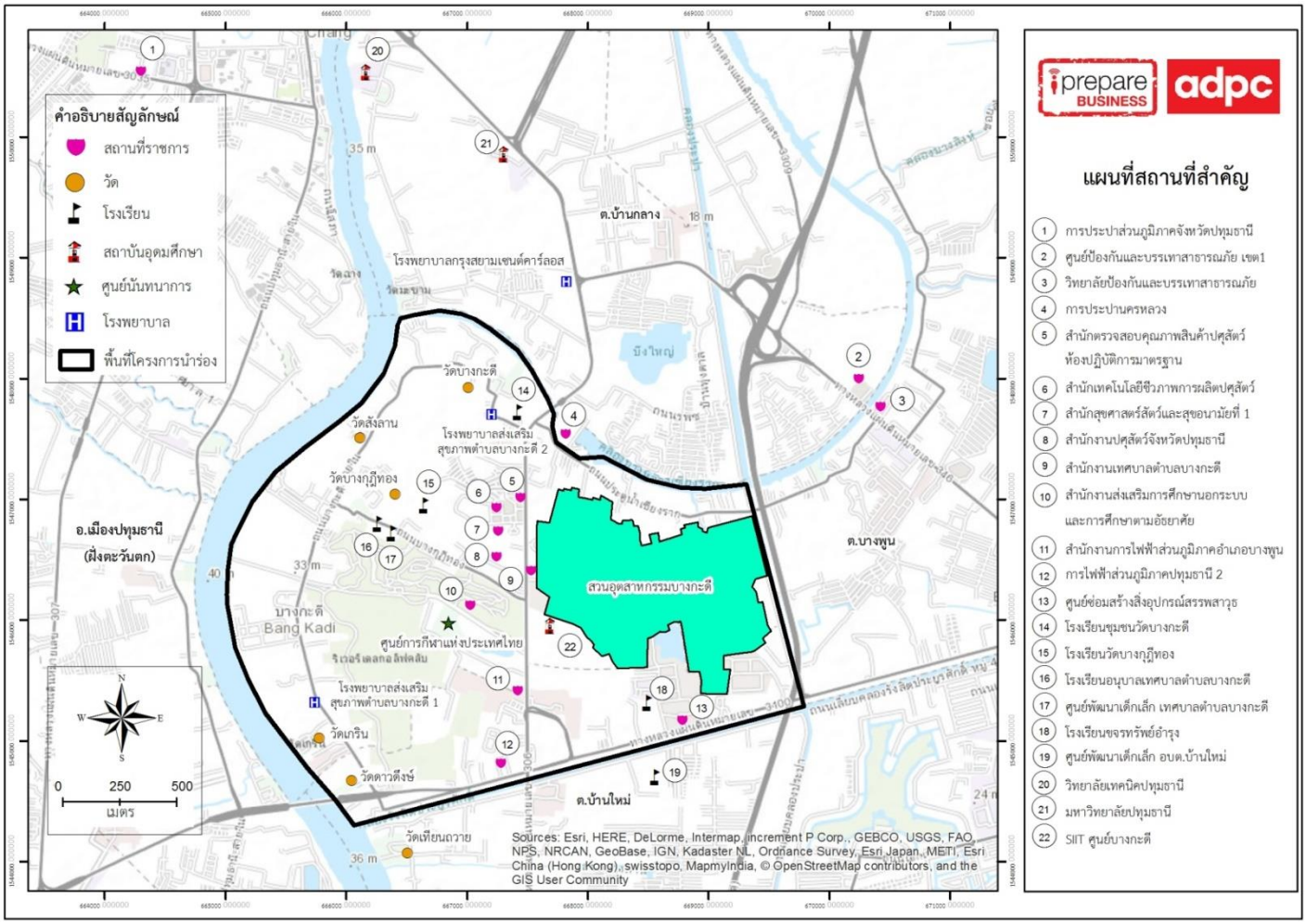
Aqua area represents regions with altitude between 0-2 MSL.

Beige area represents regions with altitude between 2-4 MSL.

Brown area represents regions with altitude between 4-5 MSL.

4.6 Critical facilities in the Area

Figure 4.7: Critical facilities in the Area BCM pilot project



Note:

represents Government Agencies

represents Temples

represents Schools

represents Universities

represents Recreational Centers

represents Hospitals

represents boundary of the study area of the pilot project

And the green area represents Bangkadi Industrial Park.

Besides the altitude of the area which is an important factor to analyze problems, considering obstacles and strategies for Area BCM, the working group should also have a better understanding in the locations of critical facilities in order to reach a common decision as to which locations should be the priority for support and evacuation in an event of flooding. This will also help in determining which location should be protected and which site would be best to establish a shelter for the community. Notably the above map also shows important locations outside the scope of the pilot area as well because stakeholder from these locations can partner with the pilot area in the event of flooding.

4.7 Critical water resources

The west side of the pilot area around Bangkadi Industrial Park is located right next to Chao Phraya River which is an important source of ground water for the area and for Pathumthani province. There are important natural and artificial canals such as Rangsit canal, Chiang Rak canal and Prapa canal. For the source of underground water in Pathumthani province, there are two types. The first one is the underground water source with limited supply but good quality. However, some areas contain brackish water with rust and sediment contamination. The second one is the large underground water source with good water quality found in Sam Khok district. For the pilot project area, it was found that underground drilling is quite difficult because groundwater is relatively deep with limited amount of water (based on data by the Royal Irrigation Department, Pathumthani Office in May 2016).

4.8 Critical infrastructures

4.8.1 Transportation

Transportation in the area mainly relies on road networks and most roads are in good conditions. The main road for transportation is the highway 306 (Tiwanon Road), which is the main highway that connects the north of the area to the south through the province's industry and commerce region and links Nonthaburi with neighboring provinces. Highway 306 also serves as a dyke on left bank of the Chao Phraya River. In addition, the highway 345 (or 3100) is the main highway in the south of the area that connects the outer ring road, which eventually connects to the Southern, Western and Northern regions of the country. Less important transportation routes in the area include Inner Bangkadi Road (reinforced concrete), Pratunam Chiang Rak Road (reinforced concrete), Leab Klong Prapa Road (reinforced concrete and only for small vehicles) and Bang Kudi Thong Road (paved).

In addition, after the great flood of 2011, Bangkadi Industrial Park constructed a road that connects the park with Leab Klong Prapa Road in order to use it in case of disaster emergency. However, there are two major limitations. First, the vehicles that are allowed to pass through this route must be 4-wheel cars with a maximum height of 2.50 meters. Second, the park has to pay a road connecting fee to the Provincial Waterworks Authority for over 97 million baht and a rental fee for using the road as well.

Although Bangpoon-Rangsit road is not located in the project pilot area, it is the main road that connects to Tiwanon road (306) and it is located adjacent to the pilot area. In case of disasters, especially flooding, this road can be used as a route to transport items or obtain help from outside of the area since it connects to the expressway at Future Park Rangsit and links to the Northern region, the East-West Ring road, and to Bangkok. Moreover, the road is wide and can also accommodate large trucks.

Besides the fact that the roads in the area are used for transportation, after the great flood of 2011, major streets were renovated to use as flood barriers in the area as follows.

- North of the pilot area: Pratunam Chiang Rak Road with a height of +3.5 MSL after renovation
- East of the pilot area: Leab Klong Prapa Road with a height of +2.77 MSL after renovation
- West of the pilot area: Inner Bangkadi Road with a height of +2.5 MSL after renovation
- South of the pilot area: Leab Klong Rangsit Prayoonsak Road with a height of +4.00 MSL and a 0.8-meter-tall barrier
- The road that is located at the center of the pilot area: Tiwanon Road with a height of +4.00 MSL and a 1-meter-tall barrier

4.8.2 Communication and Telecommunication

Landline phone services include those provided by Bangpoon phone service office and Telecom Asia Corporation Public Company Limited. There are 3 major mobile phone service operators with transmission towers that cover the pilot area, namely Advanced Info Service Public Company Limited, Total Access Communication Company Limited and True Corporation Public Company Limited. Moreover, there is one community radio station in Bangkadi sub-district, namely Bangkadi Arcade community radio station FM 98.75 MHZ Moo 2. As for wireless services, Bangkadi Municipality currently has installed wireless system in 17 communities in the area. As for Banmai Municipality, there is one broadcasting tower.

The working group agreed in the meeting that in the event of disaster, Pathumthani Province will establish a radio broadcasting center so that the provincial administrative agencies and local governments can tune into the broadcasting center to so as to keep up to date with news announced by the province. This radio broadcasting center can provide walkie-talkies that are issued by the Ministry of Information and Communication. Also at the meeting, there was a discussion whether the Office of Disaster Prevention and Mitigation of Pathumthani can provide walkie-talkies to allow private companies to listen to the news in an event of disaster emergency.

4.8.3 Electricity

The provider of electricity in the Area BCM project area is based at the Provincial Electricity Authority of Pathumthani 2 (Bangkadi) comprising of substations, which are the Local Electricity substation, PEA substation and Bangkadi Industrial Park substation. In an event of disaster where the power cannot function normally, communities and government agencies would not be greatly affected much but the industrial sector, especially manufacturing, would be directly affected.

4.8.4 Water Supply

The provider of water supply in the Area BCM project area is based on the Provincial Waterworks Authority (special) Rangsit branch. However, Bangkadi Industrial Park has a waterworks facility with a production capacity of 18,000 cubic meters/day. This facility can provide water supply to factories in Bangkadi Industrial Park at approximately 10,000 cubic meters/day and to the public at no more than 500 cubic meters/day. Since Bangkadi Industrial Park has no water trucks, government and communities must obtain water trucks by themselves to access water from the waterworks plant in case of emergency.

4.8.5 Natural Gas

Natural gas is transported through underground pipelines for industrial uses. In an event of flooding, there will be no effect to these underground pipelines.

4.8.6 Waste Management System

According to the environmental impact assessment/ survey in Bangkadi sub-district area in 2014[31], it was found that Bangkadi municipality has a capacity of approximately 20 tons per day to collect waste from the source. The treatment of waste disposal is undertaken at a landfill site owned by private waste disposal service business located in Bang Pli sub-district in Bang Sai district of Ayutthaya. For dust cleaning, Bangkadi municipality owns a dusting truck that operates in the area every day.

For waste water management in Bangkadi Municipality, factories in Bangkadi Industrial Park are responsible for treating their own wastewater prior to sending it to the treatment facility of Bangkadi Industrial Park. However, wastewater from waterfront communities is discharged into drainage canals and Chao Phraya River.

[31] www.bangkadi.go.th

Chapter 5 - Area BCM Cycle: Area Business Impact Analysis (BIA)

As the workshop for the purpose of understanding the nature of the area has been completed, the working group has identified the clear boundary of the Area BCM pilot project and created a network of cooperation between organizations within the working group. Upon understanding the nature area, the next step is to analyze business impact on the area in order to determine BCM strategies for water and flood management so that the stakeholders in the area can enhance capability to restore operations in a short period of time despite being affected by a disaster.

By analyzing the impact on the area, besides the fact that it is important to understand the nature of the factors mentioned above, it is also important to understand problems and systems for managing potential disaster. Creating disaster simulation scenarios can help the working group to be able to visualize a similar actual situation which may occur and to analyze the potential business impact in the area more clearly.

5.1 Flood scenario

The purpose for simulating a disaster scenario and business impact analysis is to achieve the following:

1) To study impacts that may occur in the area, especially business impact as a result of potential disruptions on its operations

2) To analyze necessary items and targeted duration for disaster recovery operations

3) To generate supporting information for possible disaster mitigation plans as well as plans for restoring operations within a Maximum Tolerable Period of Disruption (MTPD) that can be accepted by stakeholders. During this period, there is a high risk of failure in restoring operations to return to normal situation if this time limit is exceeded.

When conducting a disaster scenario simulation, it should take into account the worst case scenario that is possible in the area, which may be analyzed from past experience. From the workshop on Strategic Area BCM on Monday, July 11, 2016 at Bangkok Golf Club hotel, the working group discussed on whether the disaster simulation should be based on the flooding event that occurred in 2011 since this event had a long duration and the flood risk level was increased over time. The group finally decided that the simulation of disaster scenario should be based on the flood risk level that

occurred during that time in order to determine the risk level of the situation and implementation approach for the simulation.

Incidentally, the working group agreed to utilize the same indicator system for raising flood risk level that was previously used by Bangkadi Industrial Park but to change the criteria of level measurement (volumetric flow rate and water level in Chao Phraya River at Sumlae floodgate) at each level since the previous criteria was based on the capability of Bangkadi Industrial Park in tackling flooding situation only.

In addition, the working group also agreed that if the 2011 flooding was used as a reference scenario, the surveillance of volumetric flow rate (volume of passing water) in Chao Phraya River should be tracked from Chao Phraya Dam at C13 Sapphaya District station in Chainat province and Rama VI Dam at S5 station in Ayutthaya province. Moreover, the surveillance of Chao Phraya River should also be conducted at the point before water enters into Bangkok Metropolitan area at C29 Bangsai Sai district station in Ayutthaya by using the surveillance criteria as set by the Royal Irrigation Department.

According to the study by Royal Irrigation Department, it was determined that the set criteria of water level for surveillance and early warning purpose in Chao Phraya Basin area at C13, S5 and C29A stations are as follows.

Table 5.1: Criteria of water level for surveillance and early warning purpose in Chao Phraya Basin area

Province	Surveillance stations	Normal Level Volumetric flow rate (cubic metres/second)	Critical Level Volumetric flow rate (cubic metres/second)	Flooding Level Volumetric flow rate (cubic metres/second)
Chainat	C13 Sapphaya District at Chao Phraya River	< 1,800	1,800 – 2,840	>2,840
Ayutthaya	S5 Muang District at Pasak River	< 700	700 – 1,400	>1,400
	C29 Bangsai District at Chao Phraya River	< 2,500	2,500 – 3,500	>3,500

Source: Royal Irrigation Department Annual report of 2012

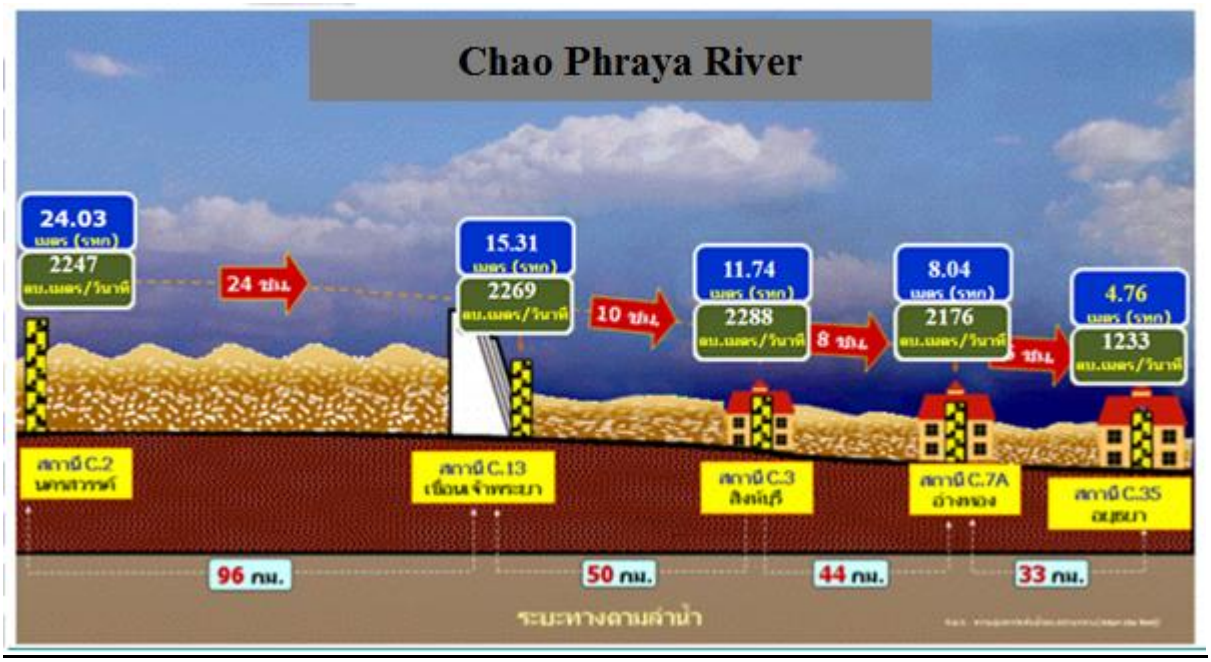
In addition to measuring the amount of water flowing from the north into Chao Phraya River, in order to prevent and alleviate flooding covering all dimensions, the working group of Area BCM suggested in the meeting that there should be metrics of rainfall as well since this is one of the causes of flooding. Table 5.2 shows the indicators for the flood risk level taking into account the amount of water flowing through the surveillance stations of Royal Irrigation Department, the water level in Chao Phraya River at Bang Luang Chiang Rak canal, and the amount of rainfall in the pilot area. Moreover, it was noted in the meeting that in addition to monitoring the water level, images of the area that are published or made public by the media can also serve as a simple indicator for observation to consider raising the flood risk level. For example, the account of the water situation in Chao Phraya River reported by Royal Irrigation Department (Figure 5.1), which indicates the duration of water flowing from one surveillance station to another station such as the picture indicates that water from Chao Phraya Dam C13 station on September 20, 2016 will reach C35 station in Ayutthaya within 24 hours. This can help people and the private sector to predict how long the water will take to flow through Pathumthani easier.

Furthermore, the layout of the lower Chao Phraya Basin area is another picture that can help people and the private sector that are unfamiliar with the characteristic of the area to understand the water flowing system easily. Figure 5.2 is the situation report showing the layout of the lower Chao Phraya Basin area, which makes it easier to understand that the surveillance C13 station is an important point to measure the amount of water flowing through since it is located downstream from Chao Phraya Dam. The S5 station, which is the station that measures the amount of water from Rama VI Dam and Lopburi River before converging at C29A station, located at Bang Sai district in Ayutthaya, is also recorded.

Table 5.2: Indicator for flood risk level

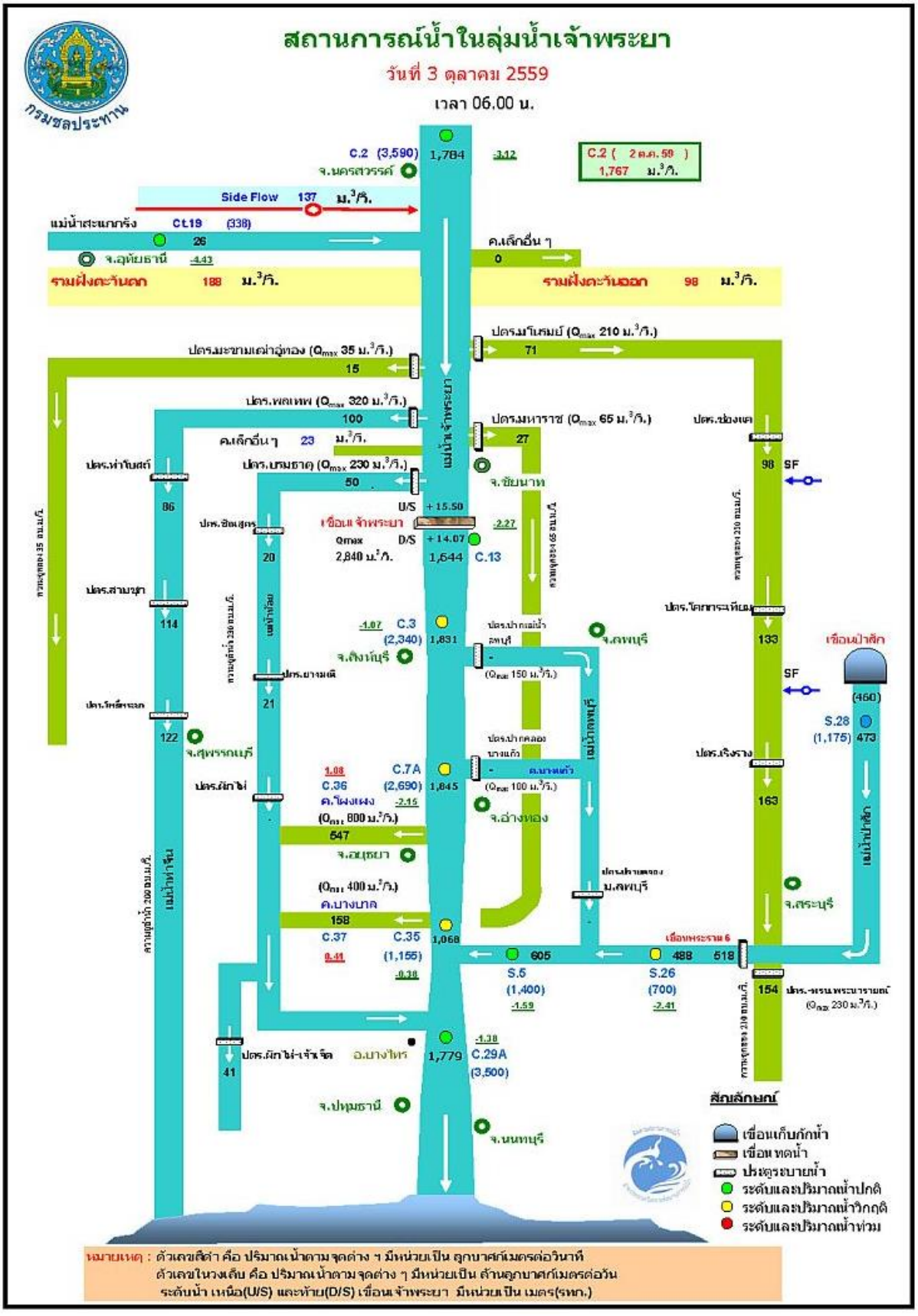
Flood Risk Level	Criteria of Measurement		
	Volumetric flow rate of Chao Phraya and Pasak River (cubic metres/second)	**Chao Phraya River water level at Bang Luang Chiang Rak canal (MSL)**	**Amount of rainfall in the pilot area (millimetres/hour)**
Normal	<1,800 (C13) <700 (S5) <2,500 (C29)	<1.5	<60 and raining less than 1 day
Moderate	>1,800 (C13) >700 (S5) >2,500 (C29)	1.5 – 2.5	60-90 and raining less than 1 day
Significant	> 2,300 (C13) > 1,050 (S5) > 3,000 (C29)	2.5 – 3.0	> 90 and raining less than 1 day
Severe	>2,840 (C13) >1,400 (S5) >3,500 (C29)	> 3.0	> 90 and continuously raining for over 1-2 days

Figure 5.1: Water situation report of Chao Phraya River



Source: Central Region Irrigation Hydrology Center, Office of Water Management and Hydrology, Royal Irrigation Department, http://www.hydro-5.com/index_.php?id=100P

Figure 5.2: Layout of the lower Chao Phraya Basin area



Source: Water Watch and Monitoring System of Warning Center, Royal Irrigation Department
http://water.rid.go.th/flood/plan_new/chaophaya/Chao_low.php?cal2=03102016

5.2 Possible impact from flooding

Considering the impact that may be caused by flooding according to the flood risk levels as mentioned above, the analysis of the impact can be described as follows.

Table 5.3: Possible impact from flooding according to the flood risk level

Flood Risk Level	Possible impact		
	To communities	**To industrial sector**	**To infrastructure**
Normal	No impact	No impact	No impact
Moderate	Due to water flowing from the north and overflowing river banks: • No impact if water level in Chao Phraya River at Bang Kudithong canal is less than 1.5 meters • If water level is more than 1.5 meters, people who live in Moo 1, 2, and 3 on Inner Bangkadi Road may experience inconvenience in travelling and their home may face some damages. Due to rainfall in the area: • No impact	No impact	No impact
Significant	Due to water flowing from the north and overflowing river banks: • Houses in Moo 1, 2, and 3 on Inner Bangkadi Road would face heavy damages. People have to migrate to live elsewhere and people would experience inconvenience in travelling. Also, there could be accidents from damages of electrical wires. • People would lose their income and may lose their job because they cannot commute to work. • There would be a problem of sanitation, environment and well-	Due to water flowing from the north and overflowing river banks: • Businesses would be indirectly affected from partners who are located in flood area. • Some employees cannot come to work because of flooding. Due to rainfall in the area: • Businesses located in basin areas would be	Due to water flowing from the north and overflowing river banks: • Infrastructure may be affected slightly from damaged power poles or other equipment. • Electricity and water supply may not be available to public thoroughly. • Roads would be slightly damaged due to lingering flood water. • The waste disposal

Flood Risk Level	Possible impact		
	To communities	**To industrial sector**	**To infrastructure**
	being, especially for people who may be vulnerable to waterborne diseases. • There would be a problem regarding electricity and water supply in some spots. Due to rainfall in the area: • People may experience inconvenience in travelling as they wait for flood water to drain. • People who are vulnerable to waterborne diseases man get sick if they have to wade through flood water for a long time. • Vehicles may be damaged due to flood.	flooded and they have to wait for the water to drain. • There would be delays in transporting goods to customers.	system may face problems in case there is lingering flood water. Due to rainfall in the area: • There may be a temporary power outage in the area. • Roads would be slightly damaged due to lingering flood water. • The waste disposal system may face problems in case there is lingering flood water.
Severe	Due to water flowing from the north and overflowing river banks: • Houses would face heavy damages. People have to migrate to live elsewhere and people would experience inconvenience in travelling. Also, there could be accidents from damages of electrical wires. • People would lose their income and their job. • People may be injured or die from high flood water level, diseases, or toxic animals that come with flood water. • Vehicles would be damaged from flood water. • There would be a problem of sanitation, environment and well-being, especially for people who do not wish to migrate to live	Due to water flowing from the north and overflowing river banks: • Businesses would be indirectly affected from partners who are located in flood area. • Some areas of the plant may be flooded. • There would be inconvenience in accessing utilities. • Some employees cannot come to work because of flooding. • Goods transportation would be difficult or even impossible. • Machines that cannot be lifted or moved may be damaged from	Due to water flowing from the north and overflowing river banks: • Equipment would be damaged. • The key areas for controlling power and water supply may have to halt their operations. As a result, people, as well as private and industrial sectors, would have trouble accessing full services. • Streets would be heavily damaged due to erosion from flood water. • Waste collecting and disposal services would not be available.

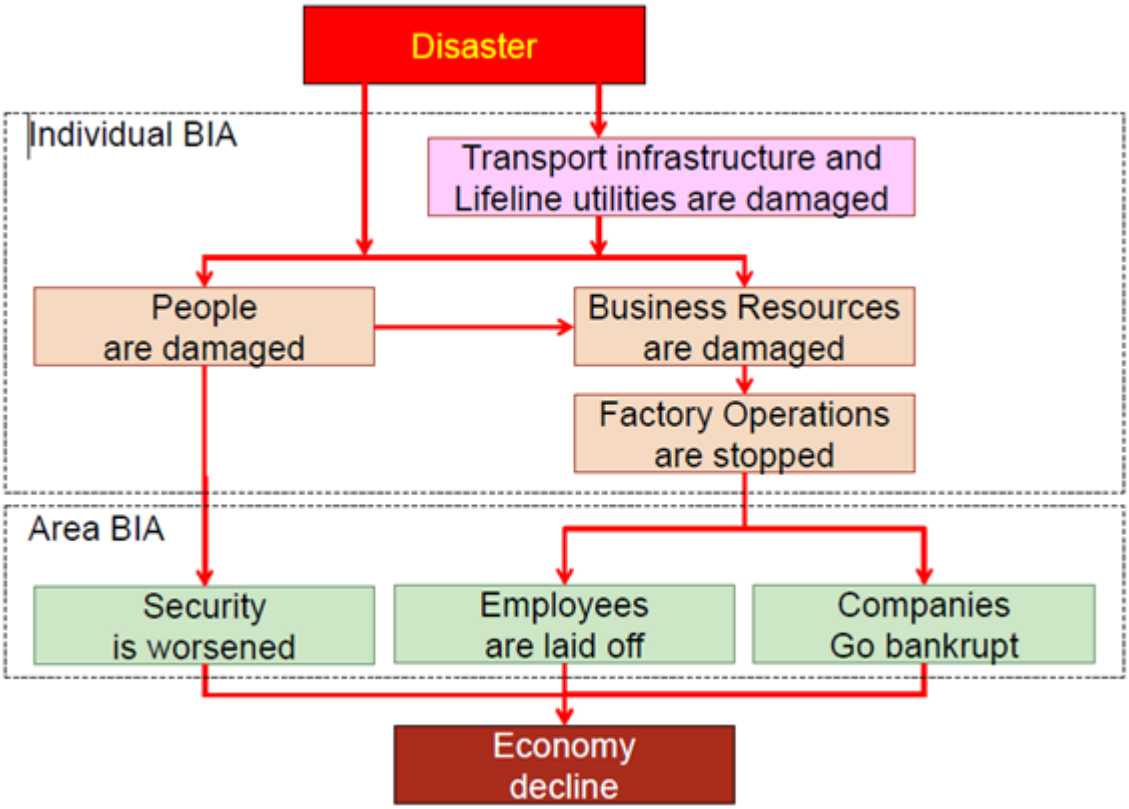
Flood Risk Level	Possible impact		
	To communities	**To industrial sector**	**To infrastructure**
	elsewhere. • People would be concerned about the security of their property and residence. • People would be stressed out and experience health problems. • There would be no access to electricity and clean water supply. Food and other consumer goods will be limited to access. Due to rainfall in the area: • Some residential area is located in a basin where it can face damaged from floods. • People may experience inconvenience in travelling as they wait for flood water to drain. • People who are vulnerable to waterborne diseases man get sick if they have to wade through flood water for a long time. • Vehicles may be damaged from flood water. • People would be stressed out and experience health problems. • There would be no access to electricity and clean water supply. Food and other consumer goods will be limited to access. • There would be a problem regarding electricity and water supply in some spots. • There might be a flash flood if water pump station becomes malfunction which causes homes and residence to suffer.	flood and production has to be terminated. Due to rainfall in the area: • Businesses located in basin areas would be flooded and they have to wait for the water to drain. • There might be a flash flood if water pump station becomes malfunction which causes production and goods transportation to halt. • There would be delays in transporting goods to customers. • There would be a problem regarding electricity and water supply in some spots.	Due to rainfall in the area: • The basin areas would face lingering flood water and they have to wait for the water to drain. • There might be a flash flood if water pump station becomes malfunction which causes transportation system and public utilities to suffer. • There could be a power failure in some spots for an extended period of time.

5.3 Critical resources to area business continuity

5.3.1 Flow for analyzing resources

In order to understand the relationship between disaster, necessary resources for operations, and the impact that may occur in the area, the working group was able to replicate the flow of Business Impact Analysis (BIA) from the below example:

Figure 5.3: An example of the flow of BIA when a flood event is assumed



Source: Planning Guide for Area Business Continuity (March 2015), AHA CENTRE, Japan International Cooperation Agency

Resources are all the elements that an organization needs in order to continue to operate in order to achieve its objectives. For example, resources may include people, skills, knowledge, technology, facilities, materials, information, as well as basic infrastructure that is essential to everyday life and business continuity such as power, water supply, communications, transportation, waste disposal systems, etc. Most infrastructure components are defined as External Resources.

According to the workshop on Strategic Area BCM conducted on Monday, July 11, 2016, the meeting involved discussion on necessary resources and important infrastructure that is critical in facilitating Area BCM such as industrial zones, industrial park tenants, employees, urban communities, residents in the area, rivers, roads, railways (not critical for the area), trucks and ships for goods transportation in an event of flooding, buses, seaports (not existing in the area), airports (not existing in the area), electricity, regular water supply, water supply for manufacturing, natural gas for manufacturing, phone systems, the Internet, public buildings and disaster prevention tools (such as earth dams, flood gates etc.). During the meeting, it was also discussed on lead time to restore these resources.

5.3.2 Identification of Area Bottlenecks and capacity of post-disaster recovery to critical resources

Resources and infrastructure are critical factors for Area BCM, which experience bottlenecks in case of damage as it could result in a severe impact if such assets are unavailable for use. This could result in the whole process not being able to continue to function, which can delay post-disaster recovery procedures. Most of the bottlenecks are caused by structural damage to infrastructure or damages that render the infrastructure unusable, such as those related to transportation and lifeline utilities.

The Area BCM working group of Bangkadi Industrial Park has utilized elevation maps, satellite images, and maps of important sites in the pilot area in order to analyze and discuss on bottlenecks that may occur as well as the capacity of post-disaster recovery in addition to the acceptable period for unavailability of resources, which can be summarized as follows:

Table 5.4: List of bottlenecks in the area

In case of flooding at Significant to Severe level					
Resources	**Characteristic of damage**	**Impact to the area**	**Current capacity of post-disaster recovery**	**Maximum Tolerable Period of Disruption (MTPD)**	**Measure**
Water supply	Water contamination	No water supply for production and consumption	Medium	Not over 1 day	Necessary
Electricity	Electricity needs to be shut down in residential area for safety due to high level of flood	No electricity or not enough electricity for use	Medium	Not over 1 day for factories Not over 3 days for households (if water has receded)	Necessary
Tiwanon Road (306)	Over 50 cm of flood water level	Difficulty for personal and commercial transportation at it is a major road, in which people living on the west side of the road may have to suffer from lingering flood water	High	Not over 1 day	Necessary
Leab Klong Prapa Road	Street damage due to flood water pressure	No alternate route for transportation into the industrial park	-	Not over 1 day	Necessary
Inner Bangkadi Road (this road is used as a flood barrier)	Over 2 meters of flood water level	People who live outside the barrier have to suffer	High	Not over 1 day	Necessary

In case of flooding at Significant to Severe level					
Resources	**Characteristic of damage**	**Impact to the area**	**Current capacity of post-disaster recovery**	**Maximum Tolerable Period of Disruption (MTPD)**	**Measure**
Pratunam Chiang Rak Road (this road is used as a flood barrier)	Over 2 meters of flood water level	Water is likely to enter the inner area of Bangkadi Industrial Park	High	Not over 1 day	Necessary
Temporary floodgate at Rangsit Station	** No damage but the floodgate is located far inside the area for commercial sand ship benefits	People who live along the river outside the floodgate have to suffer and have a chance of flooding since Surveillance to Risky level	Low	-	-
Shelter (Child Development Center, which is used as a shelter for residents who live outside flood barrier, Inner Bangkadi Road)	Over 1 meter of flood water level	Communities around the school area and those living outside the barrier have no place to stay in an event of flooding	Low	Not over 1 day after an opening of shelter	Necessary
Food supplies	Facing shortages due to difficulties in delivery and high cost	Shortage in food supplies for residents	High	Not over 1 day	Not necessary
Leab Klong Prayoonsak Road	** No damage but this road is used as a barrier to protect flood water from the	Drainage of flood water may be slow and residents in the area have to suffer	Medium	-	-

In case of flooding at Significant to Severe level					
Resources	**Characteristic of damage**	**Impact to the area**	**Current capacity of post-disaster recovery**	**Maximum Tolerable Period of Disruption (MTPD)**	**Measure**
	north which could cause difficulty in draining water out of the area				
Mobile phone and Internet connection	Problems with signal transmission	Difficulty in personal and commercial communication as well as in contacting the government to seek assistance	Medium	Not over 6 hours	Necessary

Chapter 6 - Area BCM Cycle: Current Capacity to Prevent and Mitigate Flood Situation

Capacity Assessment of the area for flood prevention and mitigation is necessary for planning and improving existing measures for better results in the pilot Area BCM project in Bangkadi Industrial Park. Most of the key stakeholders in the area are members of the working group of the pilot project, including Pathumthani Provincial Office, Bangkadi Municipality, Banmai Municipality, Bangkadi Industrial Park, private enterprises, and the surrounding communities, who have recognized the importance of awareness of the stakeholders on the areas of flood prevention and mitigation.

According to the workshop conducted by the working group on Monday, July 11, 2016 at Bangkok Golf Club Hotel, the meeting participants discussed the current potential or capacity to prevent and alleviate flooding. In addition, Bangkadi Industrial Park has partnered with the private sector and the government, both at provincial level and local level to set up a meeting to discuss the potential to prevent and mitigate flooding in the area at the Office of Bangkadi Municipality on Thursday, September 22, 2016, with the following objectives: (1) to make sure that all parties understand the current capacity of the government and industrial park (based on the Annual Action Plan for Flood Prevention of Bangkadi Industrial Park) to prevent and mitigate flood in Bangkadi Industrial Park and (2) to reassure investors and private companies in Bangkadi Industrial Park following the meeting which demonstrated a strong cooperation from all sectors. Government measures, private measures, and community-based measures to prevent and mitigate flooding can be described as follows.

6.1 Government measures

Following the great flood in 2011, Pathumthani and related government agencies have conducted improvements in structural and non-structural measures[32] to prevent and mitigate flooding, which can be summarized as follows.

[32] **Structural measures**: Any physical construction to reduce or avoid possible impacts of hazards, or application of engineering techniques to achieve hazard-resistance and resilience in structures or systems.
Non-structural measures: Any measure not involving physical construction that uses knowledge, practice or agreement to reduce risks and impacts, in particular through policies and laws, public awareness raising, training and education.

Table 6.1: Measures to prevent and mitigate flooding by Pathumthani and related government agencies following the flood in 2011

Structural measures	Non-structural measures
• Elevating road surfaces and flood barriers, including Inner Bangkadi Road (+2.5 MSL), Pratunam Chiang Rak Road (+3.5 MSL), Leab Klong Rangsit Prayoonsak Road (+4.0 MSL) • Installing more pumps at the floodgates and pumping stations • Repairing and upgrading pumps and floodgates to be ready for use • Removing water hyacinth plants in canals • Dredging pipelines in drainage system to accommodate more water and rainfall in the area • Establishing shelters to accommodate flood victims	• Creating a network of coordination between government agencies, private companies and communities with Bangkadi Industrial Park for communication in surveillance and monitoring floods • Developing disaster management plan for agencies as well as exercising the plan regularly in order for the plan to stay current • Coordinating between the public and private sectors to pump flood water out of the area • Preparing water situation and early warning reports (information derived from Department of Meteorology-Hydrology) • Preparing evacuation routes and evacuation points

Pathumthani officials have created proactive measures to prevent and mitigate flooding under the mission called "Operation to restore happiness for Pathum people".

The preventive measure includes: (1) Maintenance of floodgates and pumping stations. For the area around Bangkadi Industrial Park, Pathumthani officials have partnered with Royal Irrigation Department, Pathumthani Office in monitoring floodgates and pumping stations, including Chiang Rak Noi station, Chiang Rak Yai station, Ban Krasaeng station, Ban Phrao station, Bang Luang Chiang Rak station, Chulalongkorn station and Pak Khlong Rangsit temporary station (2) Removing Water Hyacinth plants in all the canals in Pathumthani province, which contains more than 200 to 300 canals and (3) Dredging pipelines in drainage system to accommodate more water and rainfall in the area. In this case, the province has received supports from the Department of Rural Roads and local governments in dredging pipelines in drainage system in the area to ensure that government is well-managed and to prepare for an event that may occur as happened in 2011.

Bangkadi Municipality is the responsible, leading agency for the Area BCM pilot project. Bangkadi Municipality has indicated risk areas from the floods, which are pan-shape basins and riverside basins that are often flooded every year. Currently, Bangkadi Municipality has designated 5 areas to accommodate evacuation arrangements, including Wat Bangkadi, Wat Bang Kudi Thong, Wat Bang

Kudi Thong School, Bangkadi Municipality School, and Bangkadi Municipality Office. In order to mitigate flooding that may occur, Bangkadi Municipality has provided manpower, vehicles and boats (punts) as well as providing a space to act as a water detention basin (Kaem Ling), public water pathway dredging, removing water weed barriers and monitoring rainfall data. Moreover, it has also repaired and installed additional pumps to be ready for use, in which the pump (according to the 2011 annual plan of Bangkadi Municipality) were installed along the flood-prone areas in Moo 1, 2 and 3, especially along Chao Phraya River for the distance of 5 kilometers as detailed in table 6.2.

Table 6.2: Pump installation sites of Bangkadi Municipality for the year 2016

Installation sites	Number of pumps	Capacity of pumps
Floodgate area at Wat Sang Lan canal, Moo 3	1	12”
Floodgate area at Wat Banggudithong intersection, Moo 2	2	12”
Flood barrier area at Sala Daeng canal, Moo 1	1	8”
Ban Grean Health Center area, Moo 1	2	6”
Floodgate area at Tanok canal, Moo 3	1	9”
Floodgate area at Bang Ngew canal, Moo 5	12	2”

Source: Bangkadi sub-district map showing flood-prone areas for the year 2016

In addition, the agency responsible for the irrigation project in Pathumthani province, which is the one that oversees the irrigated area in Bangkadi Industrial Park has implemented the plan to prevent and mitigate disasters caused by flooding (in rainy season) of Royal Irrigation Department. The plan can be divided into structural measures and non-structural measures as shown in Table 6.3 below.

Table 6.3: Plan to prevent and mitigate disasters caused by flooding

Structural measures	Non-structural measures
• Dredging program to increase the capacity to handle more water volume in irrigation canals in case of drought and flood water draining • Repairing and maintenance of irrigation facilities, floodgates, pumping stations to control water drainage and pumping effectively to improve flood barriers along Chao Phraya River • Checking the readiness of irrigation facilities such as flood barriers, floodgates, and pumping stations	• Forecasting and monitoring of meteorological and hydrogeology conditions • Using telemetry system for forecasting and early warning • Controlling the amount of water according to the forecast. Linking data and analyzing situations by using trend analysis provided by the sub-committee to examine water resources condition

6.2 Private measures

As assigned in the pilot project, Bangkadi Industrial Park is the leader for private sector and a coordinator for the government at the provincial and local levels as well as private companies to achieve common understanding about the preventive measures and flood mitigation that may occur in the pilot area in Bangkadi Industrial Park.

6.2.1 Bangkadi Industrial Park measures

Following the great flood in 2011, Pathumthani and related government agencies have implemented measures to improve structural and non-structural measures to prevent and mitigate flooding, which can be described as follows.

Table 6.4: Measures to prevent and mitigate flooding of Bangkadi Industrial Park after the flood in 2011

Structural measures	Non-structural measures
• Constructing concrete barrier with a height of +5.00 MSL surrounding Bangkadi Industrial Park for the length of 8.762 kilometers, where 7.227 kilometers of which are made of double constructed concrete wall that vehicles are allowed to run on it and 1.535 kilometers of which is made of a single concrete wall. The barrier has been designed to endure 70 years of rain periods. • Installing 5 high capacity pumps each with an ability to pump water at a speed of 1 cubic meter per second. The total capacity would be 432,000 cubic meters per day and a diesel backup power generator is also installed in case of outages. In addition, the elevation of the pumping station and controlling building has been raised from a +4.00 MSL to +5.00 MSL. • The industrial park has been designed with a rain water drainage system which consists of open rain gutters that is separated from the sewers of the plant which is a closed off system. Rain water would eventually flow to the water detention area (Kaem Ling) of the park, which has a capacity to hold 73,500	• Creating a network of coordination between government agencies, private companies and communities with Bangkadi Industrial Park for communication in surveillance and monitoring floods • Establishing a Water Management Committee for Bangkadi Industrial Park • Developing a disaster management plan for agencies as well as exercising the plan regularly in order for the plan to stay current • Preparing Business Continuity Plan (BCP) at the enterprise level • Buying insurance • Preparing tools, equipment and vehicles that are necessary for operations, such as walkie-talkies, power generators, fire extinguishers, life jackets, boats and cars, as well as preparing food and drinking water, first aid supplies and materials necessary for a repair of flood barriers such as crushed rock, sand and sandbags

Structural measures	Non-structural measures
cubic meters of water to be pumped out of the park.	• Preparing readiness of communication, communication channels and communication tools such as phones, walkie-talkies, car radio amplifiers and other electronic information technology equipment as well as preparing an emergency communication network for companies located in Bangkadi Industrial Park • Preparing a method for water situation reporting and early warning by tracking information on the water situation from (1) the data on sea level monitoring forecasts by Hydrographic Department (2) tracking information from Meteorological Department forecast, especially during the rainy season, and (3) monitoring data the water situation from Royal Irrigation Department at 3 main stations, including C13 (water from the Chao Phraya Dam), S5 (water discharged from Rama VI dam and Lopburi River) and C29A (water combined from C13 and S5 stations) • Preparing evacuation routes and evacuation points

In addition to preparing for the prevention and mitigation of flooding which might occur, Bangkadi Industrial Park also considered environmental impacts that could result from prevention and mitigation measures, such as the possibility of lubricant oil spills. Thus, in order to reduce environmental impacts, Bangkadi Industrial Park also employs maintenance measures by checking the pumps regularly. The pumps are mainly powered by electricity and use fuel in emergency cases only. However, in case of an oil spill, the industrial park has a protection measure by preparing materials to absorb the oil before pumping takes place. For flooding over a long period of time such as the case in 2011, the Industrial Park would analyze and improve water quality before pumping it to the outside. It also encourages companies in the park area to move and store hazardous materials and arrange the storage area so that it is properly in accordance with the law.

6.2.2 Other private companies' measures

Even though only private companies from Bangkadi Industrial Park are the members of the working group of the Area BCM project, private companies from other areas also joined the discussion in the workshop as well, such as Bangkok Golf Spa Resort Co., Ltd., which is a medium-sized enterprise doing business in hotel and golf course in the area and Ajinomoto (Thailand) Co., Ltd. These two companies joined the discussion group since they also experienced the great flood in 2011. All private companies in the working group have undertaken preparation for flood mitigation and employed protection measures together as follows.

Table 6.5: Measures to prevent and mitigate flooding of private companies in the area after the flood in 2011

Structural measures	Non-structural measures
• Installation of additional pumps • Repairing and upgrading pumps and floodgates to be ready for use • Elevating road surface in company area	• Preparing Business Continuity Plan (BCP) at the enterprise level • Moving production lines and critical machines up to the second floor of factories • Moving equipment and electrical control panels higher up and redesigning the layout of production lines • Annual inspection of building structure • Buying insurance

According to the discussion of the private sector to plan for business continuity management in the area, it was pointed out that the key factor that hindered their ability to prevent and mitigate the flood disaster in 2011 was due to the errors and delays of flood situation information from government agencies since private sector only received news from television news media as the major source of information. However, companies located within Bangkadi Industrial Park area received timely information about flood situation from the industrial park office.

In addition, following the great flood that occurred in Thailand, private companies, especially small and medium-sized enterprises have realized the importance of business continuity planning at the enterprise level. For example, for Transtron (Thailand) Co., Ltd., which is a member of the working

group of the pilot project and it is considered as a medium-sized enterprise[33], the top management of the company has paid attention and support to the staff to prepare a plan to deal with catastrophic events that could cause an interruption to the company's operation. Moreover, since Bangkadi Industrial Park was chosen as a pilot project for Area BCM, the top management has encouraged the company to participate as a part of the working group. In general, the ability to prevent and mitigate disasters of small and medium-sized enterprises is usually limited due to their inadequate availability of resources, such as finance and personnel. However, being a part of the Area BCM working group has allowed the company to have access to the network of partnerships between the public, private and community, by which the company believes that the mechanism of the network will allow the company to increase their capacity in terms of communications and information exchange with regards to disaster management. Moreover, being aware of the Area BCM measures would allow the company to benefit from management of resources, particularly in terms of utilities and infrastructure, which are the important resources that are beyond the companies' immediate control.

6.3 Community-based measures

The pilot area in Bangkadi Industrial Park is built in a bowl-shaped valley on marshy land close to a river area that is prone to annual flooding. Since the majority of the population and communities in the area are native to the area, most people are aware that flooding is a regular event in the vicinity and accept it as part of their life. As a result, most houses in the communities are built in a way that is suitable for flooding with elevated floor and a basement. In addition, they have prepared boats and pumps to cope with possible flooding as well as creating tools to measure the water level in the community. They know the preliminary actions to take when flooding occurs, such as providing first aid for flood victims, preparing food supplies in case of flood, evacuating to all of the 5 evacuation centers in Bangkadi sub-district, and making temporary walkways for flooded areas, etc. Generally, local government agencies such as Bangkadi Municipality, Banmai Municipality and leaders in the communities usually provide education and knowledge to strengthen the capacity of the communities and those living in the area to deal with flooding on a regular basis.

[33] Companies with employees fewer than 200 people can be considered as an SME, according to the ministerial regulation on employment and value of fixed assets of small and medium-sized enterprises in 2002.

6.4 The establishment of Area Emergency Operation Center

In order to be able to manage disaster and restore business promptly, the roles and responsibilities of stakeholders for the Area BCM, including details on how to contact the stakeholders, have been clearly indicated in the BCM measures. In addition, clearly defined roles and responsibilities on how to respond to emergencies in the area can help the stakeholders in terms of readiness to face and mitigate incidents that may result in operational disruptions.

In the workshop on Friday, November 4, 2016, the working group of the pilot project discussed and considered the elements on how to respond to emergencies in the area by referring to the command center of Pathumthani province according to the Prevention and Mitigation Act of 2007. As a result, there are many responsible agencies who are the members of the working group of the pilot project as well as the stakeholders in the pilot area in Bangkadi Industrial Park. The roles of the responsible agencies can be briefly described as follows:

Operations

- Preparing relief materials for dealing with flood disaster and conducting disaster drill
- Observing, monitoring and evaluating the situation regularly so that related agencies can be promptly informed and prepared
- Rescuing, searching and saving lives of disaster victims
- Facilitating security in property of victims
- Facilitating transportation, electricity and waterworks services
- Supporting troops and military vehicles

Supporting

- Facilitating an evacuation of victims from a risky spot to a safe spot
- Facilitating an evacuation of victims back to the area after flooding subsides
- Proceeding to help victims promptly, especially in providing food, drinking water and medicines
- Performing first aid for victims and coordinating with hospitals to send patients over in case the condition exceeds the ability to handle
- Taking donation of consumer goods and distributing the goods to victims
- Giving advice and facilitating issues in legal aspect
- Facilitating mental rehabilitation of victims

Public Relations

- Coordinating with the province and municipality to convey news to Bangkadi Industrial Park, representatives of private companies and community leaders
- Reporting flood situation to operational agencies so that they are informed regularly in order to assess the situation effectively
- Coordinating with municipalities and other agencies to request support in rescuing and relieving

Coordination

- Coordinating with relevant authorities to help facilitating the operation to be smooth and efficient
- Coordinating with agencies in operations, supporting and agencies outside the area to help support in various aspects

Table 6.6: Roles and responsibilities of Area Emergency Operation Center in Bangkadi Industrial Park

Roles and Responsibilities	Responsible Agencies	Contact Information / Phone Number
Operations		
Lifesaving / Rescuing	Bangkadi Municipality Provincial Office of Disaster Prevention and Mitigation of Pathumthani Banmai Municipality Banklang Municipality	02-019-6030-7 02-581-7119-21, 1784 02-501-1721, 02-501-2153 02-979-6877
Safety	Bangkadi Municipality Banmai Municipality Banklang Municipality Pakklong Rangsit Police Station	02-019-6030-7 02-501-1721, 02-501-2153 02-979-6877 02-501-2298
Infrastructure (public utility)	Energy Provincial Office of Pathumthani Metropolitan Waterworks Authority Provincial Waterworks Authority Provincial Electricity Authority, Pathumthani 2	02-529-5138 02-504-0123 #2548, 1125 02-581-6656, 1662 02-501-3383, 02-019-5792-3
Military unit in the area	Military Maintenance Center	02-501-2256
Situation analysis	Meteorological station in Pathumthani	02-529-0939

Roles and Responsibilities	Responsible Agencies	Contact Information / Phone Number
	Royal Irrigation Department, Pathumthani Office Geo-Informatics and Space Technology Development Agency	02-531-7721 02-143-9605
Supporting		
Communications	Pathumthani Public Relations Office Bangkadi Industrial Park	02-979-1285 02-501-1364
Food supplies	Bangkadi Municipality Office of Social Development and Human Security Representatives from private companies	02-019-6030-7 02-581-6043 - Transtron (Thailand) Co., Ltd. 02-501-1100 - Sony Technology (Thailand) Co., Ltd. 02-501-1749 - B.Grimm BIP Power Co., Ltd. 02-156-9897 - Toshiba Consumer Products (Thailand) Co., Ltd. 02-501-1400 - Ajinomoto Co. (Thailand) Ltd. 02-019-5991-4 - Chaba Bangkok Co., Ltd. 02-501-3388 - Bangkok Golf Spa Resort Co., Ltd. Hotel 02-0009777 - Technology Store Co., Ltd. 02-019-0216 - Asahi Intecc Co., Ltd. 02-501-1302
Transportation	Pathumthani Office of Highways	02-529-1441-2
Healthcare	Pathumthani Red Cross Pathumthani Public Health Office	02-581-5550 02-581-6140
Law and order	Office of Labour Protection and Welfare Banklang Municipality	02-567-5102 02-019-6030-7
General support	Representatives from private	See contact details of Food

Roles and Responsibilities	Responsible Agencies	Contact Information / Phone Number
	companies Representatives from educational institutions The Federation of Thai Industries, Pathumthani Chapter	Supplies unit SIIT: 02-501-3505-20 02-501-2284
Public Relations		
Public relations and Information	Pathumthani Public Relations Office Bangkadi Industrial Park Leaders from communities Representatives from private companies	02-979-1285 02-501-1364 - Vice Leader of Pratunam Chiangrak Community 081-493-1657, 086-887-9138 - Leader of Pruksaville Village Community 081-924-8202 - Leader of Klong Lampoo Community 082-584-8281 - Leader of Klong Prapa Community 089-477-9041 - Leader of Tiwanon Pattana Community 087-362-3320 See contact details of Food Supplies unit
Coordination		
Coordinating	Bangkadi Municipality Bangkadi Industrial Park Leaders from communities Representatives from private companies	02-019-6030-7 02-501-1364 See contact details of Public Relations unit See contact details of Food Supplies unit

Chapter 7 - Area BCM Cycle: Area BCM Strategy

Area BCM strategies and measures are critical components that play a key role for resources and major operations such as infrastructure to be able to operate continuously and recover to normal conditions within a Maximum Tolerable Period of Disruption (MTPD). The working group of the Area BCM pilot project in Bangkadi Industrial Park area conducted another workshop on Tuesday, September 13, 2011, with the aim of analyzing measures to improve the capability of Area BCM. For this workshop, Mr. Surachai Khanasa, the Governor of Pathumthani, was the one who presided over the meeting and Mr. Surachai Koomsin, the Advisor for the Office of the National Economic and Social Development, was the one who gave a speech to stress the importance of the discussions and cooperation of the working group in order to prepare the Area BCP. After that, Ms. Varunee Lamyai, Deputy Mayor of Bangkadi sub-district, led the discussion of the working group, whereby the ADPC staff acted as team facilitator and coordinator in order to jointly define the objectives and strategies, as well as provide analysis of measures of Area BCM in case of flooding.

7.1 Determining objectives and strategies for Area business continuity

The purpose of determining objectives for Area BCM in the pilot area in Bangkadi Industrial Park is to guide the working group of the pilot project to achieve the goal of Area BCM together in the same direction. The objectives of Area BCM can be described as follows.

1) To ensure that critical infrastructure in the pilot areas can be restored within the specified time frame in case of flooding
2) To ensure that Bangkadi Industrial Park and other private companies can operate their business continuously and has minimal impact on their business operations in case of flooding
3) To ensure that residents in the pilot area and the surrounding area, especially the victims, are safe from flooding and that they are reasonably and equally taken care of by the government and the private sector in the area

In line with the objectives listed above, the strategies for Area BCM in Bangkadi Industrial Park can be identified as follows:

*Strategy 1:*improving infrastructure management so that the infrastructure can operate continuously in case of flooding in the area and the surrounding area (infrastructure improvement)

*Strategy 2:*increasing capacity and readiness of private sector resilience to flooding that may occur (capacity building)

*Strategy 3:*strengthening capacity of the communities to cope with flooding that may occur (capacity building)
*Strategy 4:*enhancing partnerships between the government, private sector and local agencies to prevent and mitigate the impact on the lives, properties and businesses in case of flooding in the area and the surrounding area (partnership)

In addition, in order to promote understanding on measures to reduce disaster risk of the stakeholders in the same direction, the definition of measures for disaster reduction (both structural non-structural measures) for flood mitigation is described in the next section before the topic regarding analysis of measures to improve Area BCM.

7.2 Categories of Disaster risk reduction

The United Nations International Strategy for Disaster Reduction (UNISDR) has given the definition for terminology in Disaster Risk Reduction measures such as Prevention, Mitigation, Preparedness, Response and Recovery, which is described in the table below.

Table 7.1: Terminology in Disaster Risk Reduction measures

Terminology	Definition
Prevention	The outright avoidance of adverse impacts of hazards and related disasters.
Mitigation	The lessening or limitation of the adverse impacts of hazards and related disasters.
Preparedness	The knowledge and capacities developed by governments, professional response and recovery organizations, communities and individuals to effectively anticipate, respond to, and recover from, the impacts of likely, imminent or current hazard events or conditions.
Response	The provision of emergency services and public assistance during or immediately after a disaster in order to save lives, reduce health impacts, ensure public safety and meet the basic subsistence needs of the people affected.
Recovery	The restoration, and improvement where appropriate, of facilities, livelihoods and living conditions of disaster-affected communities, including efforts to reduce disaster risk factors.

Source: Terminology in Disaster Risk Reduction, The United Nations International Strategy for Disaster Reduction (UNISDR); https://www.unisdr.org/we/inform/terminology

In addition, UNISDR has defined Structural and Non-Structural measures[34] as follows.

Structural measures: Any physical construction to reduce or avoid possible impacts of hazards, or application of engineering techniques to achieve hazard-resistance and resilience in structures or systems.

Non-structural measures: Any measure not involving physical construction that uses knowledge, practice or agreement to reduce risks and impacts, in particular through policies and laws, public awareness raising, training and education.

Common structural measures for disaster risk reduction include dams, flood levies, ocean wave barriers, earthquake-resistant construction, and evacuation shelters. Common non-structural measures include building codes, land use planning laws and their enforcement, research and assessment, information resources, and public awareness programmes.

7.3 Area business continuity strategy

In the workshop on Tuesday, September 13, 2016, the working group of the pilot project has discussed measures to develop the capacity for area business continuity operations by focusing on resolving the bottlenecks that can occur under Area BCM strategies. The meeting participants were divided into 3 groups to discuss measures, which are (1) the government and infrastructure administrator group, (2) the private sector group and (3) the community group. The focus on measures is divided into 2 periods, which are the normal to moderate period and the significant to severe period as shown in table 7.2 and 7.3, respectively, where the normal, moderate, significant, and severe periods are indicated according to the criteria to raise the flood risk level as described in Chapter 5 (table. 5.2).

[34] https://www.unisdr.org/we/inform/terminology#letter-s

Table 7.2: Measures to improve effectiveness of Area BCM in order to respond to flooding in Normal and Moderate periods

Key Stakeholders	Bottleneck	Flood Risk Level[35]	Type of DRR Measures		Possible DRR Measures	BCM Strategies[36]
			Classification	Structural / Non-structural		
Government	Waterworks	Normal and Moderate	Preparedness	Non-structural	**Preparation of Water Supply**: Surveying the use of water supply in public sector, private sector and communities in order to estimate the total amount of water that may be needed during a crisis	Infrastructure Improvement
			Prevention Preparedness Mitigation	Structural Non-structural	**Waterworks Pipeline**: Exploring possibility to install waterworks pipelines and preparing guidelines for transporting water from the Provincial Waterworks Authority to Bangkadi Industrial Park and affected areas	Infrastructure Improvement, Capacity Building
			Preparedness Mitigation	Non-structural	**Risk Identification:** Investigating risks of water contamination and water supply canal erosion	Infrastructure Improvement
		Significant and Severe	Response	Structural Non-structural	**Preparation of Water Supply**: Delivering drinking water from Waterworks Authority agencies to shelters	Partnership
	Drainage and water management	Normal and Moderate, Severe to Normal	Prevention Mitigation Recovery	Structural Non-structural	**Preparation of Drainage System**: Maintaining and repairing drainage pumps so that they are always available for use	Infrastructure Improvement, Capacity Building
			Preparedness	Structural and	**Preparation for Barriers:** Conducting training in flood preparedness on how to place	Partnership

[35] Refer to Table 5.2 Indicator for flood risk level on page 91
[36] Refer to four strategies defined for Area BCM in Bangkadi Industrial Park on page 112

			Mitigation	Non-structural	sandbags	
			Prevention Preparedness	Non-structural	**Water and Rainfall Levels:** Scheduling and preparing information about water and rainfall levels to send to government agencies, private sector and communities	Partnership
			Prevention Mitigation	Structural	**Preparation of Drainage System**: Dredging canals in the area regularly	Infrastructure Improvement
			Prevention Mitigation	Structural	**Preparation of Drainage System**: Exploring a possibility to increase flood water drainage channels around the south side (connected to Military Maintenance Center) of Bangkadi Industrial Park ***Note: In 2011, JICA has provided water pumps at the center in Bangkadi Industrial Park and this has effectively helped in draining of trapped water out of the park.	Infrastructure Improvement Capacity Building
		Significant and Severe	Response	Non-structural	**Flood Risk Level:** Distributing data on flood risk level and rainfall levels to relevant agencies	Partnership
			Response	Structural	**Preparation for Barriers:** Placing sandbags in designated areas and preparing water pumps	Infrastructure Improvement
	Power Supply / Electricity	Normal and Moderate	Prevention	Structural	**Power Stations:** Monitoring and relocating control systems of power stations to a higher position	Infrastructure Improvement
			Preparedness	Non-structural	**Power Supply Risk:** Investigating risky spots in factories and communities that may be prone to danger from electricity usage during flooding	Capacity Building
			Preparedness	Non-structural	**Power Generator:** Encouraging all important agencies in the area to buy power generators and preparing fuel to use for these generators	Infrastructure Improvement, Capacity Building
			Mitigation	Non-structural	**Preparation for Power Supply**: Examining demand for electricity and determining areas that may require uninterrupted power supply to prepare for an event of crisis	Infrastructure Improvement
			Prevention Mitigation	Non-structural	**Preparation for Power Supply**: Encouraging Bangkadi Industrial Park and Electricity Generating Authority of Thailand in leveraging a MOU regarding the use of self-made electricity in an event of crisis	Capacity Building, Partnership

		Severe to Normal	Recovery	Non-structural	**Preparation for Power Supply**: Preparing uninterrupted power supply to designated areas in an event of crisis	Infrastructure Improvement
			Recovery	Non-structural	**Preparation for Power Supply**: Supplying electric power according to the memorandum of understanding between Bangkadi Industrial Park and Electricity Generating Authority of Thailand	Capacity Building, Partnership
	Transportation	Normal and Moderate	Prevention Mitigation	Structural	**Barrier along Transportation Routes:** Encouraging relevant parties to prepare in placing sandbags along important transportation routes	Partnership
			Prevention Mitigation	Structural Non-Structural	**Addition of Transportation Routes:** Conducting a feasibility study in building a road along the water supply canals to connect to Rangsit Pathumthani Road	Infrastructure Improvement
			Preparedness	Structural	**Emergency Transportation Routes:** Assigning secondary routes from Bangkadi Industrial Park to the 3100 Highway for use in time of crisis	Partnership
			Preparedness	Structural	**Rules for Transportation Route Usage:** Organizing street usage for private sector, communities and other agencies to use during crisis	Infrastructure Improvement
			Mitigation	Structural	**Transportation Vehicles:** Preparing boats and other vehicles for use in time s of crisis	Infrastructure Improvement Capacity Building
		Significant and Severe Severe to Normal	Response Recovery	Structural	**Transportation Routes for Evacuation:** Maintaining key transportation routes for evacuation and traffic during a flood, such as placing sandbags at vulnerable spots, including: - Tiwanon Road - Inner Bangkadi Road - Wat Bangkadi Road - Bang Kudi Thong Road - Etc.	Infrastructure Improvement
			Response	Structural	**Transportation Route Risk Reduction:** Placing additional sand bags at risky and vulnerable	Infrastructure

					spots on important transportation routes ** Bangkadi Municipality has no concern in availability of equipment but has concern in availability of volunteers who can assist during crisis time.	Improvement
	Shelters and Evacuation	Significant and Severe Severe to Normal	Response	Structural	**Shelter Establishment:** Establishing temporary shelters closed to the communities	Capacity Building
			Response Recovery	Structural Non-structural	**Shelter Establishment:** Establishing a centralized shelter and assigning job functions for those in the shelter, such as: - in providing or facilitating telecommunications - in healthcare services - in vocational training - in training and management of hygiene - Etc.	Capacity Building, Partnership
		Severe to Normal	Recovery	Structural	**Shelter Establishment:** Establishing a shelter in Bangkadi Industrial Park	Capacity Building, Partnership
	Information and Communication	Normal and Moderate	Preparedness	Non-structural	**Increasing Channels of Communication:** Spreading information through various channels of communication such as email, line messenger application, fax about flood risk level and rainfall levels to government agencies, private sector and communities	Partnership
			Preparedness	Non-structural	**Establishment of Communication Center:** Establishing "Flood Fighting" team for Bangkadi Industrial Park area to help coordinating for communication during crisis events. The team should organize an annual meeting at least one a year as well as enhance the capacity of team members to be able to understand flood risk level and rainfall level in order to prevent, prepare and response to flooding	Partnership
		Significant and Severe	Response	Non-structural	**Information Transmission to Communication Center:** Sending information to "Flood Fighting" team as planned and internal communication through call structures of relevant agencies ***Note: There was a communication problem among government agencies during the 2011	Partnership

					flooding that caused delay and error of information being sent.	
Private	Human Resources	Normal and Moderate	Preparedness	Non-structural	**Setting Standard of Communication for Labor Issues:** Determining means to convey information from employers and government agencies to employees	Capacity Building
			Prevention Mitigation	Non-structural	**Sending Information to Employees:** Providing employment information for employees during Moderate risk period	Capacity Building
		Significant and Severe	Response	Structural	**Employee Relocation:** Relocating employees to work in alternate locations such as factories or branches in other areas that are not affected by disaster	Capacity Building
			Response	Structural	**Shelter Establishment for Employees:** Providing temporary shelters for employees	Capacity Building
			Response	Non-structural	**Arrangements of Healthcare Facilities:** Allowing people to use healthcare facilities other than the ones that are listed in the Social Security regulations during crisis	Capacity Building
			Response	Non-structural	**Arrangements of Labor Force Optimization:** Providing employment information for employees who are able to function normally and for employers who require labor force	Capacity Building
		Severe to Normal	Recovery	Non-structural	**Arrangements of Financial Resources for Employees:** Assisting employers regarding compensation to employees in case of business disruption during crisis	Capacity Building
			Recovery	Non-structural	**Arrangements of Financial Resources for Employees:** Providing support for employees for social security payments during a crisis period	Partnership
	Information and Communication	Normal and Moderate	Preparedness	Non-structural	**Availability and Reliability of Information:** Ensuring that sources of information regarding water and flood situation are clear and reliable so that important issues can be responded to promptly	Capacity Building
		Significant and Severe	Response	Structural	**Availability and Reliability of Information:** Establishing information centers regarding disaster situation so that the government can receive information from victims and provide necessary action promptly ***Note: During the 2 011flooding, the private sector only received information from television media due to a lack of information provided by government.	Partnership
	Transportation	Normal and	Preparedness	Structural	**Transportation Vehicles:** Preparing boats or water vehicles to use for transportation during a	Partnership

		Moderate		Non-structural	flood	
		Significant and Severe	Response	Structural	**Transportation Services for Employees:** Arranging transportation service for employees to use in given spots during a flood	Capacity Building
			Response	Non-structural	**Information on Transportation Routes:** Communicating information on transportation routes that are not affected by flooding	Capacity Building
			Response	Non-structural	**Arrangements for Transportation:** Lessening transportation regulations to be more flexible during crisis such as scheduling a period that trucks are allowed for street usage, etc.	Capacity Building
			Response	Non-structural	**Arrangements for Transportation:** Proposing toll way fee exemption	Capacity Building
	Financial Resources	Normal and Moderate	Preparedness	Non-structural	**Arrangements for Insurance:** Checking the conditions and protection of insurance policy held by private companies	Capacity Building
			Prevention	Non-structural	**Arrangements for Insurance:** Considering purchasing additional insurance which is not currently covered	Capacity Building
			Preparedness	Non-structural	**Arrangements of Assets:** Preparing list of company assets	Capacity Building
			Preparedness	Non-structural	**Arrangements for Insurance:** Getting support from the government in disaster insurance	Capacity Building
		Severe to Normal	Recovery	Non-structural	**Financial Assistance through Taxation:** Getting support from the government for tax deductions due to disaster	Partnership
			Recovery	Non-structural	**Arrangements for Insurance:** Contacting insurance companies to check and assess the damages in order to expedite claim process	Capacity Building
Community	Waterworks	Normal and Moderate	Mitigation	Structural	**Preparation for Water Supply:** Installing water tanks in households for use in case of emergency	Capacity Building
			Mitigation	Non-structural	**Preparation for Water Supply:** Designating community coordinators and coordinating points in each community regarding water supply for crisis event	Capacity Building
			Mitigation	Structural Non-structural	**Preparation for Water Supply:** Preparing elevated locations for assisting people in case of flooding such as the installation of drinking water machines	Infrastructure Improvement,

						Capacity Building
			Mitigation	Non-structural	**Preparation for Water Supply:** Creating a network of water resources for organizations in Bangkadi area, including Bangkadi Municipality, Bangkadi Industrial Park and Waterworks Offices in the area and vicinity	Partnership
		Significant and Severe	Response	Structural	**Preparation for Water Supply:** Using water from drinking water generating machines	Infrastructure Improvement, Capacity Building
	Power Supply / Electricity	Normal and Moderate	Preparedness	Structural Non-structural	**Arrangement for Power Supply:** Monitoring and relocating control systems of power stations to a higher position	Capacity Building
			Preparedness	Non-structural	**Safety Training for Using Power Supply**: Training and educating the communities about safety for using electrical equipment in an event of flooding	Partnership
	Transportation	Normal and Moderate	Preparedness	Non-structural	**Arrangements for Transportation**: Assigning primary and secondary routes for use in time of crisis	Partnership
			Mitigation	Structural	**Arrangements for Transportation**: Preparing boats for use in time of crisis	Capacity Building
			Preparedness	Non-structural	**Arrangements for Transportation**: Organizing street usage for private sector (for transportation), communities and other agencies to use during crisis	Partnership
	Drainage and water management	Normal and Moderate	Mitigation	Non-structural	**Floodgate Management**: Conducting training to provide knowledge about how to open and close floodgates for the communities	Partnership
	Information and Communication	Normal and Moderate	Mitigation	Non-structural	**Arrangements for Communications**: Preparing a roster (contact list) as well as indicating communication channels in an event of crisis	Capacity Building
			Mitigation	Structural	**Arrangements for Communications**: Preparing battery chargers for mobile phones and changing prepaid phone plan to monthly phone plan	Capacity Building
			Mitigation	Structural	**Arrangements for Communications**: Preparing secondary channels for communication, such	Capacity

					as walkie-talkies, etc.	Building
	Health and Waste Management	Significant and Severe	Response	Structural	**Arrangements for Healthcare Services**: Establishing healthcare service spots in the area	Capacity Building
	Shelter and Evacuation	Normal and Moderate Significant and Severe	Preparedness	Structural Non-structural	**Shelter Establishment**: Designating sites to be used as shelters and informing people as to where these are located in the following areas of: - Bangkadi Municipality - Bangkadi Temple - Bangkadi Industrial Park	Capacity Building, Partnership
			Preparedness	Non-structural	**Arrangements for Evacuation**: Preparing evacuation plans for communities in the area	Capacity Building, Partnership
			Preparedness Prevention	Non-structural	**Arrangements for Evacuation**: Indicating locations and symbols for vulnerable spots in each community	Capacity Building
	Food supplies	Normal and Moderate	Preparedness	Non-structural	**Food Supplies Preparation**: Preparing food supplies in Normal to Moderate periods	Capacity Building
		Significant and Severe	Response	Non-structural	**Food Supplies Preparation**: Delivering food supplies to flood victims by using designated transportation routes	Capacity Building
	Safety and Security of Asset	Significant and Severe	Mitigation	Non-structural	**Arrangements for Security**: Arranging guard assignment and schedule to help maintaining order for residents during crisis	Capacity Building
	Information and Communication	Normal and Moderate period	Preparedness	Non-structural	**Arrangements for Data Collection**: Preparing census of total population including unregistered population with health data and the total number of residents (and migrants) so that the government and relevant agencies are aware of the information	Capacity Building
	Financial Resources	Severe to Normal	Recovery	Non-structural	**Arrangements for Financial Support**: Getting support from the government regarding financial compensation for residents who are affected by flooding	Partnership

7.4 Determining Area BCM strategy

Due to limited time and available resources, selecting proposed measures to prepare for action plans based on an appropriate set of criteria to evaluate each set of measures is important to ensure that the action plans are efficient and meet the needs of stakeholders. Specifically, since there are so many measures that have been proposed to prevent and mitigate flooding, prioritizing each activity is absolutely necessary.

Criteria used for selecting measures may differ based on the values, policies, and environmental or economic realities of each community. However, the following is a set of criteria that can be used when selecting measures[37].

(1) Cost effective
(2) Environmentally friendly
(3) Social impacts
(4) Activity addresses the problem
(5) Politically acceptable
(6) Activity reduces the risk
(7) Technically feasible

In order to prioritize proposed measures to prepare for action plans for Area BCM, the following rating scale is used for assessing the decision matrix.

5 = Excellent
4 = Good
3 = Fair
2 = Bad
1 = Unacceptable

The criteria for assessment and method of prioritizing can be changed as is seen fit. The criteria mentioned above are examples of those used in the pilot project in Bangkadi Industrial Park. Due to the time constraint of the pilot project, the evaluation is only focused on qualitative aspects based on

[37] Criteria to Evaluate Activities are adapted from *Evaluating and Prioritizing Mitigation Actions* in the Local Mitigation Planning Handbook by Federal Emergency Management Agency : FEMA, USA(https://www.fema.gov/media-library/assets/documents/31598); and Ohio Natural Hazard Mitigation Planning Guidebook by Ohio Department of Natural Resources and Ohio Emergency Management Agency (https://water.ohiodnr.gov/portals/soilwater/pdf/floodplain/interimguidance.pdf)

opinions of the working group. In depth analysis for each activity was not conducted. In the future, the method of assessment to prioritize measures may use other approaches such as Cost-Benefit Analysis and Cost-Effectiveness Analysis, etc.

Moreover, based on the table 7.2 and 7.3 above, it can be seen that measures to improve the Area BCM are derived from discussions of the working group across the 3 sectors including the government, private sector, and community which contains certain measures that are similar to each other or redundant. In order to avoid duplication of measures and to allow the working group to prioritize each measure more efficiently, the measures derived from the discussion are categorized by factors that could cause bottlenecks as shown in table 7.4. The results from prioritization of measures are shown in table 7.5, in which the results are summarized into the matrix where the vertical axis represents the types of measures based on the factors that could cause bottlenecks whilst the horizontal axis represents the time period for implementation of each measure, which are before, during, and after the incident, respectively, according to the principle of public administration in general.

Although the analysis of potential risk for flooding from the pilot area has found that flash floods caused by heavy rain in the area and Riverine flood are among the most frequent types of flood that occur in the area, an overwhelming amount of cumulative water flowing from the Northern region, which are more commonly affected by a series of storms as in the year 2011, is an event that may occur again in the future. This can cause serious impacts in the area for many months. Thus, the measures which were in place during flooding may include those for responding to emergencies and mitigating the impact by helping victims in the immediate term. The measures which were in place after flooding could be a result of similar measures that are derived from mitigation measures in times of emergency. Examples of these measures are setting guidelines for transporting water to the government, Bangkadi Industrial Park, private sector and public sector, considering the possibility of supplying electricity without interruption to some areas, organizing street usage and transportation routes during crisis and lessening transportation regulations to be more flexible during crisis, etc.

Table 7.3: Form for prioritization of measures for Area BCM

Rating scale (score 1-5) 1 = very low 2 = low 3 = moderate 4 = high 5 = very high	How to evaluate: The assessor should review each measure against the following 7 criteria and rate the relevance of each measure in accordance to each criteria from 1 (very low) to 5 (very high). The assessor should fill out all boxes completely.						
Measures	**Criteria for evaluation**						
	Cost effective ness	Environ mentally sound friendly?	Social impacts	Activity addresses the problem	Politically acceptable	Activity reduces the risk	Technically feasible
Waterworks							
1. Surveying the use of water supply in public sector, private sector and communities in order to estimate the total amount of water that may be needed during a crisis							
2. Exploring a possibility to install waterworks pipelines in Bangkadi Industrial Park and setting guidelines for transporting water during a crisis							
3. Investigating risks of water contamination and water supply canal erosion							
4. Creating a network of water resources in Bangkadi area led by Bangkadi Municipality, Bangkadi Industrial Park and Waterworks Offices in the area and vicinity							
Drainage and water management in the area							
5. Maintaining and repairing pumps so that they are always available for use							
6. Conducting training in flood preparedness and how to respond (such as how to place sandbags, evacuation procedure, how to read data from Royal Irrigation Department, buying insurance, making list of assets, etc.)							

Rating scale (score 1-5) 1 = very low 2 = low 3 = moderate 4 = high 5 = very high	How to evaluate: The assessor should review each measure against the following 7 criteria and rate the relevance of each measure in accordance to each criteria from 1 (very low) to 5 (very high). The assessor should fill out all boxes completely.

Measures	**Criteria for evaluation**						
	Cost effective ness	Environ mentally sound friendly?	Social impacts	Activity addresses the problem	Politically acceptable	Activity reduces the risk	Technically feasible
for the private sector and communities and relevant government officials							
7. Dredging canals in the area regularly							
8. Exploring a possibility to increase flood water drainage channels around the south side of Bangkadi Industrial Park							
9. Encouraging all sectors in the area to prepare for Area BCM prior to a disaster							
10. Conducting training to provide knowledge about how to open and close floodgates for the communities							
11. Asking volunteers to help responding to flood disaster in the area (such as asking them to place sandbags in risky or vulnerable areas, etc.)							
Electricity							
12. Monitoring and relocating control systems of power stations to a higher position							
13. Examining demand for electricity and determining areas that may require uninterrupted power supply to prepare for an event of crisis							
14. Investigating risky spots in factories and communities that may be prone to danger from electricity usage							

Rating scale (score 1-5) 1 = very low 2 = low 3 = moderate 4 = high 5 = very high	How to evaluate: The assessor should review each measure against the following 7 criteria and rate the relevance of each measure in accordance to each criteria from 1 (very low) to 5 (very high). The assessor should fill out all boxes completely.

Measures	**Criteria for evaluation**						
	Cost effective ness	Environ mentally sound friendly?	Social impacts	Activity addresses the problem	Politically acceptable	Activity reduces the risk	Technically feasible
during flooding							
15. Encouraging BIP and Electricity Generating Authority of Thailand, MEA, PEA leveraging an MOU regarding the use of self-made electricity in an event of crisis							
16. Training and educating the communities about safety for using electrical equipment in an event of flooding							
Communications and transmission of information							
17. Spreading information about flood risk level and rainfall levels to government agencies, private sector and communities							
18. Establishing “Flood Fighting” team for Bangkadi Industrial Park area and preparing a roster (contact list) as well as indicating communication channels in an event of crisis							
19. Publishing information on traffic and transportation routes to use during a flood							
Transportation							
20. Maintaining key transportation routes for evacuation and traffic during a flood, such as placing sandbags at vulnerable spots, including: - Tiwanon Road							

Rating scale (score 1-5) 1 = very low 2 = low 3 = moderate 4 = high 5 = very high	How to evaluate: The assessor should review each measure against the following 7 criteria and rate the relevance of each measure in accordance to each criteria from 1 (very low) to 5 (very high). The assessor should fill out all boxes completely.

Measures	**Criteria for evaluation**						
	Cost effective ness	Environ mentally sound friendly?	Social impacts	Activity addresses the problem	Politically acceptable	Activity reduces the risk	Technically feasible
- Inner Bangkadi Road - Wat Bangkadi Road - Bang Kudi Thong Road - Etc.							
21. Conducting a feasibility study in building a road along the water supply canal to connect to Rangsit Pathumthani Road							
22. Preparing boats and other vehicles for use in time of crisis							
23. Arranging transportation service for employees to use in given spots during a flood							
24. Assigning primary and secondary routes for use in time of crisis and organizing street usage for private sector (for transportation), communities and other agencies to use during crisis							
25. Lessening transportation regulations to be more flexible during crisis such as schedule of period that trucks are allowed for street usage, fee exemption, etc.							
Evacuation and temporary shelters							
26. Preparing shelters, establishing a centralized shelter and assigning job functions for those in the shelters, such							

Rating scale (score 1-5) 1 = very low 2 = low 3 = moderate 4 = high 5 = very high	How to evaluate: The assessor should review each measure against the following 7 criteria and rate the relevance of each measure in accordance to each criteria from 1 (very low) to 5 (very high). The assessor should fill out all boxes completely.

Measures	**Criteria for evaluation**						
	Cost effective ness	Environ mentally sound friendly?	Social impacts	Activity addresses the problem	Politically acceptable	Activity reduces the risk	Technically feasible
as: - in providing or facilitating telecommunications - in healthcare services - in vocational training - in training and management of hygiene - Etc.							
27. Preparing evacuation plans for communities in the area as well as indicating locations and signs for vulnerable spots in each community							
28. Preparing food supplies and fundamental necessities for people in the area such as delivery of drinking water to shelters and coordinating centers (by Metropolitan Waterworks Authority, Provincial Waterworks Authority, Disaster Prevention and Mitigation Center District 1)							
Labor							
29. Advising private sector on human resources policies during a flood disaster							
30. Providing support for employees in social security payment during a crisis period							
31. Assisting employers regarding compensation to employees in case of							

Rating scale (score 1-5) 1 = very low 2 = low 3 = moderate 4 = high 5 = very high	How to evaluate: The assessor should review each measure against the following 7 criteria and rate the relevance of each measure in accordance to each criteria from 1 (very low) to 5 (very high). The assessor should fill out all boxes completely.

Measures	**Criteria for evaluation**						
	Cost effective ness	Environ mentally sound friendly?	Social impacts	Activity addresses the problem	Politically acceptable	Activity reduces the risk	Technically feasible
business disruption during crisis							
32. Allowing people to use healthcare facilities other than the ones that are listed in the Social Security regulations during crisis							
Financial situation							
33. Getting support from the government for disaster insurance							
34. Getting support from the government for tax deduction for disaster							
35. Getting support from the government regarding financial compensation for residents who are affected by flooding							
Preparedness of communities in the area							
36. Installing water tanks in households for use in case of emergency							
37. Preparing elevated locations for assisting people in case of flooding such as for installing drinking water machines, phone services, healthcare services, etc.							
38. Designating community coordinators and coordinating points in each community for crisis event							
39. Arranging guard assignment and schedule to help maintaining order for							

Rating scale (score 1-5) 1 = very low 2 = low 3 = moderate 4 = high 5 = very high	How to evaluate: The assessor should review each measure against the following 7 criteria and rate the relevance of each measure in accordance to each criteria from 1 (very low) to 5 (very high). The assessor should fill out all boxes completely.

Measures	**Criteria for evaluation**						
	Cost effective ness	Environ mentally sound friendly?	Social impacts	Activity addresses the problem	Politically acceptable	Activity reduces the risk	Technically feasible
residents during crisis							
40. Preparing census of total population including unregistered population including health data and the total number of residents (and migrants) so that the government and relevant agencies are aware of the information							

Table 7.4: Results of measure ranking based on the factors that could cause bottlenecks against periods of time that each measure should be executed

- Score ranking is calculated from personal opinions of the working group of the pilot project, in which 37 people have participated in voting through the form in the 4th workshop on November 4, 2016.
- Italic red text refers to measures that are in the top 18 of the ranking, in which they are selected for inclusion in the action plan.

Factors that could cause bottlenecks	**Measures**		
	Before disaster (Normal to Moderate period)	**During disaster (Significant to Severe period)**	**After disaster (Severe to Recovery period)**
Waterworks	*- Investigating risks of water contamination and water supply canal erosion (28.66 points)* *- Surveying the use of water supply in public sector, private sector and communities in order to estimate the total amount of water that may be needed during a crisis (28.23 points)* - Exploring a possibility to install waterworks pipelines in Bangkadi Industrial Park and setting guidelines for transporting water during a crisis (24.89 points) - Creating a network of water resources for organizations in Bangkadi area, including Bangkadi Municipality, Bangkadi Industrial Park and Waterworks Offices in the area and vicinity (24.49 points)		
Drainage and water management in the area	*- Maintaining and repairing pumps so that they are always available for use (26.96 points)* *- Dredging canals in the area regularly (26.80 points)* *- Conducting training in flood preparedness and how to respond*	*- Asking volunteers to help responding to flood disaster in the area (such as asking them to place sandbags in risky or vulnerable areas, etc.) (26.23 points)*	*- Maintaining and repairing pumps so that they are always available for use (26.96 points)*

	(such as how to place sandbags, evacuation procedure, how to read data from Royal Irrigation Department, buying insurance, making list of assets, etc.) for the private sector and communities and relevant government officials (26.44 points) *- Encouraging all sectors in the area to prepare for Area BCM prior to a disaster (25.89 points)* - Exploring the possibility to increase flood water drainage channels around the south side of Bangkadi Industrial Park (25.61 points) - Conducting training to provide knowledge about how to open and close floodgates for the communities (24.66 points)		
Electricity	*- Training and educating the communities about safety for using electrical equipment in an event of flooding (26.77 points)* *- Monitoring and relocating control systems of power stations to a higher position (26.57 points)* - Investigating risky spots in factories and communities that may be prone to danger from electricity usage during flooding (25.86 points) - Examining demand for electricity and determining areas that may require uninterrupted power supply to prepare for an event of crisis (24.81 points)		

	- Encouraging BIP and Electricity Generating Authority of Thailand, MEA, PEA leveraging an MOU regarding the use of self-made electricity in an event of crisis (24.74 points)		
Transportation	*- Assigning primary and secondary routes for use in time of crisis and organizing street usage for private sector (for transportation), communities and other agencies to use during crisis (26.76 points)* - Preparing boats and other vehicles for use in time of crisis (25.14 points) - Conducting a feasibility study in building a road along the water supply canal to connect to Rangsit Pathumthani Road (24.29 points)	*- Maintaining transportation routes for traffic during a flood, such as placing sandbags at vulnerable spots (27.16 points)* *- Arranging transportation service for employees to use in given areas during a flood (26.67 points)* - Lessening transportation regulations to be more flexible during crisis such as schedule of period that trucks are allowed for street usage, fee exemption, etc. (24.30 points)	*- Maintaining transportation routes for traffic during a flood, such as placing sandbags at vulnerable spots (27.16 points)* - Lessening transportation regulations to be more flexible during crisis such as schedule of period that trucks are allowed for street usage, fee exemption, etc. (24.30 points)
Evacuation and temporary shelters	*- Preparing evacuation plans for communities in the area as well as indicating locations and symbols for vulnerable spots in each community (27.21 points)* *- Preparing shelters, establishing a centralized shelter and assigning job functions for those in the shelters (26.01 points)*	*- Preparing food supplies and fundamental necessities for people in the area such as delivery of drinking water to shelters and coordinating centers (by Metropolitan Waterworks Authority, Provincial Waterworks Authority, Disaster Prevention and Mitigation Center District 1) (26.77 points)* *- Preparing shelters,*	*- Preparing shelters, establishing a centralized shelter and assigning job functions for those in the shelters (26.01 points)*

		establishing a centralized shelter and assigning job functions for those in the shelters (26.01 points)	
Communications and transmission of information	- Establishing "Flood Fighting" team for Bangkadi Industrial Park area and preparing a roster (contact list) as well as indicating communication channels in an event of crisis (25.34 points)	*- Spreading information about flood risk level and rainfall levels to government agencies, private sector and communities (26.71 points)* - Publishing information on traffic and transportation routes to use during a flood (26.67 points)	
Labor	- Determining means to convey information from employers and government agencies to employees*	- Relocating employees to work in alternate locations such as factories or branches in other areas that are not affected by disaster* - Providing employment information for employees who are able to function normally*	*- Advising private sector on human resources policies during a flood disaster (26.01 points)* - Allowing people to use healthcare facilities other than the ones that are listed in the Social Security regulations during crisis (25.44 points) - Assisting employers regarding compensation to employees in case of business disruption during crisis (23.94 points) - Providing support for employees in social security payment during a crisis period (23.36 points)
Financial situation	- Getting support from the government in disaster insurance (23.43 points)		*- Getting support from the government regarding financial compensation for*

	- Checking the conditions and protection of insurance policy that private companies are holding and considering purchasing additional insurance that is not covered* -Making list of assets*		*residents who are affected by flooding (26.71 points)* - Getting support from the government in tax deduction due to disaster (23.43 points) - Contacting insurance companies to check and assess the damages in order to expedite claim process*
Preparedness of communities in the area	- Installing water tanks in households for use in case of emergency (25.73 points) - Preparing elevated locations for assisting people in case of flooding such as for installing drinking water machines, phone services, healthcare services, etc. (23.89 points) - Designating community coordinators and coordinating points in each community for crisis event (25.60 points) -Preparing census of total population including unregistered population with health data and the total number of residents (and migrants) so that the government and relevant agencies are aware of the information (25.03 points)	- Arranging guard assignment and schedule to help maintaining order for residents during crisis (25.00 points)	

Note: * indicates measures under "Labor" and "Financial situation" that were discussed independently by private sector but not included in the analysis for the Area BCM measures because the working group decided that the suitability of those measures depends on regulations and policies of each company.

Chapter 8 - Area BCM Cycle: Developing a plan for Area BCM

After the workshop on analyzing measures for Area BCM (September 13, 2016) and the workshop in prioritizing appropriate measures for action plans (November 4, 2016), the working group of the Area BCM pilot project selected priority measures to prepare action plans for Area BCM in the pilot area of Bangkadi Industrial Park in Pathumthani province, for which Ms. Varunee Lamyai, who is the Deputy Mayor of Bangkadi sub-district, led the discussion of the preparation.

8.1 Action plans for Area BCM of Bangkadi Industrial Park

The working group of Area BCM pilot project conducted analysis, and discussion on activities to improve effectiveness of Area BCM on 40 measures. The working group of 37 members discussed to prioritize those activities to prepare for the action plans on November 4, 2016.

Table 8.1 shows 20 measures that include the top 18 measures prioritized by the working group as well as one measure added as per discussion with NESDB. According to the analysis, it was found that measures required to reduce potential bottlenecks in waterworks included investigating risks of water contamination and water supply canal erosion and surveying the use of water supplies in the public sector, private sector and communities in order to estimate the total amount of water that may be needed during a crisis ranked as the 2 top highest priorities, whereas the measures to prepare evacuation plans for each community in the area ranked as the next priority.

Table 8.1: Top 20 measures that have been prioritized to prepare for Area BCM action plans

Number	Measures	Bottleneck factors	Timing of execution
1	Investigating risks of water contamination and water supply canal erosion (28.66 points)	Waterworks	Before disaster
2	Surveying the use of water supply in public sector, private sector and communities in order to estimate the total amount of water that may be needed during a crisis (28.23 points)	Waterworks	Before disaster
3	Preparing evacuation plans for communities in the area as well as indicating locations and symbols for vulnerable spots in each community (27.21 points)	Evacuation and temporary shelters	Before disaster
4	Maintaining key transportation routes for evacuation and traffic during a flood, such as placing sandbags at vulnerable spots (27.16 points)	Transportation	During (and After) disaster
5	Maintaining and repairing pumps so that they are always available for use (26.96 points)	Drainage and water management in the area	Before (and After) disaster
6	Dredging canals in the area regularly (26.80 points)	Drainage and water management in the area	Before disaster
7	Training and educating the communities about safety for using electrical equipment in an event of flooding (26.77 points)	Electricity	Before disaster
8	Preparing food supplies and fundamental necessities for people in the area such as delivery of drinking water to shelters and coordinating centers (by Metropolitan Waterworks Authority, Provincial Waterworks Authority, Disaster Prevention and Mitigation Center District 1) (26.77 points)	Evacuation and temporary shelters	During disaster
9	Assigning primary and secondary routes for use in time of crisis and organizing street usage for private sector (for transportation), communities and other agencies to use during crisis (26.76 points)	Transportation	Before disaster
10	Spreading information about water and rainfall levels to government agencies, private sector and communities (26.71 points)	Communications and transmission of information	During disaster
11	Getting support from the government regarding financial compensation for residents who are affected by flooding (26.71 points)	Financial situation	After disaster

Number	Measures	Bottleneck factors	Timing of execution
12	Arranging transportation service for employees to use in given spots during a flood (26.67 points)	Transportation	During disaster
13	Monitoring and relocating control systems of power stations to a higher position (26.57 points)	Electricity	Before disaster
14	Conducting training in flood preparedness and how to respond (such as how to place sandbags, evacuation procedure, how to read data from the Royal Irrigation Department, buying insurance, making list of assets, etc.) for the private sector and communities and relevant government officials (26.44 points)	Drainage and water management in the area	Before disaster
15	Asking volunteers to help responding to flood disaster in the area (such as asking them to place sandbags in risky or vulnerable areas, etc.) (26.23 points)	Drainage and water management in the area	During disaster
16	Preparing shelters, establishing a centralized shelter and assigning job functions for those in the shelters (26.01 points)	Evacuation and temporary shelters	Before (and During and After) disaster
17	Advising private sector on human resources policies during a flood disaster (26.01 points)	Labor	After disaster
18	Encouraging all sectors in the area to prepare for Area BCM prior to a disaster (25.89 points)	Drainage and water management in the area	Before disaster
19	Educating and executing waste management by private sector and communities during flood (Note: This measure is not derived from the working group but it was added according to the comments from the steering committee).	Health and Waste Management	Before (and During and After) disaster
20	Building temporary walkways for people who live outside the flood barrier (Note: This measure is not derived from the working group but it was added according to the comments from the steering committee).	Transportation	During disaster

Nevertheless, because of limitations of resources and time, the working group of the pilot project selected 1 top measure before disaster, 1 top measure during disaster, and 2 top measures after disaster to prepare for the action plans. However, the measure of surveying the use of water supply for public sector, private sector and communities in order to estimate the total amount of water that may be needed during a crisis, which is the second-ranked measure, has been selected to be included

in the action plan instead of the first-ranked measure. Investigating risks of water contamination and water supply canal erosion, which is the first-ranked measure, has not been selected because risky spots for this measure have already been investigated and examined regularly by relevant waterworks authorities in the area. In order to implement the action plans effectively, there should be a clear setting of lead time needed for preparation, a list of key agencies in charge and other relevant agencies, and guidelines for allocation of financial resources especially the source of budget that will be used when preparing the action plans for Area BCM as shown in Table 8.2.

In addition, in order for the action plans to be effective and practical, where there are key assigned agencies to be responsible for the plans, the plans should be approved by the local authorities in the area, such as the Provincial Area BCM Board of Committee, which includes the governor, who is chairman of the board. Furthermore, information about Area BCM should be published or provided to organizations across all sectors in the area in order to promote public awareness on strengthening and maintaining progress to achieve the plans.

Table 8.2: Action plans for Area BCM (for top 20 measures)

Note: Blue text refers to the plans of the four top priorities discussed and agreed among the working group during the workshop on November 4, 2016.

	Time period	Proposed measures	Detailed plans	Execution lead time	Key agencies in charge	Other relevant agencies	Source of budget	Full Scale Exercise
1	Before disaster	Investigating risks of waterworks contamination and water supply canal erosion	-Collect water samples and check water quality at risk prone locations by using water supply system map -Analyze the quality of water supply based on physical, chemical and biological criteria -Assess the canal capacity and vulnerable spots along each canal -Distribute the test results and findings to concerned divisions in case there are problems with water contamination and canal erosion	weekly	Provincial Waterworks Authority	Private companies Department of Industrial Works	Provincial Waterworks Authority	Optional
2	Before disaster	Surveying the use of water supply in public sector, private sector and communities to estimate the total amount of water that may be needed during a crisis	-Representatives from Provincial Waterworks Authority, Metropolitan Waterworks Authority, public sector, private sector and communities in the area discuss on the topic of water supply usage. -Each agency seeks information about the	1 month	Provincial Waterworks Authority Metropolitan Waterworks	Bangkadi Industrial Park	Own budget of each agency or unit	Optional

	Time period	Proposed measures	Detailed plans	Execution lead time	Key agencies in charge	Other relevant agencies	Source of budget	Full Scale Exercise
			demand for water supply. -Each agency determines and calculates the required amount of water during crisis, which is approximately 50% of regular usage.		Authority			
3	Before disaster	Preparing evacuation plans for communities in the area as well as indicating locations and symbols for vulnerable spots in each community	-Assign person in charge of each community to facilitate plan development and evacuation -Conduct a meeting among community leaders to assess safe and efficient evacuation routes, identify vulnerable spots and develop evacuation guidelines -Develop IEC materials and disseminate to community members -Implement evacuation drill or exercise -Placing warning signs in vulnerable spots and exposure areas	6 months	Pathumthani Disaster Prevention and Mitigation Community leaders	Community members Bangkadi Industrial Park representatives from shelters Bangkadi municipality	Pathumthani Disaster Prevention and Mitigation	Recommended
4	During and after disaster	Maintaining key transportation routes for traffic during a flood, such as placing sandbags at vulnerable spots	-Conducting a meeting between the relevant agencies to assign responsible traffic areas -Protecting major routes for traffic usage by placing sandbags and barriers at risk	1 day for meeting (lead time needed to take care of	Pathumthani Highways Office	Bangkadi Municipality Pathumthani Disaster Prevention and	Own budget of each agency (self-responsible)	Recommended

	Time period	Proposed measures	Detailed plans	Execution lead time	Key agencies in charge	Other relevant agencies	Source of budget	Full Scale Exercise
			prone locations -Preparing warning signs to show height of roads and depth of flood water -Preparing street signs to make known the available traffic routes during a flood -Assigning responsible staff to monitor issues along each route, such as the rescue agencies, which is coordinated through the Pathumthani Disaster Prevention and Mitigation	the routes varies, depending on each route)		Mitigation Military agencies in the area such as Military Maintenance Center		
5	Before and after disaster	Maintaining and repairing drainage pumps	- Make plans to investigate the condition of drainage pumps in the area on a regular basis - Investigate condition of drainage pumps in the area as per the plans -Request budget for repairs in case it is necessary to fix drainage pumps	Before rainy season	Royal Irrigation Department Bangkadi Municipality Bangkadi Industrial Park	Military agencies in the area such as Military Maintenance Center	Own budget of each agency (self-responsible)	Optional
6	Before disaster	Regular dredging of canals in the vicinity	-Survey the area and waterways in order to dredge and improve public canals -Set up a meeting for relevant agencies -Execute the dredging operation with	Before rainy season	Bangkadi Municipality	Royal Irrigation Department Department of	Bangkadi Municipality	Optional

	Time period	Proposed measures	Detailed plans	Execution lead time	Key agencies in charge	Other relevant agencies	Source of budget	Full Scale Exercise
			appropriate equipment, such as excavators			Rural Roads		
7	Before disaster	Training and educating the communities about safe use of electrical equipment in an event of flooding	-Provincial Electricity Authority of Pathumthani cooperates with community leaders to educate community members, especially Civil Defense Volunteers, about safe use of electrical equipment in an event of flooding -Encourage local residents to inspect their electrical appliances and wires at least once a year -Publish brochures and other IEC materials to increase relevant knowledge about safe use of electrical equipment in an event of flooding	6 months	Provincial Electricity Authority of Pathumthani Community leaders	Pathumthani Disaster Prevention and Mitigation	Provincial Electricity Authority of Pathumthani	Optional
8	During disaster	Preparing food supplies and fundamental necessities for affected residents in the area	-Assess food, water and other necessities needs in each shelter at the time of flooding including survival bags, care packages, help aid and supply kits -Development of plans to deliver all the supplies to shelters and coordinating centers	Before rainy season	Bangkadi Municipality Pathumthani Disaster Prevention and Mitigation	Pathumthani Red Cross Pathumthani Social Development and Human	Pathumthani Red Cross	Recommended

	Time period	Proposed measures	Detailed plans	Execution lead time	Key agencies in charge	Other relevant agencies	Source of budget	Full Scale Exercise
			-Encourage people to stock their own food, water and other necessities for emergency use		Private companies Metropolitan Waterworks Authority Provincial Waterworks Authority Disaster Prevention and Mitigation Center District 1	Security Military agencies in the area such as Military Maintenance Center		
9	Before disaster	Assigning primary and secondary routes for use in time of crisis and organizing street usage for private sector (for transportation), communities and other agencies for use during crisis	-Set up a team to study and investigate transportation routes for use in time of crisis -Conduct meetings with representatives from agencies, private sector and communities in order to gain consensus on the primary and secondary routes -Disseminate information through key stakeholders (focal points)	3 months	Department of Highways Department of Rural Roads Pathumthani Disaster Prevention and Mitigation	Private Companies Community leaders	Department of Highways Department of Rural Roads	Recommended

	Time period	Proposed measures	Detailed plans	Execution lead time	Key agencies in charge	Other relevant agencies	Source of budget	Full Scale Exercise
10	During disaster	Disseminate information about water and rainfall levels to government agencies, private sector and communities and increasing efficiency and number of the channels in providing the data and information to local people thoroughly during the crisis from relevant focal points (Remark: This measure has been further improved by the recommendations of the steering committee).	-Study and analyze whether the existing communication channels e.g. email, line application, fax, website, radio are sufficient to provide necessary information to government agencies, private sector and communities -Improve/develop public flood information website and radio -Disseminate flood information through pre-arranged respective focal points by using most effective communication channels identified	6 months	Bangkadi Industrial Park Royal Irrigation Department Pathumthani Meteorological Station Pathumthani Disaster Prevention and Mitigation	Pathumthani Provincial Public Relations Office Private Companies Community leaders Government agencies in the area	Pathumthani Disaster Prevention and Mitigation	Recommended
11	After disaster	Getting support from the government regarding financial compensation for residents who are affected by flooding	- In case the area is declared as a disaster area: • Surveying damage • Assessing damage • Providing assistance	 7 days 60 days 30 days	Governor of Pathumthani Department of Disaster Prevention and Mitigation	Leaders of communities Related government agencies	According to government regulations	Optional

	Time period	Proposed measures	Detailed plans	Execution lead time	Key agencies in charge	Other relevant agencies	Source of budget	Full Scale Exercise
			-In case the area is not declared as a disaster area: • Responsible agencies can determine criteria for compensation. • -In case a request was done by private companies, CSR can be utilized to obtain additional funding.	6 months	Bangkadi Municipality Banmai Municipality	Department of Royal Irrigation Bangkadi Municipality Leaders of communities Private Companies	According to regulations that have been set up	Optional
12	During disaster	Arranging transportation service for employees to use in given spots during a flood	-Set up a meeting among private companies to plan together on transportation arrangements during times of flooding -Assign responsibility and transportation schedules as an MOU among private companies -Assess employees' need for special transportation services during crisis -Mobilize pre-arranged emergency transportation e.g. boats, water vehicle (may share transportation with other	3 month	Bangkadi Industrial Park Private companies in Bangkadi Industrial Park area Pathumthani Transportation Office Pathumthani	Military agencies in the area such as Military Maintenance Center	Own budget of each agency (self-responsible)	Recommended

	Time period	Proposed measures	Detailed plans	Execution lead time	Key agencies in charge	Other relevant agencies	Source of budget	Full Scale Exercise
			neighboring companies)		Disaster Prevention and Mitigation			
13	Before disaster	Monitoring and relocating control systems of power stations to a higher position	-Set up a team to investigate power station control systems to see if they are located in safe locations -Identify potential relocating sites and develop relocation plan for power station control systems	3 months	Metropolitan Electricity Authority Pathumthani Provincial Electricity Authority	Bangkadi Industrial Park	Metropolitan Electricity Authority Pathumthani Provincial Electricity Authority	Optional
14	Before disaster	Conducting training in flood preparedness and how to respond (such as where to place sandbags, evacuation procedure, how to interpret data from the Royal Irrigation Department, purchase of insurance, compiling a list of assets, etc.) for the private sector and communities and relevant government officials	-Pathumthani Disaster Prevention and Mitigation coordinates with community leaders, especially Civil Defense Volunteers, private sector representatives and government agency focal points to set up training on flood preparation -Increase the knowledge and public awareness through IEC materials -Encourage communities, private sector and government agencies to develop flood preparedness plan and link to the Area BCP -Encourage local residents, private	1 year	Pathumthani Disaster Prevention and Mitigation Community leaders	Community members Civil Defense Volunteers Bangkadi Municipality	Pathumthani Disaster Prevention and Mitigation	Optional

	Time period	Proposed measures	Detailed plans	Execution lead time	Key agencies in charge	Other relevant agencies	Source of budget	Full Scale Exercise
			companies and government agencies to inspect their preparedness measures at least once a year					
15	During disaster	Asking volunteers to help responding to flood disaster in the area (such as asking for assistance in placing sandbags in risk prone or vulnerable areas, etc.)	- Encourage local residents to become volunteers when crisis occurs - Assign responsibility among the volunteers and provide training on emergency operations -Assess areas most exposed and vulnerability to flood risk in order to dispatch volunteers to appropriate locations	Before rainy season	Community leaders Civil Defense Volunteers Bangkadi Municipality	Community members Military agencies in the area such as Military Maintenance Center	Community leaders	Recommended
16	Before, during and afterdisaster	Preparing shelters, establishing a centralized shelter and assigning job functions and specific responsibilities for those in the shelters	-Survey existing shelters including risk assessment to see if the location is safe and explore and evaluate a possibility of new shelter locations -Set up a meeting to determine public and community facilities that can be used as new shelters. -Define job functions for those in the	Before rainy season	Pathumthani Disaster Prevention and Mitigation Bangkadi Municipality Bangkadi	Pathumthani Social Development and Human Security Community leaders	Pathumthani Disaster Prevention and Mitigation Bangkadi Municipality	Recommended

	Time period	Proposed measures	Detailed plans	Execution lead time	Key agencies in charge	Other relevant agencies	Source of budget	Full Scale Exercise
			shelters through documentation -Coordinate with supporting agencies for water supply, food supplies and provision of other necessities		Industrial Park	Police Pathumthani Red Cross Representatives from shelters		
17	After disaster	Advising private sector on human resources policies during a flood disaster	-Establishing an advising center for consultation of issues on employees and employers such as: - Regarding labor law, such as social security, wage, compensation, absence from work - Regarding Social Security issues, such as monetary compensation for employees who are affected during and after a flood - Asking workers to help during flooding and in recovery period - Advising on tax issues for employees and employers	Within one week after the occurrence of disaster	Disaster mitigation agencies Department of Local Administration	Department of Labour Protection and Welfare Social Security Office Department Of Employment The Revenue Department	According to budget plans for emergency situation of each agency	Optional

	Time period	Proposed measures	Detailed plans	Execution lead time	Key agencies in charge	Other relevant agencies	Source of budget	Full Scale Exercise
18	Before disaster	Encouraging stakeholders in the area to be prepared and have individual business continuity plan (BCP)	-Educate private companies and other stakeholders to develop individual business continuity plan through workshops and information dissemination -Encourage individual BCP to be linked with Area BCM/BCP	1 year	Pathumthani Disaster Prevention and Mitigation	Private companies in Bangkadi Industrial Park	Pathumthani Disaster Prevention and Mitigation	Optional
19	Before and during disaster	Educate private sector and communities on waste management during flood, i.e. waste management of the industry factories and the solid waste management from the communities during the crisis. (Note: This measure is not derived from the working group but it was added according to the comments from the steering committee).	-Survey and estimate the type and amount of waste in each spot in the area -Coordinate with Department of Industrial Works to conduct training sessions on waste and hazardous materials management for private companies and community leaders -Private companies and community leaders should develop waste management plans for flooding events, such as moving and storing hazardous materials and arranging the disposal areas	6 months	Department of Industrial Works	Bangkadi Industrial Park Private companies in Bangkadi Industrial Park Community leaders Bangkadi Municipality	Private companies in Bangkadi Industrial Park	Recommended

	Time period	Proposed measures	Detailed plans	Execution lead time	Key agencies in charge	Other relevant agencies	Source of budget	Full Scale Exercise
20	During disaster	Building temporary walkways for people who live outside the flood barrier (Note: This measure is not derived from the working group but it was added according to the comments from the steering committee).	-Set up a team in investigate the need to build temporary walkways for people who live outside the flood barrier -Build temporary walkways for people who live outside the flood barrier	Within first week of disaster	Community leaders Pathumthani Disaster Prevention and Mitigation	Community members Military agencies in the area such as Military Maintenance Center Civil Defense Volunteers	Pathumthani Disaster Prevention and Mitigation	Recommended

Table 8.3: 10 measures and detailed plans related to Full Scale Exercise

	Bottleneck factors	Proposed measures	Detailed plans	Key agencies in charge	Other relevant agencies
3	Evacuation and temporary shelters	Preparing evacuation plans for communities in the area as well as indicating locations and symbols for vulnerable spots in each community	-Assign person in charge of each community to facilitate plan development and evacuation -Conduct a meeting among community leaders to assess safe and efficient evacuation routes, identify vulnerable spots and develop evacuation guidelines -Develop IEC materials and disseminate to community members -Implement evacuation drill or exercise -Placing warning signs in vulnerable spots and exposure areas	Pathumthani Disaster Prevention and Mitigation Community leaders	Community members Bangkadi Industrial Park representatives from shelters Bangkadi municipality
4	Transportation	Maintaining key transportation routes for traffic during a flood, such as placing sandbags at vulnerable spots	-Conducting a meeting between the relevant agencies to assign responsible traffic areas -Protecting major routes for traffic usage by placing sandbags and barriers at risk prone locations -Preparing warning signs to show height of roads and depth of flood water -Preparing street signs to make known the available traffic routes during a flood -Assigning responsible staff to monitor issues along each route, such as the rescue agencies, which is coordinated through the Pathumthani Disaster Prevention and Mitigation	Pathumthani Highways Office	Bangkadi Municipality Pathumthani Disaster Prevention and Mitigation Military agencies in the area such as Military Maintenance Center
8	Evacuation and temporary shelters	Preparing food supplies and fundamental necessities for affected residents in the area	-Assess food, water and other necessities needs in each shelter at the time of flooding including survival bags, care packages, help aid and supply kits -Development of plans to deliver all the supplies to shelters and coordinating centers -Encourage people to stock their own food, water and other necessities for emergency use	Bangkadi Municipality Pathumthani Disaster Prevention and Mitigation	Pathumthani Red Cross Military agencies in the area such as Military Maintenance Center

	Bottleneck factors	Proposed measures	Detailed plans	Key agencies in charge	Other relevant agencies
				Private companies Pathumthani Social Development and Human Security Metropolitan Waterworks Authority Provincial Waterworks Authority Disaster Prevention and Mitigation Center District 1	
9	Transportation	Assigning primary and secondary routes for use in time of crisis and organizing street usage for private sector (for transportation), communities and other agencies for use during crisis	-Set up a team to study and investigate transportation routes for use in time of crisis -Conduct meetings with representatives from agencies, private sector and communities in order to gain consensus on the primary and secondary routes -Disseminate information through key stakeholders (focal points)	Department of Highways Department of Rural Roads	Private Companies Community leaders
10	Communications and	Disseminate information about water and rainfall	-Study and analyze whether the existing communication channels e.g. email, line application, fax, website, radio are sufficient	Bangkadi Industrial Park	Pathumthani Provincial Public

	Bottleneck factors	Proposed measures	Detailed plans	Key agencies in charge	Other relevant agencies
	transmission of information	levels to government agencies, private sector and communities and increasing efficiency and number of the channels in providing the data and information to local people thoroughly during the crisis from relevant focal points (Remark: This measure has been further improved by the suggestions of the steering committee).	to provide necessary information to government agencies, private sector and communities -Improve/develop public flood information website and radio -Disseminate flood information through pre-arranged respective focal points by using most effective communication channels identified	Royal Irrigation Department Pathumthani Meteorological Station Pathumthani Disaster Prevention and Mitigation	Relations Office Private Companies Community leaders Government agencies in the area
12	Transportation	Arranging transportation service for employees to use in given spots during a flood	-Set up a meeting among private companies to plan together on transportation arrangements during times of flooding -Assign responsibility and transportation schedules as an MOU among private companies -Assess employees' need for special transportation services during crisis -Mobilize pre-arranged emergency transportation e.g. boats, water vehicle (may share transportation with other neighboring companies)	Bangkadi Industrial Park Private companies in Bangkadi Industrial Park area	Military agencies in the area such as Military Maintenance Center
15	Drainage and water management in the area	Asking volunteers to help responding to flood disaster in the area (such as asking for assistance in placing sandbags in risk prone or	- Encourage local residents to become volunteers when crisis occurs - Assign responsibility among the volunteers and provide training on emergency operations -Assess areas most exposed and vulnerability to flood risk in order to dispatch volunteers	Community leaders Civil Defense Volunteers	Community members Military agencies in the area such as Military

	Bottleneck factors	Proposed measures	Detailed plans	Key agencies in charge	Other relevant agencies
		vulnerable areas, etc.)	to appropriate locations	Bangkadi Municipality	Maintenance Center
16	Evacuation and temporary shelters	Preparing shelters, establishing a centralized shelter and assigning job functions and specific responsibilities for those in the shelters	-Survey existing shelters including risk assessment to see if the location is safe and explore and evaluate a possibility of new shelter locations -Set up a meeting to determine public and community facilities that can be used as new shelters. -Define job functions for those in the shelters through documentation -Coordinate with supporting agencies for water supply, food supplies and provision of other necessities	Pathumthani Disaster Prevention and Mitigation Bangkadi Municipality Bangkadi Industrial Park	Pathumthani Social Development and Human Security Community leaders Police Pathumthani Red Cross Representatives from shelters
19	Health and Waste Management	Educate private sector and communities on waste management during flood, i.e. waste management of the industry factories and the solid waste management from the communities during the crisis. (Note: This measure is not derived from the working group but it was added according to the comments from the steering committee).	-Survey and estimate the type and amount of waste in each spot in the area -Coordinate with Department of Industrial Works to conduct training sessions on waste and hazardous materials management for private companies and community leaders -Private companies and community leaders should develop waste management plans for flooding events, such as moving and storing hazardous materials and arranging the disposal areas	Department of Industrial Works	Bangkadi Industrial Park Private companies in Bangkadi Industrial Park Community leaders Bangkadi Municipality

	Bottleneck factors	Proposed measures	Detailed plans	Key agencies in charge	Other relevant agencies
20	Transportation	Building temporary walkways for people who live outside the flood barrier (Note: This measure is not derived from the working group but it was added according to the comments from the steering committee).	-Set up a team in investigate the need to build temporary walkways for people who live outside the flood barrier -Build temporary walkways for people who live outside the flood barrier	Community leaders Pathumthani Disaster Prevention and Mitigation	Community members Military agencies in the area such as Military Maintenance Center Civil Defense Volunteers

Chapter 9 - Area BCM Cycle: Implementation, Review, and Area BCM Improvement

At the workshop in prioritizing appropriate measures for action plans (November 4, 2016), the working group examined the steps of implementation, reviewed the Area BCP, exercised and tested the plans as well as maintained the action plans in order to improve the Area BCM cycle for the next year.

Following the final workshop, the National Steering Committee as well as the Provincial Area BCM Board of Committee also reviewed the process of the pilot project and discussed areas for improvement in the current Area BCM cycle. All the suggestions from both the working group and the committees were compiled.

9.1 Plan Review

After the business continuity plan in the area including the action plans to strengthen the capacity to respond and adapt to flooding have been approved by relevant authorities, such as the Area BCM steering committee and Provincial Area BCM Board of Committee, those plans should be reviewed in order to update and develop them to ensure that the plans can be put to effective, practical use as well as to ensure that they are in line with international standards, which require a process of Plan-Do-Check-Act as per the Deming cycle.

The first thing to consider for a plan that requires cooperation from stakeholders from various agencies is to determine who should be the leader in preparing, reviewing and updating the plan. On September 13, 2016, the workshop by the working group of the pilot project decided that in order for Area BCM / Area BCP to be reviewed, updated and developed effectively, the governor of Pathumthani should take leadership in the preparation of such matters, with the Provincial Disaster Prevention and Mitigation Office acting as the key agency responsible for the preparation together with local authorities, including Bangkadi Municipality, Banmai Municipality, Bangkadi Industrial Park, private companies and community leaders.

Subsequently, on February 6, 2017 the Provincial Area BCM Board of Committee meeting was held and it was agreed that the office of Pathum Thani Province will be the primary implementing agency of the Area BCM/BCP developed for the pilot area and coordinate the review process of the Area BCM cycle in close coordination with the Provincial Disaster Prevention and Mitigation Office as well as other stakeholders.

9.1.1 Description of review process on Area BCM

The Area Business Continuity Plan, or Area BCP, should include a schedule for regular review and update so that the plan is remains current. Normally, monitoring and review can take place if a disaster or a related incident occurs. Otherwise, it can be reviewed periodically on an annual basis as agreed by the stakeholders. For the Area BCM project in Bangkadi Industrial Park, the Provincial Area BCM Board of Committee and the working group have agreed that there should be monitoring and reviewing of the plan every year around the month of May or as soon as The Meteorological Department has announced that the rainy season has started in Thailand.

For monitoring and review of Area BCM, there should be an arrangement for formal meetings as per the preparation process of the plan for the pilot project in the first year. The execution in monitoring and review should follow the Area BCM cycle whereby the leader (the governor) may start with the steps[38] as follows.

Step 1: The leader starts by checking and reviewing the list of members in the directing committee

and the work group of the project who will attend the workshop for reviewing the plan.

Step 2: Follow the phases of the Area BCM cycle by ensuring that the working group holds workshops as appropriate. The Provincial Area BCM Board of Committee of the pilot project is responsible for overseeing and suggesting guidelines for execution. In cases where there is a difficulty in monitoring and reviewing, the available documents and current information can be used as a point of reference. In reviewing the Area BCM, the following issues should be examined:

- Making sure that key stakeholders, measures and activities are up to date
- Identifying risk factors, key components, and key resources of the area, including the type of industry, infrastructure, utilities and other assets.
- Identifying bottlenecks and measures for Area BCM, in which these measures should be suitable for the objectives and risk levels.
- Preparing plans for maintenance and practice for Area BCM and to ensure that plans can be executed effectively

[38] Adapted from the Planning Guide for Area Business Continuity, AHA Center, Japan International Cooperation Agency (JICA)

Step 3: The members of the working group can prepare draft amendment measures and update the Area BCP by recording what can be improved in the "Table for document recording and editing". For example, the risk of drought is increasingly becoming a major concern and the Working Group has agreed to prepare a strategy to reduce the impact of drought on business continuity. These should be recorded in the "Table for document recording and editing" indicating the content of the plan where pages have been added or modified, etc.
Step 4: After the Provincial Area BCM Board of Committee and the working group have reviewed the plan, the Governor (leader), who chairs the Area BCM steering committee should approve the plan officially to embark on activities or measures in Area BCM, as stated in the plan.
Step 5: All the member agencies jointly execute the Area BCM activities as stated in the plan.
Step 6: After all activities have been executed, the Provincial Area BCM Board of Committee and the working group may review and modify the plan as appropriate.

9.1.1.1 Area BCP Exercise

In order for Area BCM to be executed according to the Plan-Do-Check-Act cycle and to have systematic and effective procedures, as well as to be aware of the gap in performance that can lead to improving the Area BCP, the process of testing and exercising the plan is crucial.

Exercising drills for disasters can be in a variety of formats depending on the objectives, size, scope, complexity, and methods. The Department of Disaster Prevention and Mitigation has suggested 3 formats of exercise drills for disasters as follows.
(1) Tabletop exercise: This focuses on identifying the strengths, weaknesses, including understanding the plan, policy, cooperation agreement, and execution procedures for use by relevant authorities.
(2) Functional exercise: This is a kind of activity drills within an agency or between agencies to test and assess the capabilities of individuals and functional roles in response to a simulated situation. It emphasizes on exercises, policies, procedures and practices as well as the officers who are in command and in control of the existing practices. This exercise is focused on a particular function where people and resources in the exercise are simulated.
(3) Full-Scale Exercise (FSE): This is a complex exercise that requires the significant on the part of related personnel from various participating departments and stakeholders at different levels. The movement of personnel and resources is a simulation of a real situation. Drills are tested

with full response and emergency procedures are simulated in many possible ways by focusing on the implementation of policies and procedures developed or established by the previous tabletop exercise or functional exercise. This exercise follows a scripted exercise scenario with real time setting and is subject to stressful conditions as may occur in a real crisis situation.

Since the Area BCP of the pilot project in Bangkadi Industrial Park area is executed for the first time, a tabletop exercise is the most appropriate way to help the working group and other stakeholders to understand the plan better.

The Department of Disaster Prevention and Mitigation has referred to the tabletop exercise as a practice in a stress-free environment to simulate an emergency situation. The participants of a tabletop exercise are mostly executives or policy makers who can sit together to discuss the problems and procedures in emergency situations. A tabletop exercise usually focuses on issues of training and understanding of roles and responsibilities, as well as operational procedures.

Table 9.1: Advantages and disadvantages of tabletop exercise

Advantages and disadvantages of tabletop exercise	
Advantages	• It only requires an agreement on the issues of time, cost, and resources. • It is an effective method for reviewing plan, process and policy. • It is a good way to become familiar with the responsibilities and procedures in an emergency situation.
Disadvantages	• It lacks the urgency of a realistic situation so it is impossible to test the practicality of the system for dealing with real emergencies. • It is only a training measure for the plan, operational procedures, and the capacity of the staff to be measured in an artificial scenario. • It does not include practical training which can demonstrate whether the real situation will exceed the current capabilities of the existing system or not.

Source: The Disaster Prevention and Mitigation Department (2011), Manual for disaster exercise and relief

Although the pilot project has limited time for tabletop exercise, on Friday, November 4, 2016, the meeting replicated the situation of flooding in 2011 as a simulated scenario for preparing the plan and reviewing the contents of the plan as follows.

1) Identifying bottlenecks in the area
2) Criteria for raising the severity of the flood risk level
3) The roles in responding to emergencies at the area level in Bangkadi Industrial Park
4) Measures for Area BCM

9.1.2 Description of review process on action plans

After the approval of the Action Plan for Area BCM, the responsible authorities and relevant agencies must make an effort to successfully achieve the activities. Monitoring and review of the action plan is one way to ensure that the activities outlined in the action plan have been prepared and completed within the planned period of time.

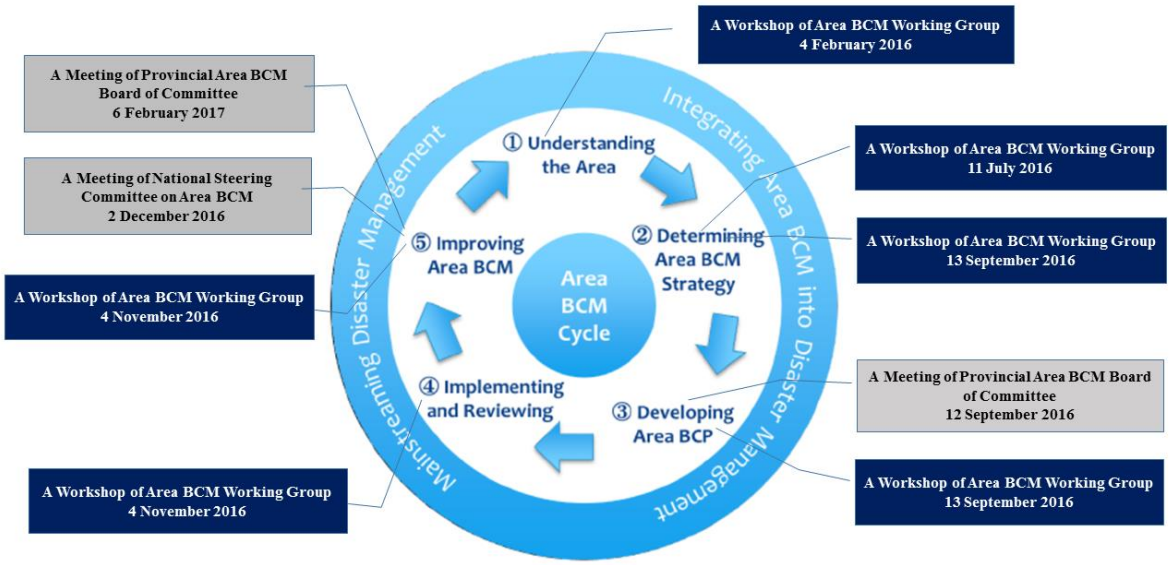
In monitoring the plan, a clear set of criteria for measurement should be established and checked periodically as set out in the agreement, such as a progress report every quarter and an annual report on progress, etc. The working group of the pilot project has proposed the Provincial Area BCM Board of Committee to evaluate the action plan of Area BCM every year during the same time as a review for Area BCP. Correspondingly, at the meeting held by the Provincial Area BCM Board of on February 6, 2017 it was agreed that the office of Pathum Thani Province will lead a follow-up of the action plans as part of its review process of the Area BCM/BCP on an annual basis. In this case, a review of the action plan would be a great opportunity to make changes to the Area BCP or activities to reduce new disaster risks. Incidentally, although the stakeholders are scheduled to review the Area BCP annually, the Area BCP should be adjusted immediately if there is even a slight change in the schedule of action plan.

9.2 Plan improvement

The Area BCM pilot project at Bangkadi Industrial Park area in Pathumthani has followed the cycle of Area Business Continuity Management (Area BCM), in which 4 workshops were conducted by the working group in order to complete the Area BCM cycle. In addition, 2 Provincial Area BCM Board of Committee meetings chaired by Pathumthani Governor or its vice governor were conducted in order to consider the draft plan for Area Business Continuity Plan (Area BCP), and lastly, 1 National Steering Committee meeting was conducted in order to monitor and recommend the preparation of the of the pilot project, where it was chaired by the Secretary General of the Office of National Economic and Social Development Board.

The results of the pilot project according to the Area BCM cycle are shown in Figure 9.1, where the steps of improving Area BCP / Area BCM began with reviewing Area BCP by the Area BCM working group on November 4, 2016 and was then followed by examining the draft plan in the meeting on December 2, 2016 by the National Steering Committee and in the meeting on February 6, 2017 by the Provincial Area BCM Board of Committee, respectively.

Figure 9.1: List of meetings under the pilot project according to the Area BCM cycle



9.2.1 Suggestions from the Working Group of Area BCM project

The Working Group of Area BCM project has reviewed the content of the plan in order to determine the 4 main topics for Area BCP measures, which are (1) identifying bottlenecks in the area, (2) criteria for indicating the severity of flooding, (3) roles and responsibilities in responding to emergencies in the area, and (4) directions and measures for business continuity management. Based on the simulation of the flood disaster in 2011, suggestions for improving Area BCP can be described as follows.

- **Criteria for indicating the severity of flooding:** Although the criteria for indicating the severity of flooding have been considered by relevant specialized agencies, such as the Royal Irrigation Department Office of Pathumthani, the working group has proposed that these criteria should also be reviewed regularly. In particular, the criteria should be consistent with the flood management plan of Bangkadi Industrial Park as well as the plans regarding preparedness for flood disaster of Bangkadi Municipality and Pathumthani Province.
- **Directions and measures for Area business continuity management:** After selecting top priority measures during the workshop, it was noted that environmental measures, such as measures to prevent chemicals and hazardous materials from leaking to the environment during an event of flooding were not taken into consideration. Therefore, such measures should also be considered in preparing the plan for the next time. In any case, the working group has proposed that government agencies that specialize in environmental issues should involve in giving suggestions on waste management as a supporter and consultant rather than merely monitoring results in an event of flooding. Moreover, the working group also have a concern about some measures that were not chosen as top priorities but may still be important to take into consideration for the next action plan, such as surveying the demand for electricity in order to determine the areas that may require uninterrupted electricity power despite a crises event, disseminating information about flood risk level and rainfall level to government agencies, private sector and communities, publishing information on traffic and transportation routes to use during a flood, and arranging public transportation for people to use at selected locations during a flood.

9.2.2 Suggestions from the National Steering Committee of Area BCM project

The National Steering Committee of Area BCM project, which is chaired by the Secretariat of the Office of National Economic and Social Development Board, has been aware of the importance of the project as well as the establishment of the working group to conduct the pilot project. The committee has considered the draft plan of Area BCP and it has recommended suggestions to improve the Area BCP as follows.

1. This pilot project is the first in the region to implement integrated framework for Sendai, which is a great project to strengthen disaster risk reduction in the region. This is also included in Section 7.1.

2. The reason for selecting this area as the pilot area should be explained. The explanation for this observation is explained in section 1.1.2.3 and 1.1.3.1. There are also explanations on restrictions on the emergency routes if disaster strikes as stated in section 4.8.1 as well.

3. The plan should include topics on eliminating water hyacinth in drainage plan, making it easier for dredging as well as removing reservoir topic as Pathumthani does not have reservoir. This has been modified in Table 6.1 and Table 6.3 respectively.

4. Area BCM and Area BCP strategies and measures

- Measures of Area BCM/BCP should include the measures from before, during and after the disaster in each issue. (This issue is now improved in Table 8.2).
- The environmental measures should be added especially the waste management of the industry factories and the solid waste management from the communities during the crisis.
- The communication and data transmission measures should be introduced by increasing the channels in providing the data and information to local people thoroughly during the crisis (focal point). (This issue is now improved in Table 8.2).
- Additional measures to prepare the local communities readiness during the crisis are needed. One of the priority measures is to educate people about managing the home and electronic appliances during the crisis in individual, village, and community levels. (This issue is now improved in Table 8.2).
- It is not clear which agency will be in charge of exercising the plan. (More explanation is now included in section 9.2.3).

5. It is very important to clarify the agencies that will be responsible for the implementation of the Area BCM/BCP, in particular the disaster drill and the process improvement. The Committee suggested that the office of Pathum Thani Province should be the primary implementing agency of this Area BCM/BCP because the office can integrate the local agencies involved efficiently. However, the Department of Disaster Prevention and Mitigation has been allocated the budget to implement these activities. Thus, it is necessary to discuss this issue with the provincial agencies in order to

improve the management of the budget process and other activities related to the plan. (More explanation is now included in section 9.2.3).

9.2.3 Suggestions from the Provincial Area BCM Board of Committee

The Provincial Area BCM Board of Committee, which is chaired by the governor of the Provincial Office of Pathumthani, has been aware of the importance of the project as well as the establishment of the working group to conduct the pilot project. The committee has considered the draft plan of Area BCP and it has agreed and recommended suggestions as follows.

1 Pathumthani provincial office has agreed to be the key agency of Area BCM/BCP in taking ownership of the plan and be the leader for improving the Area BCM cycle and Area BCP in the future. Also, Pathumthani Provincial Disaster Prevention and Mitigation Office has agreed to be the primary implementing agency for full-scale exercise of the plan.

2 The committee considers that many of the detailed activities in the action plans have already undertaken as part of the existing mandates or duties of relevant agencies. However, recalling the challenges faced by the Bangkadi Industrial Park in the 2011 floods such as a lack of information and assistance, better coordination among respective agencies is required to implement the Area BCM/BCP efficiently. This will feed into the effort of the project i.e. demonstrating Bangkadi Industrial Park as a model of the Area BCM for industry areas in the country or region.

3 The committee suggested that during the annual review of the Area BCM/BCP under the leadership of the provincial office in close coordination with Pathumthani Provincial Disaster Prevention and Mitigation Office, a full-scale exercise should be undertaken by involving various participating agencies and stakeholders as a stimulation of a real situation and thus a special budget may be earmarked to implement the exercise under the Provincial Disaster Prevention and Mitigation Office. Moreover, the full-scale exercise should focus primarily on measures for activities during disaster which is indicated in the list of action plans shown in Table 8.3.

9.2.4 Suggestions for improving Area BCM Cycle

In addition to the suggestions for improving Area BCP, the working group and the National Steering Committee for the Area BCM project also have suggestions for improving Area BCM as described in Table 9.2 below.

Table 9.2: Suggestions for improving Area BCM cycle

Topics	Suggestions	
	By the Working Group of Area BCM	**By the National Steering Committee of Area BCM**
Change of stakeholders	Adding representatives from the Provincial Waterworks Authority of Pathumthani as members of the project working group	- Adding representatives from the Bureau of Transportation of Pathumthani as a member of the Provincial Area BCM Board of Committee - Adding representatives from the Local Bureau of Transportation (Municipality) as a member of the project working group
Risks of new natural hazards	Additional consideration on drought management should be given.	-
Change of Area BCM's targeted area	-	Since Bangkadi Industrial Park is an area that has managed to cope with flood disaster fairly well, there should also be consideration for preparing Area BCM in other high-risk areas, such as provinces in the Northern region (for earthquake) or provinces in the Southern region (for flooding).
Improving Area BCM	-	After the working group has prepared the draft of Area BCP, it should be presented to the Provincial Area BCM Board of Committee for consideration and official approval. Then the approved plan should be presented to the National Steering Committee for their consideration and further recommendations.

9.2.5 Other Suggestions for Area BCM Cycle

In general, the issues that need to be improved in the plan can be derived from testing and exercising drills, as well as the lessons learned from real-world experience, which is very important. However, for the business continuity plan in the area, especially the pilot project in the Bangkadi Industrial Park area, the Provincial Area BCM Board of Committee and the steering committee of the project have overseen and made suggestions for the plans continuously. So if there are recommendations from the committees, the working group should also these into consideration for improving the plan.

In addition, improving the plan holds the objective to respond to changing circumstances in the area such as a change in stakeholders, a change in the target area of Area BCM, a change in risk factors for natural hazards, incorporating new lessons from review and exercise drills, new lessons based on experience of disaster in other areas, etc. The improvement of the current plan must be updated and recorded in a report or in the Area BCP as well.

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Appendix A

Official Order for appointing committees for the Area BCM project

คำสั่งสำนักงานคณะกรรมการพัฒนาการเศรษฐกิจและสังคมแห่งชาติ
ที่ ๒๔๗ /๒๕๕๘
เรื่อง แต่งตั้งคณะกรรมการขับเคลื่อนโครงการการบริหารความต่อเนื่องทางธุรกิจในระดับพื้นที่

ด้วย สำนักงานคณะกรรมการพัฒนาการเศรษฐกิจและสังคมแห่งชาติ ร่วมกับองค์การความร่วมมือระหว่างประเทศของญี่ปุ่นดำเนินโครงการการบริหารความต่อเนื่องทางธุรกิจในระดับพื้นที่

ดังนั้น เพื่อให้การดำเนินงานตามโครงการดังกล่าว มีผลสัมฤทธิ์ที่เป็นประโยชน์ต่อการเตรียมพร้อมรับภัยพิบัติทางธรรมชาติและเหตุฉุกเฉิน ภายใต้ยุทธศาสตร์การสร้างความเชื่อมโยงกับประเทศในภูมิภาคเพื่อความมั่นคงทางเศรษฐกิจและสังคม ของแผนพัฒนาเศรษฐกิจและสังคมแห่งชาติ ฉบับที่ ๑๑ และเป็นประโยชน์ต่อการส่งเสริมการลงทุนในประเทศ จึงเห็นสมควรให้แต่งตั้งคณะกรรมการขับเคลื่อนโครงการการบริหารความต่อเนื่องทางธุรกิจในระดับพื้นที่ โดยให้มีองค์ประกอบและอำนาจหน้าที่ ดังนี้

๑. องค์ประกอบ

๑.๑	เลขาธิการคณะกรรมการพัฒนาการเศรษฐกิจและสังคมแห่งชาติ	ประธานกรรมการ
๑.๒	ผู้ว่าราชการจังหวัดปทุมธานี	รองประธานกรรมการร่วม
๑.๓	รองเลขาธิการคณะกรรมการพัฒนาการเศรษฐกิจและสังคมแห่งชาติ	รองประธานกรรมการร่วม
๑.๔	ผู้อำนวยการสำนักงบประมาณหรือผู้แทน	กรรมการ
๑.๕	ปลัดกระทรวงการพัฒนาสังคมและความมั่นคงของมนุษย์หรือผู้แทน	กรรมการ
๑.๖	ผู้บัญชาการตำรวจแห่งชาติหรือผู้แทน	กรรมการ
๑.๗	อธิบดีกรมประชาสัมพันธ์หรือผู้แทน	กรรมการ
๑.๘	อธิบดีกรมการปกครองหรือผู้แทน	กรรมการ
๑.๙	อธิบดีกรมป้องกันและบรรเทาสาธารณภัยหรือผู้แทน	กรรมการ
๑.๑๐	อธิบดีกรมโรงงานอุตสาหกรรมหรือผู้แทน	กรรมการ
๑.๑๑	อธิบดีกรมการขนส่งทางบกหรือผู้แทน	กรรมการ
๑.๑๒	อธิบดีกรมทางหลวงหรือผู้แทน	กรรมการ
๑.๑๓	อธิบดีกรมทางหลวงชนบทหรือผู้แทน	กรรมการ
๑.๑๔	อธิบดีกรมชลประทานหรือผู้แทน	กรรมการ
๑.๑๕	อธิบดีกรมสวัสดิการและคุ้มครองแรงงานหรือผู้แทน	กรรมการ
๑.๑๖	เลขาธิการสำนักงานนโยบายและแผนทรัพยากรธรรมชาติและสิ่งแวดล้อมหรือผู้แทน	กรรมการ

๑.๑๗ ผู้ว่าการการไฟฟ้า...

Note: This is the Official Order No. 247/2558 (Page 1) issued by The National Economic and Social Development Board (NESDB) on December 28, 2015 for appointing National Steering Committee for Area BCM project as explained in Section 1.1.3.2 in the main content of the report.

๑.๑๗	ผู้ว่าการการไฟฟ้าส่วนภูมิภาคหรือผู้แทน	กรรมการ
๑.๑๘	ผู้ว่าการการประปานครหลวงหรือผู้แทน	กรรมการ
๑.๑๙	ผู้ว่าการการนิคมอุตสาหกรรมแห่งประเทศไทยหรือผู้แทน	กรรมการ
๑.๒๐	ผู้อำนวยการสำนักงานพัฒนาเทคโนโลยีอวกาศและภูมิสารสนเทศ (องค์การมหาชน) หรือผู้แทน	กรรมการ
๑.๒๑	นายทีปรัตน์ วัชรางกูร รักษาการที่ปรึกษาด้านนโยบายและแผนงาน	กรรมการและเลขานุการร่วม
๑.๒๒	ผู้อำนวยการสำนักวางแผนการเกษตร ทรัพยากรธรรมชาติและสิ่งแวดล้อม	กรรมการและเลขานุการร่วม
๑.๒๓	ผู้อำนวยการสำนักวิจัยและความร่วมมือระหว่างประเทศ กรมป้องกันและบรรเทาสาธารณภัย	กรรมการและเลขานุการร่วม

๒. อำนาจหน้าที่

๒.๑ อำนวยการ กำกับ และติดตามโครงการการบริหารความต่อเนื่องทางธุรกิจในระดับพื้นที่

๒.๒ ให้คำแนะนำแก่คณะกรรมการหรือคณะทำงานระดับจังหวัด ในการจัดทำแผนการบริหารความต่อเนื่องทางธุรกิจในระดับพื้นที่

๒.๓ เชิญเจ้าหน้าที่จากหน่วยงานภาครัฐและเอกชนที่เกี่ยวข้องมาให้ข้อมูลเพื่อประกอบการของคณะทำงานระดับจังหวัดสามารถจัดทำแผนนำร่องการบริหารความต่อเนื่องทางธุรกิจในระดับพื้นที่

๒.๔ นำผลที่ได้จากการศึกษามาบูรณาการเผยแพร่ให้หน่วยงานที่เกี่ยวข้องทราบและพัฒนาเป็นนโยบายหรือมาตรการ เพื่อสนับสนุนการบริหารความต่อเนื่องทางธุรกิจในระดับพื้นที่

ทั้งนี้ ตั้งแต่บัดนี้เป็นต้นไป

สั่ง ณ วันที่ ๒๘ ธันวาคม พ.ศ. ๒๕๕๘

(นายปรเมธี วิมลศิริ)
เลขาธิการคณะกรรมการพัฒนาการเศรษฐกิจและสังคมแห่งชาติ

Note: This is the Official Order No. 247/2558 (Page 2) issued by The National Economic and Social Development Board (NESDB) on December 28, 2015 for appointing National Steering Committee for Area BCM project as explained in Section 1.1.3.2 in the main content of the report.

คำสั่งจังหวัดปทุมธานี
ที่ ๑๔๓ /๒๕๕๙

เรื่อง แต่งตั้งคณะกรรมการอำนวยการและคณะทำงานจัดทำโครงการนำร่องการบริหารความต่อเนื่องในระดับพื้นที่ (Area Business Continuity Management: Area BCM) จังหวัดปทุมธานี

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ในช่วงทศวรรษที่ผ่านมา ผลจากการเปลี่ยนแปลงสภาพภูมิอากาศ การเจริญเติบโตของเมืองอย่างรวดเร็ว การรวมกลุ่มของอุตสาหกรรมและเชื่อมต่อกันด้วยห่วงโซ่อุปทานและเครือข่ายการค้า ทำให้ภัยพิบัติรุนแรงขนาดใหญ่ที่ยากจะจัดการได้เกิดบ่อยครั้งขึ้นและก่อให้เกิดความสูญเสียทางเศรษฐกิจอย่างรุนแรงต่อธุรกิจและเศรษฐกิจของท้องถิ่นและส่งผลกระทบแพร่กระจายไปทั่วโลกผ่านเครือข่ายและการเชื่อมโยงทางการค้าในเวลาอันรวดเร็ว ด้วยเหตุนี้ ในที่ประชุมระดับโลกด้านการจัดการภัยพิบัติที่สำคัญ เช่น UNISDR จึงเห็นว่าการบริหารจัดการผลกระทบภัยพิบัติที่ส่งผลกระทบในระดับโลกควรเริ่มต้นที่การปกป้องและฟื้นฟูให้เกิดความต่อเนื่องของธุรกิจที่ระดับท้องถิ่นอย่างมีประสิทธิภาพ โดยเน้นการสร้างความร่วมมือระหว่างภาคราชการ ธุรกิจ และท้องถิ่น ในการเพิ่มความยืดหยุ่นและความสามารถในการปรับตัวเมื่อประสบกับสถานการณ์ภัยพิบัติของภาคธุรกิจเพื่อให้การดำเนินธุรกิจมีความต่อเนื่องสามารถเข้าสู่ภาวะปกติได้ในเวลาอันรวดเร็ว องค์กรความร่วมมือระหว่างประเทศของญี่ปุ่น (Japan International Cooperation Agency: JICA) สำนักงานคณะกรรมการพัฒนาการเศรษฐกิจและสังคมแห่งชาติ จังหวัดปทุมธานี และ Asian Disaster Preparedness Center (ADPC) ได้ร่วมมือกันดำเนินโครงการนำร่องการบริหารความต่อเนื่องในระดับพื้นที่ (Area Business Continuity Management: Area BCM) เพื่อเพิ่มขีดความสามารถการบริหารจัดการแบบองค์รวม ซึ่งช่วยในการบริหารความเสี่ยงที่อาจกระทบต่อความต่อเนื่องของธุรกิจในพื้นที่ให้สามารถดำเนินธุรกิจได้อย่างต่อเนื่อง หรือฟื้นตัวได้อย่างรวดเร็วในกรณีที่เกิดเหตุฉุกเฉิน เช่น ภัยธรรมชาติที่มีผลกระทบกับทั้งพื้นที่ โดยสำนักงานคณะกรรมการพัฒนาการเศรษฐกิจและสังคมแห่งชาติร่วมกับจังหวัดและหน่วยงานที่เกี่ยวข้องได้เลือก สวนอุตสาหกรรมบางกะดี จังหวัดปทุมธานี เป็นพื้นที่นำร่องโครงการ

เพื่อให้การดำเนินโครงการเป็นไปอย่างมีประสิทธิภาพ ประสบความสำเร็จตามวัตถุประสงค์ จังหวัดปทุมธานีจึงแต่งตั้งคณะกรรมการและคณะทำงาน เพื่อจัดทำโครงการนำร่อง Area BCM ณ สวนอุตสาหกรรมบางกะดี จังหวัดปทุมธานี ดังนี้

๑. **คณะกรรมการอำนวยการจัดทำโครงการ Area BCM จังหวัดปทุมธานี ประกอบด้วย**

๑.๑ ผู้ว่าราชการจังหวัดปทุมธานี	ประธานคณะกรรมการ
๑.๒ รองผู้ว่าราชการจังหวัดปทุมธานี (ที่กำกับงานด้านยุทธศาสตร์การพัฒนาจังหวัด)	รองประธานคณะกรรมการ
๑.๓ นายแพทย์สาธารณสุขจังหวัดปทุมธานี	กรรมการ
๑.๔ ผู้บังคับการตำรวจภูธรจังหวัดปทุมธานี	กรรมการ

/๑.๕ หัวหน้า...

Note: This is the Official Order No. 143/2559 (Page 1) issued by Pathumthani Province on January 22, 2016 for appointing Provincial Board of Committee & Working Group for Area BCM project as explained in Section 1.1.3.2 in the main content of the report.

๑.๕ หัวหน้าสำนักงานป้องกันและบรรเทาสาธารณภัย จังหวัดปทุมธานี	กรรมการ
๑.๖ พัฒนาสังคมและความมั่นคงของมนุษย์ จังหวัดปทุมธานี	กรรมการ
๑.๗ ผู้อำนวยการสำนักวางแผนเกษตร ทรัพยากรธรรมชาติ และสิ่งแวดล้อม สำนักงานคณะกรรมการพัฒนา การเศรษฐกิจและสังคมแห่งชาติ	กรรมการ
๑.๘ ปลัดจังหวัดปทุมธานี	
๑.๙ นายอำเภอเมืองปทุมธานี	กรรมการ
๑.๑๐ ผู้อำนวยการแขวงทางหลวงปทุมธานี	กรรมการ
๑.๑๑ นายกองค์การบริหารส่วนจังหวัดปทุมธานี	กรรมการ
๑.๑๒ นายกเทศมนตรีตำบลบางกะดี	กรรมการ
๑.๑๓ ผู้จัดการการประปาส่วนภูมิภาคจังหวัดปทุมธานี ๒	กรรมการ
๑.๑๔ ผู้จัดการการไฟฟ้าส่วนภูมิภาค สาขาปทุมธานี	กรรมการ
๑.๑๕ ผู้ช่วยกรรมการผู้จัดการ บริษัท สวนอุตสาหกรรมบางกะดี จำกัด	กรรมการ
๑.๑๖ ประธานหอการค้าจังหวัดปทุมธานี	กรรมการ
๑.๑๗ ประธานสภาอุตสาหกรรมจังหวัดปทุมธานี	กรรมการ
๑.๑๘ หัวหน้าสำนักงานจังหวัดปทุมธานี	กรรมการและเลขานุการ
๑.๑๙ หัวหน้ากลุ่มงานยุทธศาสตร์การพัฒนาจังหวัด สำนักงานจังหวัดปทุมธานี	กรรมการ และผู้ช่วยเลขานุการร่วม
๑.๒๐ ผู้แทนสำนักงานคณะกรรมการพัฒนาการ เศรษฐกิจและสังคมแห่งชาติ	กรรมการ และผู้ช่วยเลขานุการร่วม

อำนาจหน้าที่

๑. กำกับและติดตามการดำเนินโครงการนำร่อง Area BCM ณ สวนอุตสาหกรรมบางกะดี และอำนวยการให้คณะทำงานโครงการ Area BCM ดำเนินโครงการด้วยความราบรื่น

๒. เสนอแนะความคิดเห็นเพื่อจัดทำแผนการบริหารความต่อเนื่องในระดับพื้นที่ (Area Business Continuity Plan: Area BCP) รวมทั้งประสานงานกับหน่วยงานที่เกี่ยวข้องเพื่อให้การบริหารความต่อเนื่องทางธุรกิจในระดับพื้นที่ ณ สวนอุตสาหกรรมบางกะดี เป็นไปอย่างมีประสิทธิภาพหรือสนับสนุนการดำเนินการของคณะทำงาน

๓. ดำเนินการให้มีการขับเคลื่อนและทบทวนแผน Area BCP อย่างเหมาะสม

/ คณะทำงาน...

Note: This is the Official Order No. 143/2559 (Page 2) issued by Pathumthani Province on January 22, 2016 for appointing Provincial Board of Committee & Working Group for Area BCM project as explained in Section 1.1.3.2 in the main content of the report.

๒. คณะทำงานโครงการ Area BCM จังหวัดปทุมธานี ประกอบด้วย

๒.๑ นายกเทศมนตรีตำบลบางกะดี	ประธานคณะทำงาน
๒.๒ รองนายกเทศมนตรีตำบลบางกะดี	รองประธานคณะทำงาน
๒.๓ ผู้แทนเหล่ากาชาดจังหวัดปทุมธานี	ผู้ทำงาน
๒.๔ ผู้แทนสำนักงานป้องกันและบรรเทาสาธารณภัย จังหวัดปทุมธานี	ผู้ทำงาน
๒.๕ ผู้แทนสำนักงานประชาสัมพันธ์จังหวัดปทุมธานี	ผู้ทำงาน
๒.๖ ผู้แทนสำนักงานสวัสดิการและคุ้มครองแรงงาน จังหวัดปทุมธานี	ผู้ทำงาน
๒.๗ ผู้แทนสำนักงานพัฒนาสังคมและความมั่นคงของมนุษย์ จังหวัดปทุมธานี	ผู้ทำงาน
๒.๘ ผู้แทนสำนักงานสาธารณสุขจังหวัดปทุมธานี	ผู้ทำงาน
๒.๙ ผู้แทนสำนักงานพลังงานจังหวัดปทุมธานี	ผู้ทำงาน
๒.๑๐ ผู้แทนสถานีตำรวจภูธรปากคลองรังสิต	ผู้ทำงาน
๒.๑๑ ผู้แทนสถานีอุตุนิยมวิทยาปทุมธานี	ผู้ทำงาน
๒.๑๒ ผู้แทนโครงการชลประทานปทุมธานี	ผู้ทำงาน
๒.๑๓ ผู้แทนแขวงทางหลวงปทุมธานี	ผู้ทำงาน
๒.๑๔ ผู้แทนศูนย์ซ่อมสร้างสิ่งอุปกรณ์สายสรรพาวุธ	ผู้ทำงาน
๒.๑๕ ผู้แทนการประปานครหลวง	ผู้ทำงาน
๒.๑๖ ผู้แทนการไฟฟ้าส่วนภูมิภาคจังหวัดปทุมธานี ๒	ผู้ทำงาน
๒.๑๗ ผู้แทนสำนักพัฒนาเทคโนโลยีอวกาศและภูมิสารสนเทศ (องค์กรมหาชน)	ผู้ทำงาน
๒.๑๘ ผู้แทนสถาบันเทคโนโลยีนานาชาติสิรินธร มหาวิทยาลัยธรรมศาสตร์ ศูนย์บางกะดี	ผู้ทำงาน
๒.๑๙ ผู้แทนมหาวิทยาลัยปทุมธานี	ผู้ทำงาน
๒.๒๐ ผู้แทนวิทยาลัยเทคนิคปทุมธานี	ผู้ทำงาน
๒.๒๑ ผู้แทนเทศบาลตำบลบ้านกลาง	ผู้ทำงาน
๒.๒๒ ผู้แทนเทศบาลตำบลบ้านใหม่	ผู้ทำงาน
๒.๒๓ ผู้แทนสภาอุตสาหกรรมจังหวัดปทุมธานี	ผู้ทำงาน
๒.๒๔ ผู้แทนบริษัท ชบาบางกอก จำกัด	ผู้ทำงาน
๒.๒๕ ผู้แทนบริษัท โซนี่ เทคโนโลยี (ประเทศไทย) จำกัด	ผู้ทำงาน
๒.๒๖ ผู้แทนบริษัท บี.กริม บีไอพี เพาเวอร์ ๑,๒ จำกัด	ผู้ทำงาน

/๒.๒๗ ผู้แทน...

Note: This is the Official Order No. 143/2559 (Page 3) issued by Pathumthani Province on January 22, 2016 for appointing Provincial Board of Committee & Working Group for Area BCM project as explained in Section 1.1.3.2 in the main content of the report.

๒.๒๗ ผู้แทนบริษัท ทรานสตรอน (ไทยแลนด์) จำกัด ผู้ทำงาน
๒.๒๘ ผู้แทนบริษัท โตชิบาคอนซูมเมอร์โปรดักส์ (ประเทศไทย) จำกัด ผู้ทำงาน
๒.๒๙ ผู้แทนบริษัท อาซาฮี อินเทค (ไทยแลนด์) จำกัด ผู้ทำงาน
๒.๓๐ ผู้แทนบริษัท เทคโนโลยี่ สโตร์ จำกัด ผู้ทำงาน
๒.๓๑ ประธานกรรมการชุมชนติวานนท์พัฒนา ผู้ทำงาน
๒.๓๒ ประธานกรรมการชุมชนประตูน้ำเชียงราก ผู้ทำงาน
๒.๓๓ ประธานกรรมการชุมชนคลองลำพู ผู้ทำงาน
๒.๓๔ ประธานกรรมการชุมชนหมู่บ้านพฤกษาวิลล์ ผู้ทำงาน
๒.๓๕ ประธานกรรมการชุมชนคลองประปา ผู้ทำงาน
๒.๓๖ ผู้จัดการอาวุโส บริษัท สวนอุตสาหกรรมบางกะดี จำกัด ผู้ทำงานและเลขานุการ

อำนาจหน้าที่

๑. ทำความเข้าใจกับพื้นที่ บริเวณ สวนอุตสาหกรรมนิคมบางกะดี และทำการวิเคราะห์ข้อมูลในพื้นที่ ประกอบด้วยข้อมูลเกี่ยวกับผู้มีส่วนได้ส่วนเสีย ธุรกิจที่ต้องป้องกัน ระบบคมนาคมขนส่ง ระบบสาธารณูปโภคสำหรับการดำเนินธุรกิจ และข้อมูลความเสี่ยงภัยของพื้นที่ เป็นต้น

๒. กำหนดยุทธศาสตร์ Area BCM โดยใช้ข้อมูลจากข้อ ๑ ประกอบกับการวิเคราะห์เพิ่มเติมเกี่ยวกับผลกระทบต่อธุรกิจจากภัยพิบัติ และข้อจำกัดของพื้นที่ที่ทำให้ไม่สามารถดำเนินธุรกิจได้อย่างต่อเนื่องมาวางแผนปรับปรุงการดำเนินกิจกรรมต่างๆ เพื่อเพิ่มความสามารถในการดำเนินธุรกิจได้อย่างต่อเนื่อง มาวางแผนปรับปรุงการดำเนินธุรกิจได้อย่างต่อเนื่องในกรณีเกิดภัยพิบัติ

๓. จัดทำแผนการดำเนินธุรกิจต่อเนื่องในระดับพื้นที่ (Area BCP) จากข้อมูลและยุทธศาสตร์ข้างต้น มาจัดทำแผนฯ ที่กำหนดทิศทางมาตรการ ให้ผู้มีส่วนได้ส่วนเสียร่วมกันดำเนินการเพื่อให้เกิด แผนฯ และกระบวนการที่จะช่วยให้สามารถดำเนินธุรกิจได้อย่างต่อเนื่อง หรือฟื้นฟูได้โดยเร็วในกรณีที่เกิดภัยพิบัติ

๔. ทบทวนแผน Area BCP อย่างสม่ำเสมอ ในเวลาที่เหมาะสม และเมื่อนำไปปฏิบัติ หรือทดสอบแล้ว ให้มีการจัดทำรายงานผลลัพธ์ ประสบการณ์และบทเรียนที่ได้ เพื่อปรับปรุงอย่างต่อเนื่อง

ทั้งนี้ ตั้งแต่บัดนี้เป็นต้นไป

สั่ง ณ วันที่ ๒๖ มกราคม พ.ศ. ๒๕๕๙

(นายสุรชัย ขันอาสา)
ผู้ว่าราชการจังหวัดปทุมธานี

Note: This is the Official Order No. 143/2559 (Page 4) issued by Pathumthani Province on January 22, 2016 for appointing Provincial Board of Committee & Working Group for Area BCM project as explained in Section 1.1.3.2 in the main content of the report.

Appendix B

Official Order for appointing The Water Resource Policy and Management Committee

คำสั่งคณะรักษาความสงบแห่งชาติ
ที่ ๘๕ /๒๕๕๗
เรื่อง แต่งตั้งคณะกรรมการกำหนดนโยบายและการบริหารจัดการทรัพยากรน้ำ

.....

ตามที่คณะรักษาความสงบแห่งชาติได้ประกาศเข้าควบคุมอำนาจในการปกครองประเทศ ตามประกาศ ฉบับที่ ๑/๒๕๕๗ ตั้งแต่วันที่ ๒๒ เดือนพฤษภาคม พุทธศักราช ๒๕๕๗ นั้น

เพื่อให้การพัฒนาและบริหารจัดการทรัพยากรน้ำของประเทศไทย เป็นไปอย่างรวดเร็ว มีประสิทธิภาพ ป้องกันและบรรเทาปัญหาน้ำแล้ง น้ำท่วม รวมทั้งป้องกันภัยพิบัติให้กับประชาชนได้อย่างแท้จริง จึงออกคำสั่ง ดังนี้

ข้อ ๑ ยกเลิกระเบียบสำนักนายกรัฐมนตรี ๓ ฉบับ ได้แก่

๑.๑ ระเบียบสำนักนายกรัฐมนตรีว่าด้วยยุทธศาสตร์เพื่อการฟื้นฟูและสร้างอนาคตประเทศ พ.ศ. ๒๕๕๔

๑.๒ ระเบียบสำนักนายกรัฐมนตรีว่าด้วยยุทธศาสตร์เพื่อวางระบบการบริหารจัดการทรัพยากรน้ำ พ.ศ. ๒๕๕๔

๑.๓ ระเบียบสำนักนายกรัฐมนตรีว่าด้วยการบริหารจัดการน้ำและอุทกภัยแห่งชาติ พ.ศ. ๒๕๕๕ แต่ให้คง สำนักงานนโยบายและบริหารจัดการน้ำและอุทกภัยแห่งชาติ (สบอช.) ให้เป็นหน่วยงานภายใต้สำนักงานปลัดสำนักนายกรัฐมนตรี ทำหน้าที่ในการประสานงานกับหน่วยงานของรัฐ ที่เกี่ยวข้องกับการรวบรวมข้อมูลสภาพภูมิอากาศ สภาพน้ำในลุ่มน้ำและเขื่อนหรือที่กักเก็บน้ำ เพื่อนำข้อมูลมาวิเคราะห์และเสนอต่อคณะรักษาความสงบแห่งชาติ

ข้อ ๒ แต่งตั้งคณะกรรมการกำหนดนโยบายและการบริหารจัดการทรัพยากรน้ำ ประกอบด้วย

๒.๑	พลเอกฉัตรชัย สาริกัลยะ รองหัวหน้าฝ่ายเศรษฐกิจ	ประธานกรรมการ
๒.๒	เลขาธิการคณะกรรมการพัฒนาการเศรษฐกิจและสังคมแห่งชาติ	รองประธานกรรมการ
๒.๓	พลโทศุภกร สงวนชาติศรไกร	กรรมการ
๒.๔	ปลัดกระทรวงมหาดไทย	กรรมการ
๒.๕	ปลัดกระทรวงเกษตรและสหกรณ์	กรรมการ
๒.๖	ปลัดกระทรวงคมนาคม	กรรมการ
๒.๗	ปลัดกระทรวงทรัพยากรธรรมชาติและสิ่งแวดล้อม	กรรมการ
๒.๘	ปลัดกระทรวงเทคโนโลยีสารสนเทศและการสื่อสาร	กรรมการ
๒.๙	ปลัดกระทรวงวิทยาศาสตร์และเทคโนโลยี	กรรมการ
๒.๑๐	ปลัดกระทรวงพลังงาน	กรรมการ
๒.๑๑	ปลัดกระทรวงอุตสาหกรรม	กรรมการ

Note: This is the Official Order No. 85/2557 (Page 1) issued by The National Council for Peace and Order (NCPO) on July 3, 2014 for appointing The Water Resource Policy and Management Committee as explained in Section 3.1.5 in the main content of the report.

๒.๑๒ เลขาธิการคณะกรรมการกฤษฎีกา กรรมการ
๒.๑๓ เลขาธิการคณะกรรมการพิเศษเพื่อประสานงานโครงการอันเนื่องมาจากพระราชดำริ กรรมการ
๒.๑๔ ผู้อำนวยการสำนักงบประมาณ กรรมการ
๒.๑๕ เจ้ากรมกิจการพลเรือนทหารบก กรรมการ
๒.๑๖ เลขาธิการคณะกรรมการวิจัยแห่งชาติ กรรมการ
๒.๑๗ ผู้อำนวยการสำนักงานสถิติแห่งชาติ กรรมการ
๒.๑๘ ผู้ว่าราชการกรุงเทพมหานคร กรรมการ
๒.๑๙ ผู้อำนวยการสถาบันสารสนเทศทรัพยากรน้ำและการเกษตร กรรมการ
๒.๒๐ นายกวิศวกรรมสถานแห่งประเทศไทย ในพระบรมราชูปถัมภ์ กรรมการ
๒.๒๑ เจ้ากรมการทหารช่าง กรรมการและเลขานุการ
๒.๒๒ อธิบดีกรมชลประทาน กรรมการและผู้ช่วยเลขานุการ
๒.๒๓ อธิบดีกรมทรัพยากรน้ำ กรรมการและผู้ช่วยเลขานุการ
๒.๒๔ อธิบดีกรมโยธาธิการและผังเมือง กรรมการและผู้ช่วยเลขานุการ
๒.๒๕ อธิบดีกรมเจ้าท่า กรรมการและผู้ช่วยเลขานุการ

ข้อ ๓ ให้คณะกรรมการตามข้อ ๒ มีอำนาจหน้าที่ ดังนี้

๓.๑ กำหนดกรอบนโยบายและแผนงานการบริหารจัดการทรัพยากรน้ำ การป้องกันและแก้ปัญหาอุทกภัย ภัยแล้งและคุณภาพน้ำของประเทศ เพื่อให้การบริหารทรัพยากรน้ำของประเทศเป็นไปอย่างมีเอกภาพและบูรณาการ

๓.๒ เสนอแผนงาน โครงการ และมาตรการเกี่ยวกับการบริหารจัดการทรัพยากรน้ำ เพื่อให้เกิดการบูรณาการในการปฏิบัติต่อคณะรักษาความสงบแห่งชาติ เพื่อพิจารณาอนุมัติต่อไป

๓.๓ สนับสนุนการมีส่วนร่วมและเสริมสร้างความเข้าใจของประชาชนในการบริหารจัดการทรัพยากรน้ำของประเทศ

๓.๔ บูรณาการการสั่งงานด้านการบริหารจัดการน้ำ โดยสั่งการให้หน่วยงานของรัฐดำเนินการอย่างใดอย่างหนึ่งในการบริหารจัดการทรัพยากรน้ำของประเทศโดยเฉพาะอย่างยิ่งในยามวิกฤติให้มีการประสานกับคณะกรรมการป้องกันและบรรเทาสาธารณภัยแห่งชาติ (กปภช.) ซึ่งสามารถใช้อำนาจตามพระราชบัญญัติป้องกันและบรรเทาสาธารณภัย พ.ศ.๒๕๕๐

๓.๕ ติดตาม กำกับ ดูแลการปฏิบัติตามนโยบาย แผนงาน โครงการ และมาตรการที่อนุมัติ

๓.๖ แต่งตั้งคณะอนุกรรมการคณะทำงาน และคณะที่ปรึกษา เพื่อช่วยเหลือการปฏิบัติหน้าที่ของคณะกรรมการบริหารจัดการทรัพยากรน้ำของประเทศหรือตามที่ได้รับมอบหมาย

๓.๗ เชิญบุคคลหรือองค์กรที่เกี่ยวข้องกับการบริหารจัดการทรัพยากรน้ำมาให้ข้อมูล ข้อเท็จจริง และความเห็น รวมทั้งส่งเอกสารหลักฐานที่เกี่ยวข้อง เพื่อประกอบการพิจารณาของคณะกรรมการฯ

Note: This is the Official Order No. 85/2557 (Page 2) issued by The National Council for Peace and Order (NCPO) on July 3, 2014 for appointing The Water Resource Policy and Management Committee as explained in Section 3.1.5 in the main content of the report.

๓.๘ ดำเนินการอื่นใดที่จำเป็นเพื่อการบริหารจัดการทรัพยากรน้ำของประเทศ

๓.๙ รายงานผลการดำเนินงาน พร้อมทั้งปฏิบัติหน้าที่อื่นใดตามที่หัวหน้าคณะรักษาความสงบแห่งชาติมอบหมาย

ทั้งนี้ ตั้งแต่บัดนี้เป็นต้นไป

สั่ง ณ วันที่ ๓ เดือน กรกฎาคม พุทธศักราช ๒๕๕๗

พลเอก

(ประยุทธ์ จันทร์โอชา)

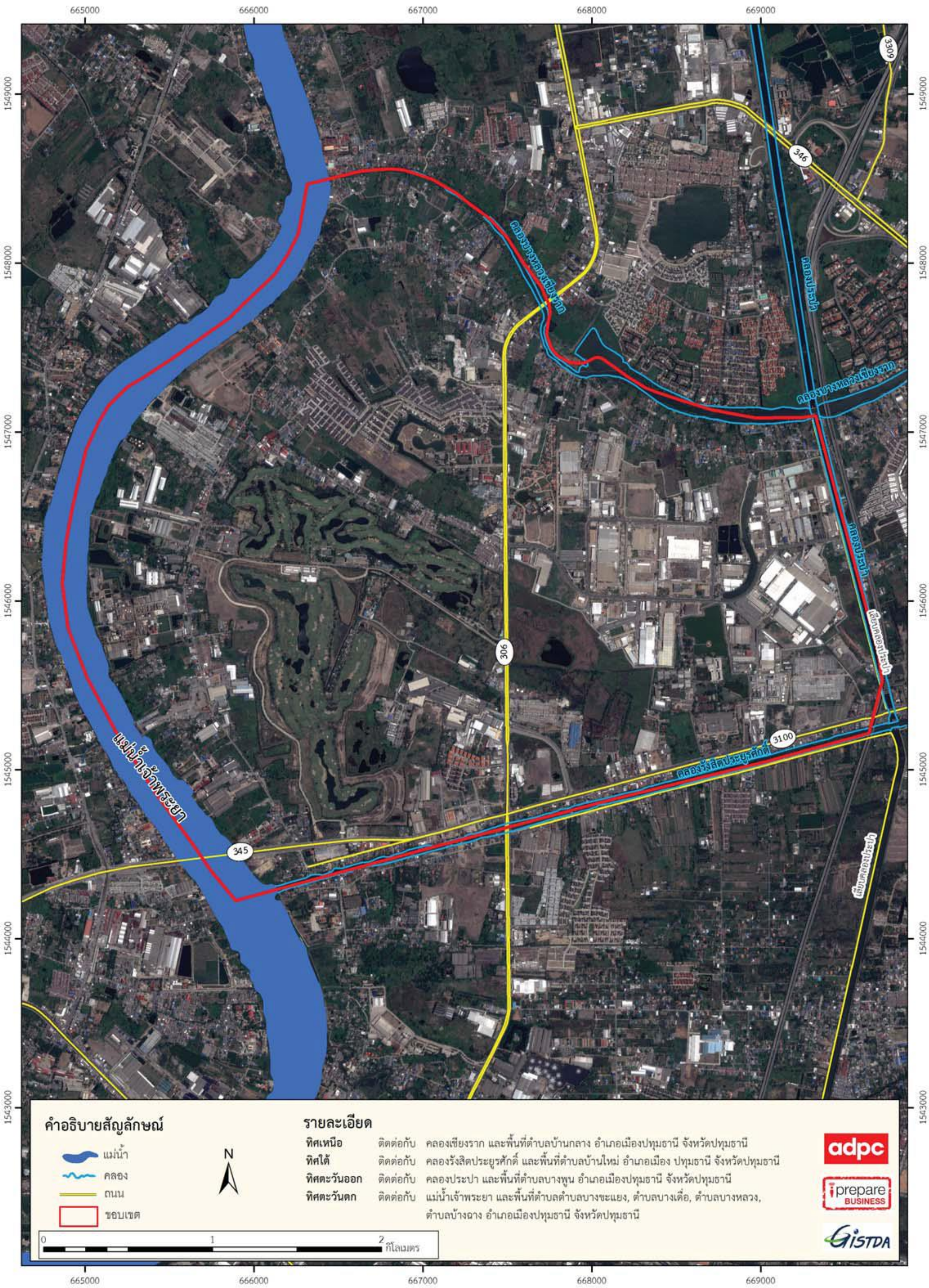
หัวหน้าคณะรักษาความสงบแห่งชาติ

Note: This is the Official Order No. 85/2557 (Page 3) issued by The National Council for Peace and Order (NCPO) on July 3, 2014 for appointing The Water Resource Policy and Management Committee as explained in Section 3.1.5 in the main content of the report.

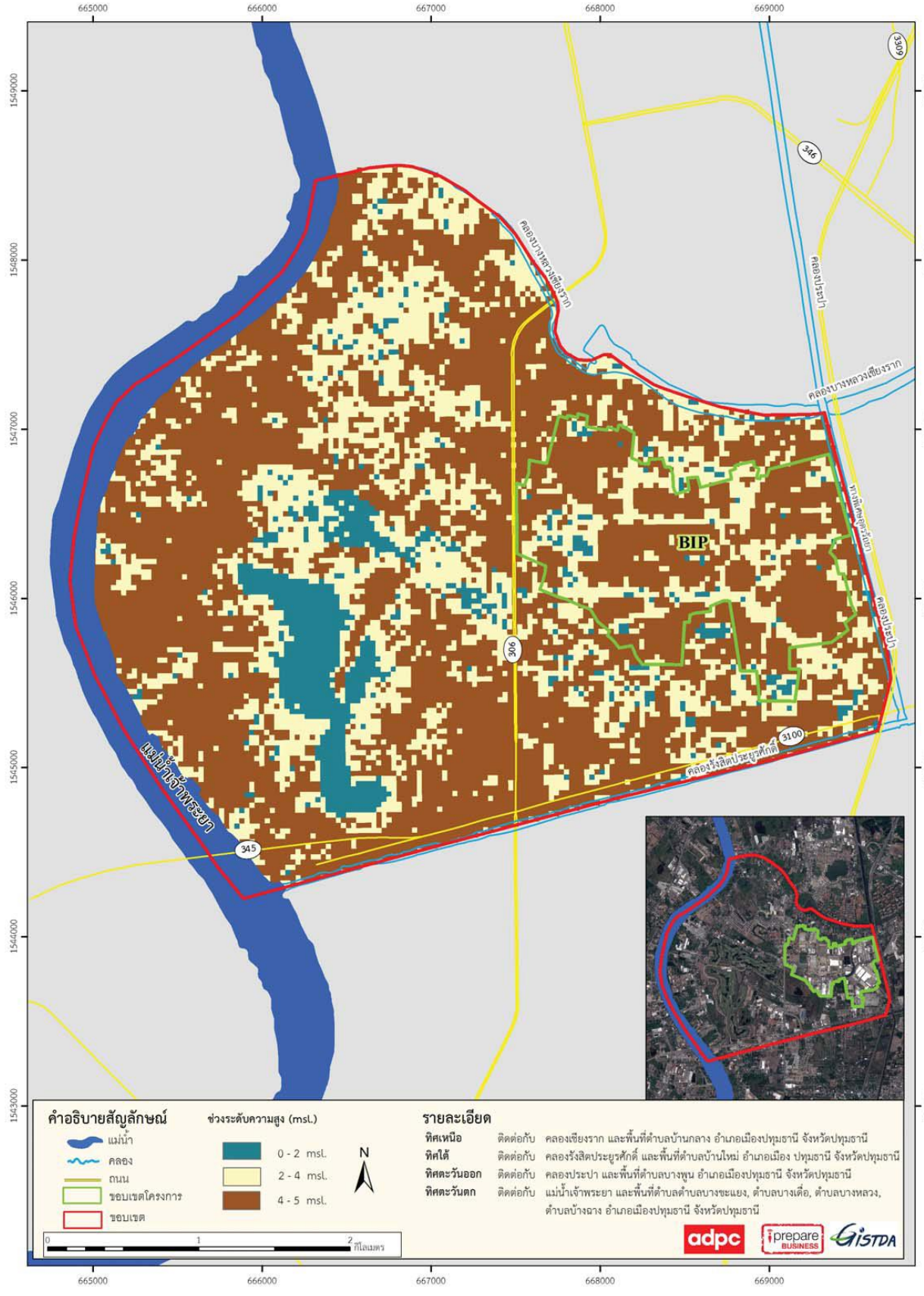
Appendix C

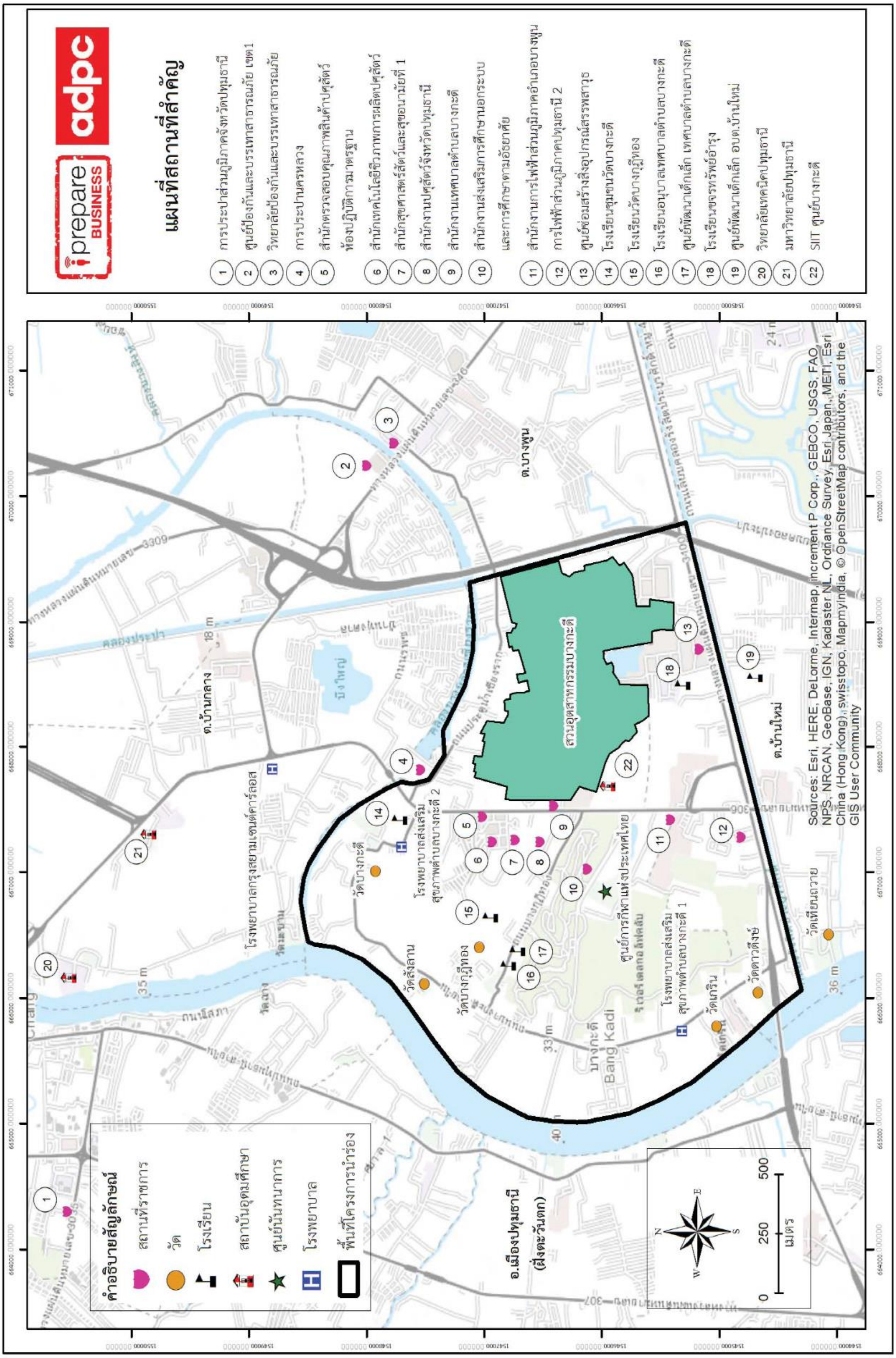
Enlarged maps of the study area for the project

พื้นที่ศึกษาโครงการนำร่อง Area BCM บริเวณสวนอุตสาหกรรมบางกะดี จังหวัดปทุมธานี



แผนที่ระดับความสูง บริเวณพื้นที่ศึกษาโครงการนำร่อง Area BCM บริเวณสวนอุตสาหกรรมบางกะดี จังหวัดปทุมธานี




iprepare BUSINESS
adpc
แผนที่สถานที่สำคัญ
1 การประปาส่วนภูมิภาคจังหวัดปทุมธานี
2 ศูนย์ป้องกันและบรรเทาสาธารณภัย เขต1
3 วิทยาลัยป้องกันและบรรเทาสาธารณภัย
4 การประปานครหลวง
5 สำนักตรวจสอบคุณภาพสินค้าปศุสัตว์ ห้องปฏิบัติการมาตรฐาน
6 สำนักเทคโนโลยีชีวภาพการผลิตปศุสัตว์
7 สำนักสุขศาสตร์สัตว์และสุขอนามัยที่ 1
8 สำนักงานปศุสัตว์จังหวัดปทุมธานี
9 สำนักงานเทศบาลตำบลบางกะดี
10 สำนักงานส่งเสริมการศึกษานอกระบบ และการศึกษาตามอัธยาศัย
11 สำนักงานการไฟฟ้าส่วนภูมิภาคอำเภอบางพูน
12 การไฟฟ้าส่วนภูมิภาคปทุมธานี 2
13 ศูนย์ซ่อมสร้างสิ่งอุปกรณ์สรรพาวุธ
14 โรงเรียนชุมชนวัดบางกะดี
15 โรงเรียนวัดบางกุฎีทอง
16 โรงเรียนอนุบาลเทศบาลตำบลบางกะดี
17 ศูนย์พัฒนาเด็กเล็ก เทศบาลตำบลบางกะดี
18 โรงเรียนขจรทรัพย์อำรุง
19 ศูนย์พัฒนาเด็กเล็ก อบต.บ้านใหม่
20 วิทยาลัยเทคนิคปทุมธานี
21 มหาวิทยาลัยปทุมธานี
22 SIIT ศูนย์บางกะดี
คำอธิบายสัญลักษณ์
สถานที่ราชการ
วัด
โรงเรียน
สถาบันอุดมศึกษา
ศูนย์นันทนาการ
โรงพยาบาล
พื้นที่โครงการนำร่อง
อ.เมืองปทุมธานี
(ฝั่งตะวันตก)
ต.บ้านกลาง
ต.บางพูน
ต.บ้านใหม่
สวนอุตสาหกรรมบางกะดี
โรงพยาบาลกรุงสยามเซนต์คาร์ลอส
โรงพยาบาลส่งเสริมสุขภาพตำบลบางกะดี 2
โรงพยาบาลส่งเสริมสุขภาพตำบลบางกะดี 1
ศูนย์การกีฬาแห่งประเทศไทย
วัดบางกะดี
วัดสังลาน
วัดบางกุฎีทอง
วัดเกริน
วัดดาวดึงษ์
วัดเทียนถวาย
บางกะดี
Bang Kadi
บึงใหญ่
0 250 500
เมตร
N
S
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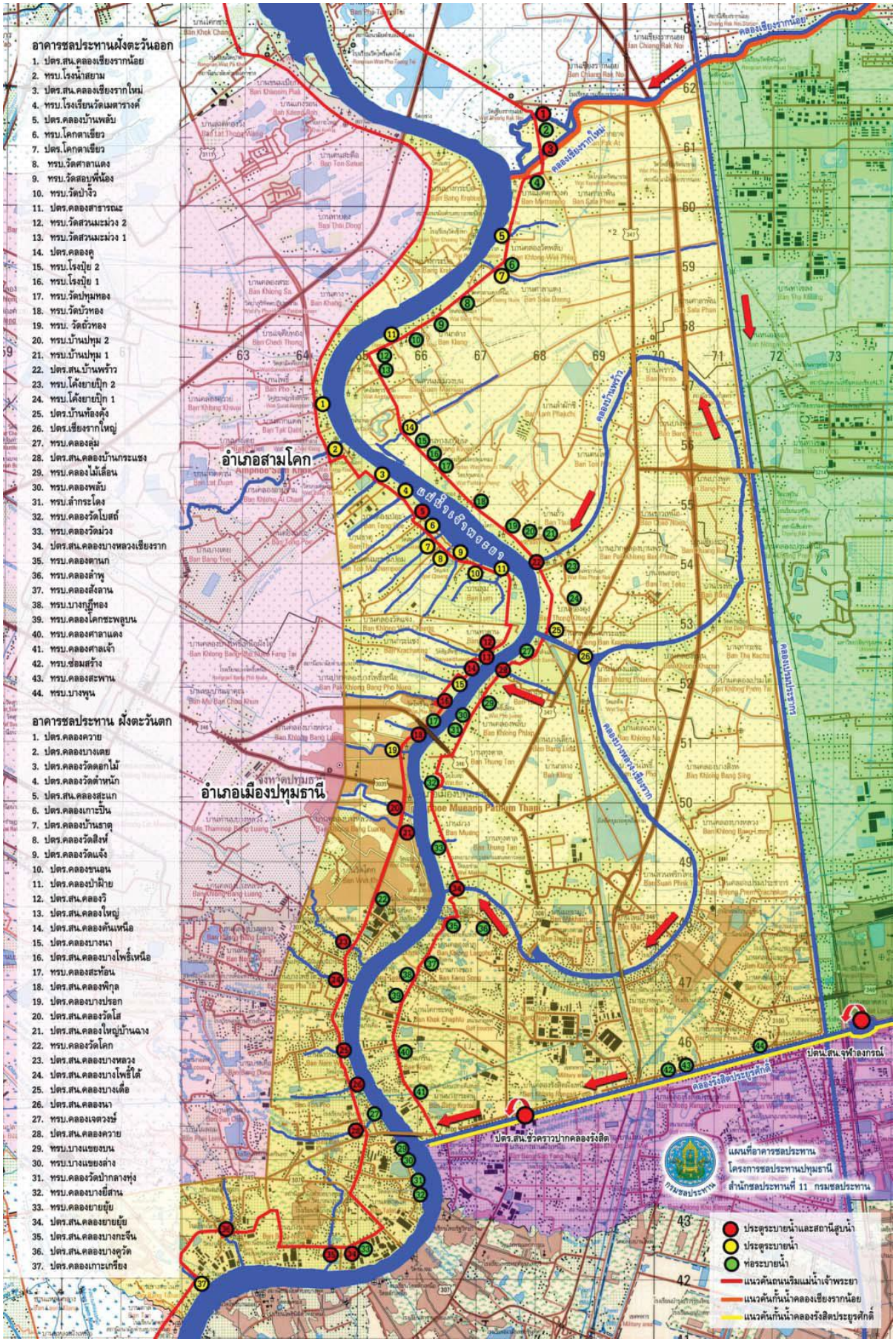
Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, Mapmyindia, © OpenStreetMap contributors, and the GIS User Community


อาคารชลประทานฝั่งตะวันออก
1. ปตร.สน.คลองเชียงรากน้อย
2. ทรบ.โรงน้ำสยาม
3. ปตร.สน.คลองเชียงรากใหม่
4. ทรบ.โรงเรียนวัดเมตารางค์
5. ปตร.คลองบ้านพลับ
6. ทรบ.โคกตาเขียว
7. ปตร.โคกตาเขียว
8. ทรบ.วัดศาลาแดง
9. ทรบ.วัดสองพี่น้อง
10. ทรบ.วัดป่าจิ้ว
11. ปตร.คลองสาธารณะ
12. ทรบ.วัดสวนมะม่วง 2
13. ทรบ.วัดสวนมะม่วง 1
14. ปตร.คลองคู
15. ทรบ.โรงปูย 2
16. ทรบ.โรงปูย 1
17. ทรบ.วัดปทุมทอง
18. ทรบ.วัดบัวทอง
19. ทรบ. วัดถั่วทอง
20. ทรบ.บ้านปทุม 2
21. ทรบ.บ้านปทุม 1
22. ปตร.สน.บ้านพร้าว
23. ทรบ.โค้งยายปุก 2
24. ทรบ.โค้งยายปุก 1
25. ปตร.บ้านท้องคุ้ง
26. ปตร.เชียงรากใหญ่
27. ทรบ.คลองลุ่ม
28. ปตร.สน.คลองบ้านกระแชง
29. ทรบ.คลองไม้เลื่อน
30. ทรบ.คลองพลับ
31. ทรบ.ลำกระโดง
32. ทรบ.คลองวัดโบสถ์
33. ทรบ.คลองวัดม่วง
34. ปตร.สน.คลองบางหลวงเชียงราก
35. ทรบ.คลองตานก
36. ทรบ.คลองลำพู
37. ทรบ.คลองสังฆาน
38. ทรบ.บางภูทอง
39. ทรบ.คลองโคกชะพลูบน
40. ทรบ.คลองศาลาแดง
41. ทรบ.คลองศาลเจ้า
42. ทรบ.ซ่อมสร้าง
43. ทรบ.คลองสะพาน
44. ทรบ.บางพูน
อาคารชลประทาน ฝั่งตะวันตก
1. ปตร.คลองควาย
2. ปตร.คลองบางเตย
3. ปตร.คลองวัดดอกไม้
4. ปตร.คลองวัดตำหนัก
5. ปตร.สน.คลองสะแก
6. ปตร.คลองเกาะปิ้น
7. ปตร.คลองบ้านธาตุ
8. ปตร.คลองวัดสิงห์
9. ปตร.คลองวัดแจ้ง
10. ปตร.คลองขนอน
11. ปตร.คลองป่าฝ้าย
12. ปตร.สน.คลองวิ
13. ปตร.สน.คลองใหญ่
14. ปตร.สน.คลองคันเหนือ
15. ปตร.คลองบางนา
16. ปตร.สน.คลองบางโพธิ์เหนือ
17. ทรบ.คลองสะท้อน
18. ปตร.สน.คลองพิกุล
19. ปตร.คลองบางปรอก
20. ปตร.สน.คลองวัดโส
21. ปตร.สน.คลองใหญ่บ้านฉาง
22. ทรบ.คลองวัดโคก
23. ปตร.สน.คลองบางหลวง
24. ปตร.สน.คลองบางโพธิ์ใต้
25. ปตร.สน.คลองบางเดื่อ
26. ปตร.สน.คลองนา
27. ทรบ.คลองเจตวงษ์
28. ปตร.สน.คลองควาย
29. ทรบ.บางแขยงบน
30. ทรบ.บางแขยงล่าง
31. ทรบ.คลองวัดปากลางทุ่ง
32. ทรบ.คลองบางยี่สาน
33. ทรบ.คลองยายยุ้ย
34. ปตร.สน.คลองยายยุ้ย
35. ปตร.สน.คลองบางกะจีน
36. ปตร.สน.คลองบางคูวัด
37. ปตร.คลองเกาะเกรียง
อำเภอสามโคก
อำเภอเมืองปทุมธานี
ปตร.สน.ขัวคราวปากคลองรังสิต
ปตน.สน.จุฬาลงกรณ์
แผนที่อาคารชลประทาน
โครงการชลประทานปทุมธานี
สำนักชลประทานที่ 11 กรมชลประทาน
ประตูระบายน้ำและสถานีสูบน้ำ
ประตูระบายน้ำ
ท่อระบายน้ำ
แนวคันถนนริมแม่น้ำเจ้าพระยา
แนวคันกั้นน้ำคลองเชียงรากน้อย
แนวคันกั้นน้ำคลองรังสิตประยูรศักดิ์

Appendix D

Area BCM project process

In order to follow the lessons learned process for Area BCM, the working group has reviewed the steps of execution of the pilot project for the purpose of understanding and review of the process, including preparing the documents being used for planning in carrying out another Area BCM cycle for the next year. The steps of execution of the pilot project can be summarized as follows.

According to the order number 143/2016 of Pathumthani province, the working group was established to prepare a business continuity plan in the area of Bangkadi Industrial Park. The Provincial Area BCM Board of Committee was assigned for directing and monitoring the Area BCM pilot project. The steering committee was assigned by the order number 247/2015 of the National Economic and Social Development Board to be an advisor for the Board and the provincial-level working group in order to prepare a business continuity plan in the area. The purpose is to allow stakeholders from all sectors in the area to be resilient to disasters, especially flooding that may occur, effectively. As a result, the administration and operation have continued in the area since October 2015, in which the key steps of process can be summarized as follows.

- On October 1, 2015 at Bangkadi Municipality office: ADPC met with representatives from Bangkadi Industrial Park and representatives of private companies in the park to introduce the Area BCM pilot project.
- On October 2, 2015 at The Central Region Economic and Social Development Office (CESO): Representatives from NESDB, The Agriculture, Natural Resource and Environment Planning Office (ANEO), The Central Region Economic and Social Development Office (CESO), with representatives from ADPC held a discussion on the establishment of a working group for Area BCM based on the draft order by Pathumthani province in March 2015.
- On October 15, 2015 at Pathumthani Provincial Office: representatives from NESDB and ADPC have attended a meeting with the stakeholders in the pilot area around the Bangkadi Industrial Park area, including representatives from government agencies at the provincial and local level (Bangkadi Municipality) and representatives from Bangkadi Industrial Park in order to discuss the direction for executing the project and the list of working group members of the pilot project prior to the meeting with the governor of Pathumthani, who is the chairman of the steering committee of Area BCM project.
- On November 16, 2015 at Pathumthani Provincial Office, Ms. Ladawan Kampa, the Deputy Secretary General of NESDB and Dr. Bhichit Rattakul, ADPC Special Advisor, led the coordinating team to meet with the governor of Pathumthani and the stakeholders from all sectors in the Bangkadi Industrial Park area. The meeting resulted in the provincial governor of Pathumthani to consider in executing the Area BCM pilot project at the Bangkadi

Industrial Park area in Pathumthani and appointing a directing committee at the provincial level as well as formally appointing the working group to carry out the Area BCM pilot project.

- On December 28, 2015: NESDB issued the order number 247/2015 to appoint the steering committee for Area BCM project.
- On January 22, 2016: The province of Pathumthani issued the order number 143/2016 issued an order to appoint the Provincial Area BCM Board of Committee and the working group for the Area BCM pilot project for Bangkadi Industrial Park in Pathumthani province.
- On February 4, 2016 at the Bangkok Golf Spa Resort Hotel in Pathumthani: The Provincial Area BCM Board of Committee and the working group attended the official launch of the pilot project in the morning and held the first workshop for the working group of the pilot project with the purpose to understand the pilot area. The Thai version of the Planning Guide for Area Business Continuity was also distributed to the attendees in order to help them to understand how to conduct Area BCM.
- From April to September 2016: the ADPC staff team visited various sites in the area to collect information in order to prepare for Area BCM and met with the stakeholders in the area such as the Royal Irrigation Department of Pathumthani, Bangkadi Industrial Park, Disaster Prevention and Mitigation Office of Pathumthani, Geo-Informatics and Space Technology Development Agency, the Provincial Office of Pathumthani, private companies in Bangkadi Industrial Park, Bangkadi Municipality Office and Banmai Municipality Office, etc.
- On April 22, 2016 at Dusit Thani Hotel: representatives from ADPC met and held a discussion with Dr. Hitoshi Baba, Senior Advisor of JICA regarding the Area BCM pilot project and challenges that encountered during the workshops.
- On May 25, 2016 at the office of National Economic and Social Development Board: representatives from ADPC met with Ms. Ladawan Kampa, the working group members from NESDB and representatives from JICA to report on the progress on the preparation of the project.
- On June 17, 2016 at the office of National Economic and Social Development Board: representatives from ADPC met with Ms. Ladawan Kampa, the working group members from NESDB to listen to suggestions from NESDB in order to proceed on drafting the plan for Area BCM in the Bangkadi Industrial Park area.
- July 11, 2016 at Bangkok Golf Resort and Spa Hotel: The working group of the pilot project attended the workshop with the objective to conduct business impact analysis and resources analysis of the area, analysis of bottlenecks, and capacity assessment of the stakeholders in prevention and mitigation of flooding as well as to prepare the objectives of the plan in order to determine strategies and measures to improve the effectiveness of Area BCM.

- On July 28, 2016 at the office of JICA (Thailand): The ADPC staff team met with Dr. Hitoshi Baba, Senior Advisor of JICA, to report on the progress of the Area BCM pilot project as well as to listen to suggestions from Dr. Hitoshi Baba to prepare a business continuity plan in the pilot area.
- On August 10, 2016 at the office of National Economic and Social Development Board: The ADPC staff team met with Ms. Ladawan Kampa, the working group members from NESDB and representatives from JICA to report on the progress of the Area BCM pilot project and to listen to suggestions from NESDB in order to proceed on drafting the plan for Area BCM in the Bangkadi Industrial Park area.
- On September 12, 2016 at the Provincial Office Pathumthani: The Provincial Area BCM Board of Committee held the first meeting to discuss on the Area BCM pilot project in the Bangkadi Industrial Park area in order to consider and agree on the progress of the project and the draft plan for business continuity in the area.
- On September 13, 2016, at the Bangkok Golf Spa Resort Hotel in Pathumthani: The working group of the pilot project attended the workshop to propose criteria for indicating the severity of flooding and measures to strengthen the effectiveness of Area BCM.
- On September 22, 2016 at the Office of Bangkadi Municipality: The ADPC staff team attended to observe the Bangkadi Industrial Park flood prevention board meeting for the year 2016. In this meeting, Bangkadi Industrial Park asked for cooperation from government agencies at the provincial and local levels, such as the Provincial Office of Pathumthani, The Royal Irrigation Department, Pathumthani Office, Bangkadi Municipalilty, Banmai Municipalilty to meet with representatives of private companies in the industrial park in order to clarify the current flood situation.
- On September 29, 2016 at the Banyan Tree Hotel: The ADPC team held a panel discussion titled "Area BCM of the pilot project case study for the Bangkadi Industrial Park area" in Thailand Business Forum: Private Sector Investment in Disaster and Climate Resilience, with Dr. Hitoshi Baba, Ms. Chuleeporn Boonyamalik, Mr. Chuchat Supawattanangkul (Director of Royal Irrigation Department, Pathumthani), Ms. Sujin Thamrongtheppithak (BIP General Manager), Ms. Duangnapa Uttamakpongs (Policy Analyst and Planning Specialist, Department of Disaster Prevention and Mitigation) as the panelist to discuss on the pilot project in order to promote the project to the private sector, international organizations, and NGOs. The panel discussion attracted a lot of interest from participants as well.
- On November 4, 2016 at the Bangkok Golf Spa Resort Hotel in Pathumthani: The working group of the pilot project attended the workshop to prepare for the Area BCM action plans as well as to review the draft of Area BCP and to designate the entity that will be in charge and be responsible for Area BCM.

- On December 2, 2016: The Steering Committee of Area BCM project attended the discussion meeting to listen to the progress in the preparation of Area BCM project as well as the feedback for improving the business continuity plan in the area of Bangkadi Industrial Park. The meeting was chaired by the Secretary General of the Office of National Economic and Social Development Board.

- On February 6, 2017 at the Provincial Office Pathumthani: The Provincial Area BCM Board of Committee held the second meeting to discuss and agreed on the plan developed and its implementation including primary implementing agency of the Area BCM/BCP. The meeting was chaired by the vice provincial governor, Pathumthani.

According to the experience in executing this pilot project in order to implement Area BCP, it was found that the key challenges are on coordinating amongst al agencies who are the stakeholders in the pilot project and how to get them to accept the new concept of unifying all sectors in the area to work together to acheive effective of business continuity management even in the face of disaster.

ADPC has gathered a list of important documents in from the Pathumthani area that are necessary for use in the preparation of Area BCP as follows.

- Altitude map and satellite images of the study area for Area BCM pilot project in Bangkadi Industrial Park area, which is prepared by the Geo-Informatics and Space Technology Development Agency (GISTDA), who is a member of the working group
- A critical facility map within the pilot project study area in Bangkadi Industrial Park, which is developed by ADPC
- Map of floodgates and pumping stations within the irrigation project area in Pathumthani
- Map of Bangkadi sub-district showing the flood risk spots in the area for the year 2016
- Annual report of Bangkadi Municipality in 2015
- Flood Protection Plan for the year 2015 and the year 2016 of Bangkadi Industrial Park
- Disaster Prevention and Mitigation Plan of Pathumthani for the year 2010 to 2014, with the chapter on water and flood management
- Disaster Prevention and Mitigation Plan of Pathumthani for the year 2015.
- Emergency Action Plan to tackle the threat of flooding in Pathumthani for the year 2014
- Analysis report in industrial economic situation for 2015, compiled by the Provincial Industrial Office of Pathumthani
- Briefing report of Pathumthani province (Revised in April 2016)

The purpose of collecting and analyzing information from these documents for the area is to compile necessary information together with the business continuity plan in the Bangkadi Industrial Park area as well as to include insights from the discussions from the formal meetings, workshops and casual meetings of the working group and stakeholders in the area by ensuring that plans and documents related to the preparation of information for business continuity plans follow a similar approach. In cases where the working group of the pilot project identified other plans that can be used for Area BCM which are not included in the above list, the working group can consider incorporating these plans for further review and improvement the next time.

Although the purpose of Area BCM in Bangkadi Industrial Park area is to improve the resilience to flood disaster that may arise, the working group of the pilot project also considers the management of water-related drought issues. As there are limitations in terms of project management at this time, the next review and preparation of the plan may consider including additional issues related to drought management in order to increase coverage to prevent the disruption of business continuity management and operations at the area level in the future.

Appendix E

Details of 4 workshops conducted for the project

AGENDA

Pilot Project Orientation Meeting and 1st Workshop

under

Pilot Project of Area Business Continuity Management: Area BCM

Bangkadi Industrial Park, Pathumthani

Date: 4 February 2016, 09.30 – 16.30

Venue: Lotus Room, Bangkok Golf Club, Pathumthani

Time	Agenda
09.30 – 10.00	Registration
Orientation Meeting	
10.00 – 10.15	**Welcoming remark:** Ms. Chuleeporn Boonyamalik Director of Agriculture, Natural Resources and Environment Planning Office, National Economic and Social Development Board (NESDB) **Opening remarks:** Mr. Nirat Phongsitthavorn, Vice Governor, Pathumthani Dr. Jingjai Hanchanlash Executive Director, Asian Disaster Preparedness Center) ADPC) Mr. Shuichi Ikeda Chief Representative Japan International Cooperation Agency (JICA), Thailand Office
10.15 – 10.30	Introduction of Committees, Working Group, and Participants Group photo
10.30 – 11.00	Technical Session: **Current Approaches for BCM in Thailand** Ms. Duangnabha Autthamangphong Research and International Cooperation Bureau Department of Disaster Prevention and Mitigation (DDPM)
11.00 – 11.15	Coffee break

Time	Agenda
11.15 – 11.45	Technical Session: **Introduction of Area BCM (based on Area BCM Guideline)** Mr. Aslam Perwaiz Department Head, Disaster Risk Management Systems, ADPC Dr. Apassanun Silapapiphat iPrepare BCP Specialist, Disaster Risk Management Systems, ADPC
11.45 – 12.00	Q&A/ Comments on Area BCM and the plans
12.00 – 13.00	Lunch break
Area BCM Workshop	
13.00 – 14.30	Technical Session: **Understanding Area BCP for Bangkadi Industrial Park** Introduction of Working Group and Presentation Introduction of Area Business Continuity Plan (Area BCP): Understanding the Area Fact Base information of BIP by Mr. Chuchart Supawanthanangkul, Director of Royal Irrigation Department, Pathumthani Office Ms. Sujin Thamrongteppithak, Senior Manager, BIP Disaster Scenario (All activities will be led by ADPC team)
14.30 – 15.15	Group discussion
15.15 – 15.30	Coffee break
15.30 – 16.15	Presentation by the group
16.15 – 16.30	Wrap up

2nd Workshop: Determining Area BCM Strategy
under
Pilot Project of Area Business Continuity Management: Area BCM
Bangkadi Industrial Park, Pathumthani
Date: 11 July 2016, 08.30 – 16.00
Venue: Violet Room, 9th Floor, Bangkok Golf Spa Resort, Pathumthani

1. Background

After large-scale natural disaster, individual enterprises struggle to continue their business due to the malfunctioning of basic infrastructure for transportation and distribution, termination of basic utilities, and disrupted supply chain surrounding their business base.

The Concept of Area Business Continuity Management (Area BCM) is introduced as a collective effort for business continuity to minimize economic losses or impacts from disaster, and formulate an Area Business Continuity Plan (Area BCP)

In collaboration with the Japan International Cooperation Agency (JICA), the National Economic and Social Development Board (NESDB) decided to adopt Area BCM and Area BCP approaches by implementing a **Pilot Project on Area Business Continuity Management (Area BCM) in Bangkadi Industrial Park area, Pathumthani province.** The project aims at integrating the efforts of area stakeholders in disaster risk reduction and promoting business continuity management and business resilience. In addition, the pilot project is implemented to support NESDB efforts to establish national BCP against natural disasters. The Asian Disaster Preparedness Center (ADPC) is the implementing agency that will facilitate the project including carrying out project activities in close consultation with JICA and NESDB.

Based on the 1st Workshop on 4 February 2016, participants were guided in order to develop a clearer understanding of the scope and objectives of Area BCM and Area BCP as well as understanding the area of the pilot project. The pilot area was identified based on water management aspects covering 12.66 km^2 at two Tambols which are the whole area of Tambol Bangkadi (8.3 km^2) and partially area at Tambol Banmai (4.36 km^2) including residential area, factory and warehouse, government agency offices, education institutions, and service provider of public utilities.

In order to achieve the ultimate goal of the project as well as to follow the national strategy on strengthening disaster risk reduction, the NESDB has released the order no. 247/2558 to formulate the National Steering Committee on Area BCM. Subsequently, the Office of Pathumthani Province has also announced the order no. 143/2559 to establish the Provincial Area BCM Board of Committee and Area BCM Working Group.

2. Objectives

- To identify and analyze Area Business Impact Analysis: Area BIA
- To identify and analyze critical resources and bottlenecks of the area
- To analyze current flood preparedness strategy
- To prepare a draft Area BCP based on key findings from the workshop

3. Scope of Content

Members of Working Group of the pilot project of Area BCM appointed by Pathumthani Governor are the key player at the workshop while ADPC team will be coordinating and facilitating the workshop in particular subjects as follow:

1) Progress report and update status of the pilot project at Bangkadi Industrial Park area, Pathumthani
2) Understanding the area and scoping area of the pilot project
3) Disaster scenario creation and Area Business Impact Analysis: (Area BIA)
4) Critical resources analysis and identify bottlenecks of the area
5) Analysis of current flood preparedness strategy
6) Wrap up and further activities

4. Participants

1) Governor Office, Pathumthani
2) Bangkadi Municipality
3) Pathumthani Provincial Red Cross Office
4) Disaster Prevention and Mitigation, Pathumthani Office
5) Pathumthani Provincial Public Relation Office
6) Office of Labour Protection and Welfare, Pathumthani
7) Pathumthani Provincial Development and Human Security Office
8) Pathumthani Provincial Health Office
9) Pathumthani Provincial Energy Office
10) Pak Klong Ranksit Police Station
11) Pathumthani Provincial Meteorological Office
12) Royal Irrigation Department, Pathumthani Office

13) Office of Highways, Pathumthani
14) Military Maintenance Center
15) Metropolitan Waterworks Authority
16) Pathumthani Provincial Electricity Authority Office 2
17) Geo-Informatics and Space Technology Development Agency (GISTDA)
18) Sirindhorn International Institute of Technology (SIIT), Bangkadi Campus
19) Pathumthani University
20) Banklang Municipality
21) Banmai Municipality
22) The Federation of Thai Industries, Pathumthani Chapter
23) Chaba Bangkok Co., Ltd.
24) Sony Technology (Thailand) Co., Ltd.
25) B.Grimm BIP Power 1-2 Co., Ltd.
26) Transtron (Thailand) Co., Ltd.
27) Toshiba Consumer Products (Thailand) Co., Ltd.
28) Asahi Intecc (Thailand) Co., Ltd.
29) Technology Store Co., Ltd.
30) Tiwanon Pattana Community
31) Pratunam Chiangrak Community
32) Klong Lampoo Community
33) Pruksaville Village Community
34) Klong Prapa Community
35) Bangkadi Industrial Park (BIP) Co., Ltd.
36) Ajinomoto Co., (Thailand) Ltd.
37) Thaibart Container Service Co., Ltd.
38) Bangkok Golf Spa Resort Co., Ltd.
39) National Economic and Social Development Board (NESDB)
40) Japan International Cooperation Agency (JICA)
41) Asian Disaster Preparedness Center (ADPC)

5. Agenda

Time	Agenda
08.30 – 09.00	Registration
09.00 – 09.10	Welcoming remark *By Mr. Aslam Perwaiz, Department Head DRMS* *Asian Disaster Preparedness Center (ADPC)*
09.10 – 09.20	Opening remark *By Mr. Surachai Koomsin, Advisor* *National Economic and Social Development Board*
09.20 – 09.35	Progress report and update status of the pilot project *By Dr. Apassanun Silapapiphat, iPrepare BCP Specialist*
09.35 – 09.50	Understanding the area and scoping area of the pilot project *By Dr. Apassanun Silapapiphat, iPrepare BCP Specialist*
09.50 – 10.45	Disaster scenario creation and Area Business Impact Analysis: (Area BIA) Group discussion: Area BIA *By Dr. Apassanun Silapapiphat, iPrepare BCP Specialist* *Mr. Weerapon Sripongchai, BCM Officer*
10.45 – 11.00	Coffee Break
11.00 – 12.30	Critical resources analysis and identify bottlenecks of the area Group discussion: Critical resources analysis and identify bottlenecks *By Dr. Apassanun Silapapiphat, iPrepare BCP Specialist* *Mr. Weerapon Sripongchai, BCM Officer*
12.30 – 13.30	Lunch
13.30 – 15.00	Analysis of current flood preparedness strategy Group discussion: Analysis of current preparedness strategy *By Dr. Apassanun Silapapiphat, iPrepare BCP Specialist* *Mr. Weerapon Sripongchai, BCM Officer*
15.00 – 15.15	Coffee Break
15.15 – 15.45	Wrap up the 2nd Workshop *Mr. Weerapon Sripongchai, BCM Officer*
15.45 – 16.00	Further activities and Closing remark *Dr. Apassanun Silapapiphat, iPrepare BCP Specialist*

Note: The above agenda is subject to change without prior notice

3rd Workshop: Determining Area BCM Strategy
under
Pilot Project of Area Business Continuity Management: Area BCM
Bangkadi Industrial Park, Pathumthani
Date: 13 September 2016, 08.00-16.00
Venue: Violet Room, 9th Floor, Bangkok Golf Spa Resort, Pathumthani

1. Background

After large-scale natural disaster, individual enterprises struggle to continue their business due to the malfunctioning of basic infrastructure for transportation and distribution, termination of basic utilities, and disrupted supply chain surrounding their business base.

The Concept of Area Business Continuity Management (Area BCM) is introduced as a collective effort for business continuity to minimize economic losses or impacts from disaster, and formulate an Area Business Continuity Plan (Area BCP)

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Based on the 1st Workshop on 4 February 2016, participants were guided in order to develop a clearer understanding of the scope and objectives of Area BCM and Area BCP as well as understanding the area of the pilot project. The pilot area was identified based on water management aspects covering 12.66 km^2 at two Tambols which are the whole area of Tambol Bangkadi (8.3 km^2) and partially area at Tambol Banmai (4.36 km^2) including residential area, factory and warehouse, government agency offices, education institutions, and service provider of public utilities.

In order to achieve the ultimate goal of the project as well as to follow the national strategy on strengthening disaster risk reduction, the NESDB has released the order no. 247/2558 to formulate the National Steering Committee on Area BCM. Subsequently, the Office of Pathumthani Province has also announced the order no. 143/2559 to establish the Provincial Area BCM Board of Committee and Area BCM Working Group.

2. Objectives

- To Identify Area BCM strategy and critical facility as well as supporting activities to enhance an effectiveness Area BCM
- To analyze and prioritize strategy for establishing implementation plan
- To formulate of Area Incident Command System (Area ICS) and their roles and responsibilities
- To prepare a draft Area BCP based on key findings from the workshop

3. Scope of Content

Members of Working Group of the pilot project of Area BCM appointed by Pathumthani Governor are the key player at the workshop while ADPC team will be coordinating and facilitating the workshop in particular subjects as follow:

1) Identifying Area BCM strategy and critical facility as well as supporting activities to enhance an effectiveness Area BCM
2) Analyzing and prioritizing strategy for establishing implementation plan
3) Formulating of Area Incident Command System (Area ICS) and their roles and responsibilities
4) Wrap up and further activities

4. Participants

1) Governor Office, Pathumthani
2) Bangkadi Municipality
3) Pathumthani Provincial Red Cross Office
4) Disaster Prevention and Mitigation, Pathumthani Office
5) Pathumthani Provincial Public Relation Office
6) Office of Labour Protection and Welfare, Pathumthani
7) Pathumthani Provincial Development and Human Security Office
8) Pathumthani Provincial Health Office
9) Pathumthani Provincial Energy Office
10) Pak Klong Ranksit Police Station
11) Pathumthani Provincial Meteorological Office
12) Royal Irrigation Department, Pathumthani Office

13) Office of Highways, Pathumthani
14) Military Maintenance Center
15) Metropolitan Waterworks Authority
16) Provincial Waterworks Authority, Pathumthani 2
17) Pathumthani Provincial Electricity Authority Office 2
18) Geo-Informatics and Space Technology Development Agency (GISTDA)
19) Sirindhorn International Institute of Technology (SIIT), Bangkadi Campus
20) Pathumthani University
21) Banklang Municipality
22) Banmai Municipality
23) The Federation of Thai Industries, Pathumthani Chapter
24) Chaba Bangkok Co., Ltd.
25) Sony Technology (Thailand) Co., Ltd.
26) B.Grimm BIP Power 1-2 Co., Ltd.
27) Transtron (Thailand) Co., Ltd.
28) Toshiba Consumer Products (Thailand) Co., Ltd.
29) Asahi Intecc (Thailand) Co., Ltd.
30) Technology Store Co., Ltd.
31) Tiwanon Pattana Community
32) Pratunam Chiangrak Community
33) Klong Lampoo Community
34) Pruksaville Village Community
35) Klong Prapa Community
36) Bangkadi Industrial Park (BIP) Co., Ltd.
37) Ajinomoto Co., (Thailand) Ltd.
38) Thaibart Container Service Co., Ltd.
39) Bangkok Golf Spa Resort Co., Ltd.
40) National Economic and Social Development Board (NESDB)
41) Japan International Cooperation Agency (JICA)
42) Asian Disaster Preparedness Center (ADPC)

AGENDA

Time	Agenda
08.00 – 08.30	Registration
08.30 – 08.45	Welcoming remark *Mr. Surachai Koomsin, Advisor* *National Economic and Social Development Board*
08.45 – 09.00	Opening remark *Mr. Surachai Khan-arsa, Governor, Pathumthani*
09.00 – 10.00	Progress update and latest workshop report • Disaster scenario creation and Area Business Impact Analysis • Critical resources analysis and identify bottlenecks of the area • Analysis of current water management preparedness strategy *By Dr. Apassanun Silapapiphat, iPrepare BCP Specialist*
10.00 – 10.15	Coffee break
10.15 – 12.00	Identifying Area BCM strategy and prioritizing strategy for establishing implementation plan *By Dr. Apassanun Silapapiphat, iPrepare BCP Specialist* *Mr. Weerapon Sripongchai, BCM Officer; Ms. Warittha Wannathong, Project Manager*
12.00 – 13.00	Lunch break
13.00 – 14.00	Identifying Area BCM strategy and prioritizing strategy for establishing implementation plan (Cont'd)
14.00 – 15.00	Formulation of Area Incident Command System (Area ICS) • Identify roles and responsibilities of stakeholders *By Dr. Apassanun Silapapiphat, iPrepare BCP Specialist*
15.00 – 15.30	Wrap up and further activities *By Dr. Apassanun Silapapiphat, iPrepare BCP Specialist*
15.30 – 15.45	Closing remark *By Mr. Aslam Perwaiz, ADPC*
15.45 – 16.00	Coffee break

Note: The above agenda is subject to change without prior notice

4th Workshop: Implementing - Reviewing and Improving Area BCM
under
Pilot Project of Area Business Continuity Management: Area BCM
Bangkadi Industrial Park, Pathumthani
Date: 4 November 2016, 08.30-16.00
Venue: Lotus Room, 3rd Floor, Bangkok Golf Spa Resort, Pathumthani

1. Background

After large-scale natural disaster, individual enterprises struggle to continue their business due to the malfunctioning of basic infrastructure for transportation and distribution, termination of basic utilities, and disrupted supply chain surrounding their business base.

The Concept of Area Business Continuity Management (Area BCM) is introduced as a collective effort for business continuity to minimize economic losses or impacts from disaster, and formulate an Area Business Continuity Plan (Area BCP)

In collaboration with the Japan International Cooperation Agency (JICA), the National Economic and Social Development Board (NESDB) decided to adopt Area BCM and Area BCP approaches by implementing a **Pilot Project on Area Business Continuity Management (Area BCM) in Bangkadi Industrial Park area, Pathumthani province.** The project aims at integrating the efforts of area stakeholders in disaster risk reduction and promoting business continuity management and business resilience. In addition, the pilot project is implemented to support NESDB efforts to establish national BCP against natural disasters. The Asian Disaster Preparedness Center (ADPC) is the implementing agency that will facilitate the project including carrying out project activities in close consultation with JICA and NESDB.

Based on the 1st Workshop on 4 February 2016, participants were guided in order to develop a clearer understanding of the scope and objectives of Area BCM and Area BCP as well as understanding the area of the pilot project. The pilot area was identified based on water management aspects covering 12.66 km^2 at two Tambols which are the whole area of Tambol Bangkadi (8.3 km^2) and partially area at Tambol Banmai (4.36 km^2) including residential area, factory and warehouse, government agency offices, education institutions, and service provider of public utilities.

In order to achieve the ultimate goal of the project as well as to follow the national strategy on strengthening disaster risk reduction, the NESDB has released the order no. 247/2558 to formulate the National Steering Committee on Area BCM. Subsequently, the Office of Pathumthani Province has also announced the order no. 143/2559 to establish the Provincial Area BCM Board of Committee and Area BCM Working Group.

2. Objectives and Scope of Content

Members of Working Group of the pilot project of Area BCM appointed by Pathumthani Governor are the key player at the workshop while ADPC team will be coordinating and facilitating the workshop in particular subjects as follow:

- To report progress update and status of the pilot project at Bangkadi Industrial Park area, Pathumthani
- To review and prioritize Area BCM strategy for suggesting implementation measures
- To review and Improve Area BCM
- To identify ownership of implementation plan and Area BCP
- To improve the Area BCP based on key findings from the workshop

3. Participants

1) Governor Office, Pathumthani
2) Bangkadi Municipality
3) Pathumthani Provincial Red Cross Office
4) Disaster Prevention and Mitigation, Pathumthani Office
5) Pathumthani Provincial Public Relation Office
6) Office of Labour Protection and Welfare, Pathumthani
7) Pathumthani Provincial Development and Human Security Office
8) Pathumthani Provincial Health Office
9) Pathumthani Provincial Energy Office
10) Pak Klong Ranksit Police Station
11) Pathumthani Provincial Meteorological Office
12) Royal Irrigation Department, Pathumthani Office
13) Office of Highways, Pathumthani
14) Military Maintenance Center
15) Metropolitan Waterworks Authority
16) Provincial Waterworks Authority, Pathumthani 2
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39) Bangkok Golf Spa Resort Co., Ltd.
40) National Economic and Social Development Board (NESDB)
41) Japan International Cooperation Agency (JICA)
42) Asian Disaster Preparedness Center (ADPC)

AGENDA

Time	Agenda
08.30 – 08.45	Registration
08.45 – 09.00	Welcoming remark *By Asian Disaster Preparedness Center (ADPC)*
09.00 – 09.30	Opening remarks • *Ms. Ladawan Kumpa, Deputy Secretary General, National Economic and Social Development Board (NESDB)* • *Mr. Nirat Phongsitthavorn, Vice Governor of Pathumthani*
09.30 – 10.30	Progress update • Area BCM strategy • Area Incident Command System (Area ICS), and roles and responsibilities of stakeholders *Dr. Apassanun Silapapiphat and Mr. Weerapon Sripongchai, ADPC*
10.30 – 10.45	Coffee Break
10.45 – 12.00	Review and prioritize Area BCM strategy for suggesting implementation measures • Suggest implementation plan • Identify ownership of implementation plan and Area BCP *Dr. Apassanun Silapapiphat and Mr. Weerapon Sripongchai, ADPC*
12.00 – 13.00	Lunch Break
13.00 – 15.30	Reviewing and Improving Area BCM • Introduction of tabletop exercise based on Area BCP • Identifying time line for repeating Area BCM cycle and improving Area BCM *Dr. Apassanun Silapapiphat and Mr. Weerapon Sripongchai, ADPC*
15.30 – 16.00	Wrap up and closing remark *By Asian Disaster Preparedness Center (ADPC)*
16.00	Coffee Break

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