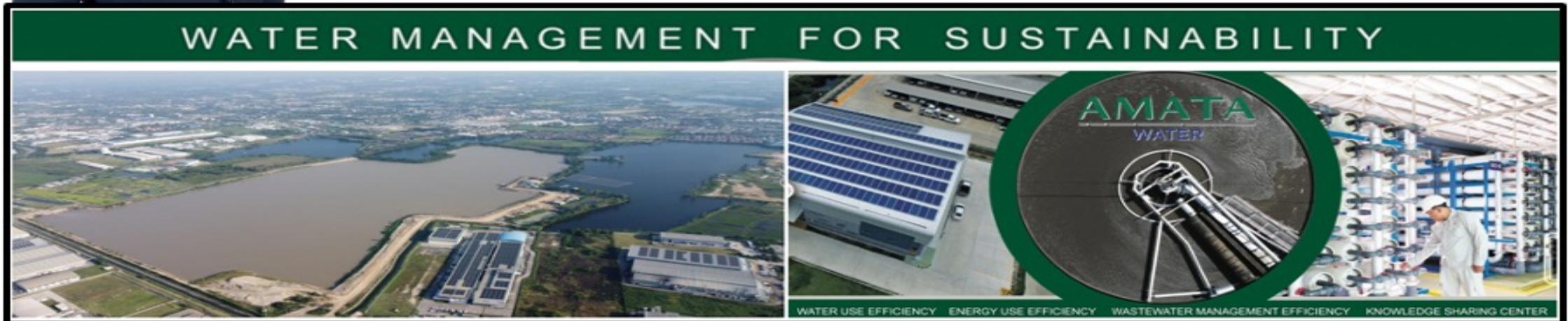


Roadmap of Water Resources Management and Business Opportunities.



Mr. Chuchat Saitin

- Chief Project Development : Amata U Co., Ltd.
- Vice Chairman : Water and Environment Institute for Sustainability (WEIS)
The Federation of Thai Industries (FTI)



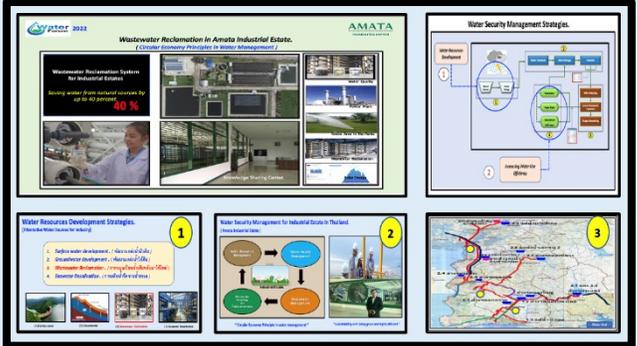
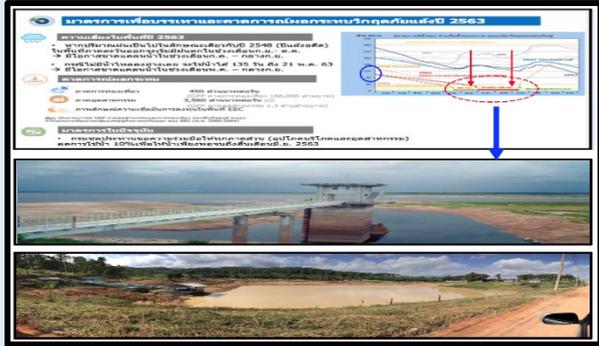
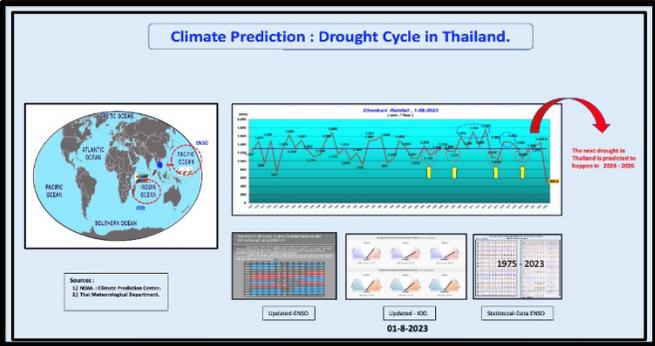
Topics :

(1) . The Overview of Water Crisis in Thailand.
(2) . Case study : Water Security Management for Amata City Industrial Estate, Thailand.

When ?

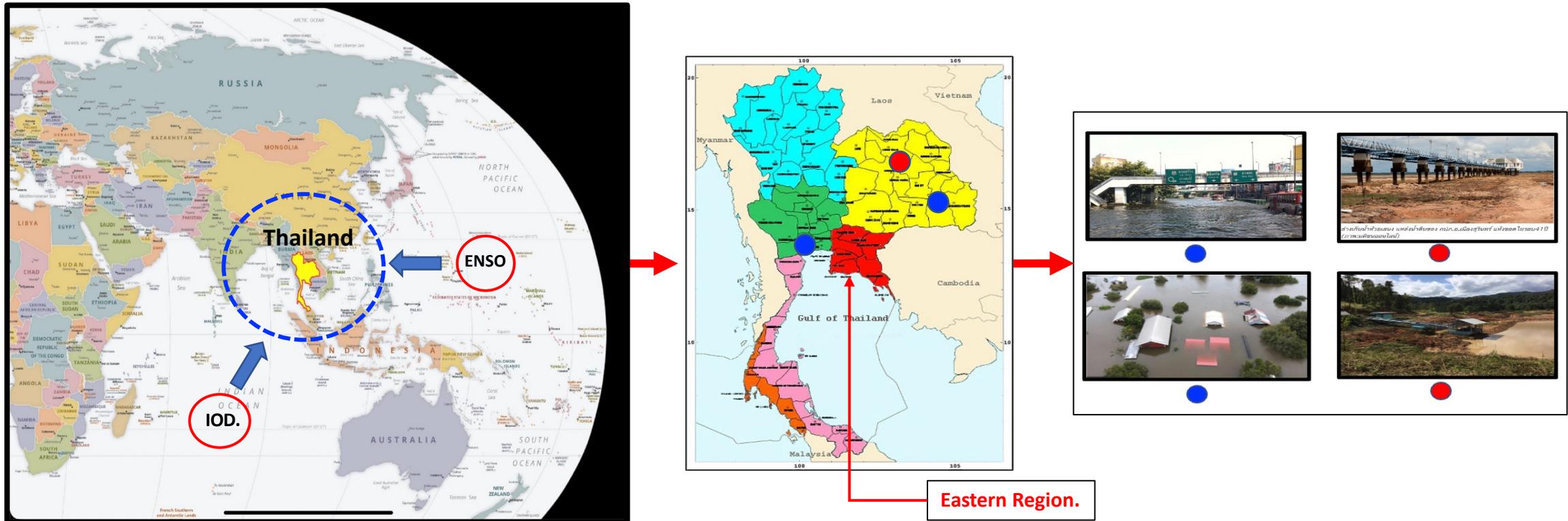
Impact ?

Solution ?



(1) Overview of water crisis in Thailand.

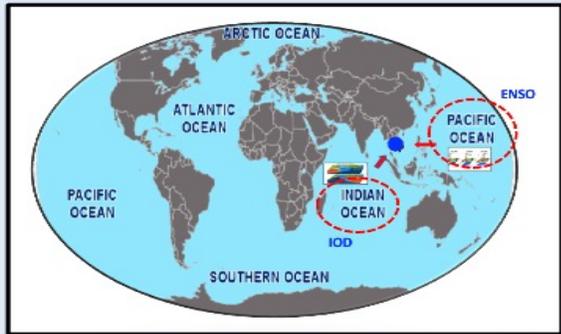
The Overview of Water Crises in Thailand



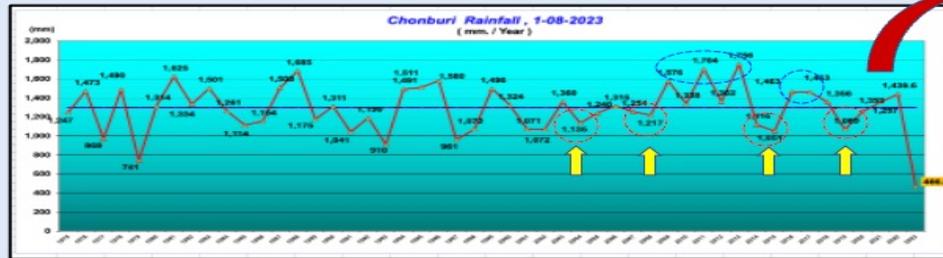
Thailand has faced several water crises in the past, primarily due to its geographical location and monsoon climate. The water crises have had significant impacts on the country's economic growth, especially [a severe drought in the eastern region.](#)

Climate cycle observed in Thailand.

Climate Prediction : Drought Cycle in Thailand.



Sources :
1.) NOAA : Climate Prediction Center.
2.) Thai Meteorological Department.



The next drought in Thailand is predicted to happen in **2024 - 2025**

Historical El Niño and La Niña Episodes based on the ONI computer using SOST v2.5

Year	ONI	Phase
1982-83	1.9	El Niño
1987	1.5	El Niño
1991-92	-1.8	La Niña
1997-98	-2.0	La Niña
2009-10	1.5	El Niño
2014-15	1.8	El Niño
2019-20	1.5	El Niño

Updated-ENSO



Updated - IOD.

Statistical Data ENSO

Year	ENSO Index
1975	0.2
1976	0.1
1977	0.3
1978	0.4
1979	0.5
1980	0.6
1981	0.7
1982	0.8
1983	0.9
1984	1.0
1985	1.1
1986	1.2
1987	1.3
1988	1.4
1989	1.5
1990	1.6
1991	1.7
1992	1.8
1993	1.9
1994	2.0
1995	2.1
1996	2.2
1997	2.3
1998	2.4
1999	2.5
2000	2.6
2001	2.7
2002	2.8
2003	2.9
2004	3.0
2005	3.1
2006	3.2
2007	3.3
2008	3.4
2009	3.5
2010	3.6
2011	3.7
2012	3.8
2013	3.9
2014	4.0
2015	4.1
2016	4.2
2017	4.3
2018	4.4
2019	4.5
2020	4.6
2021	4.7
2022	4.8
2023	4.9

Statistical-Data ENSO

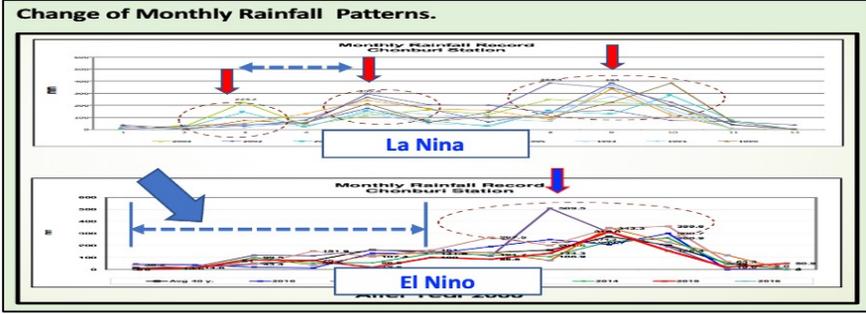
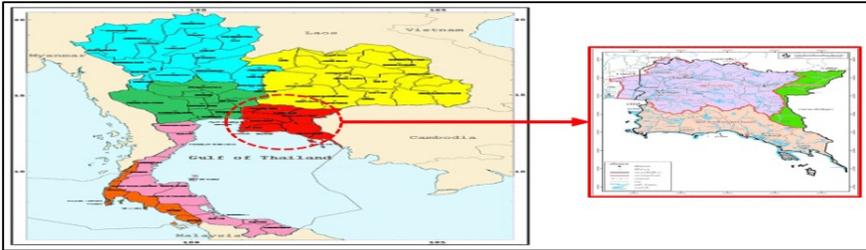
01-8-2023

1) According to ENSO phenomena.
The statistical data of sea surface temperature anomalies (SST) and Rainfall anomalies over the past 40 years in the East Region of Thailand have a correlation and can be observed that the droughts occur in the east region of Thailand approximately every 4-5 years.

2) The observation identify pattern and predict the occurrence of droughts and floods in Thailand, helping the authorities can better plan and prepare for droughts and floods mitigation to minimize their impact on agriculture, industries and communities.

According to the ENSO phenomenon and Indian Ocean Dipole phenomenon, It is expected to be a severe drought with a longer period and bigger impact on Thailand in **2024 and 2025.**

How ? The Drought impact on the Eastern Region.



มาตรการเพื่อบรรเทาและคาดการณ์ผลกระทบวิกฤตภัยแล้งปี 2563

ความเสี่ยงในปี 2563

- หากปริมาณฝนเป็นไปในลักษณะเดียวกับปี 2548 (ปีแล้งจัด) ในพื้นที่ภาคตะวันออกเฉียงเหนือจะมีฝนตกในช่วงเดือนก.ย. - ต.ค.
- > มีโอกาสขาดแคลนน้ำในช่วงเดือนก.ค. - กลางก.ย.
- กรณีไม่มีน้ำไหลลงอ่างเลย จะใช้น้ำได้ 135 วัน ถึง 21 พ.ค. 63
- > มีโอกาสขาดแคลนน้ำในช่วงเดือนพ.ค. - กลางก.ย.

คาดการณ์ผลกระทบ

- ภาคการท่องเที่ยว: 450 ล้านบาทต่อวัน (GDP ภาคการท่องเที่ยว 166,000 ล้านบาท)
- ภาคอุตสาหกรรม: 3,560 ล้านบาทต่อวัน (GDP ภาคอุตสาหกรรม 1.3 ล้านล้านบาท)
- ภาพลักษณ์ความเชื่อมั่นการลงทุนในพื้นที่ EEC

มาตรการในปัจจุบัน

- กรมชลประทานขอความร่วมมือให้ทุกภาคส่วน (อุปโภคบริโภคและอุตสาหกรรม) ลดการใช้น้ำ 10% เพื่อให้น้ำเพียงพอจนถึงสิ้นเดือนมิ.ย. 2563

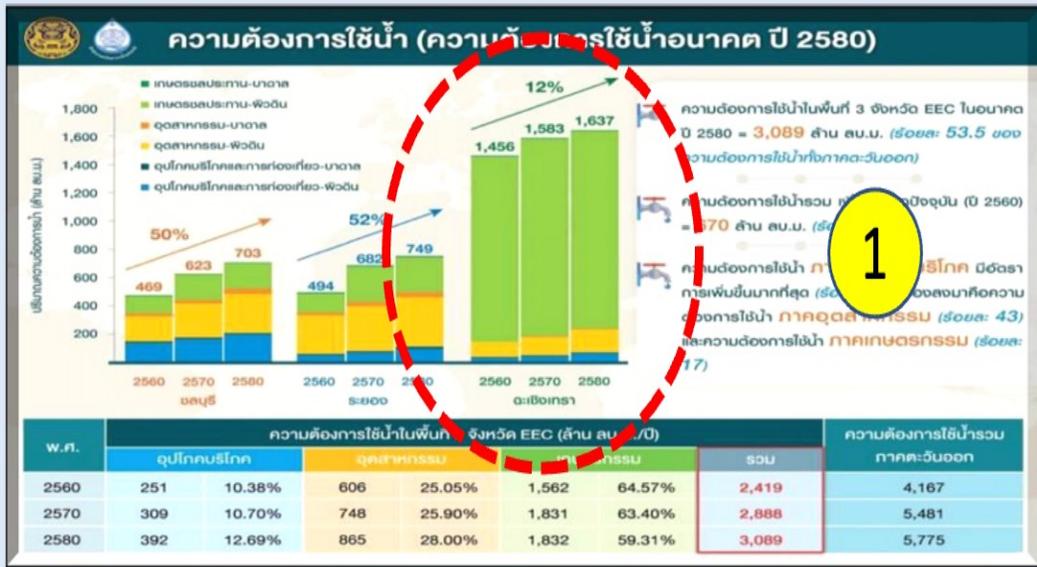


Predicted Water Demand and Supply Capacity in The Eastern Region.

WATER DEMAND GROWTH.

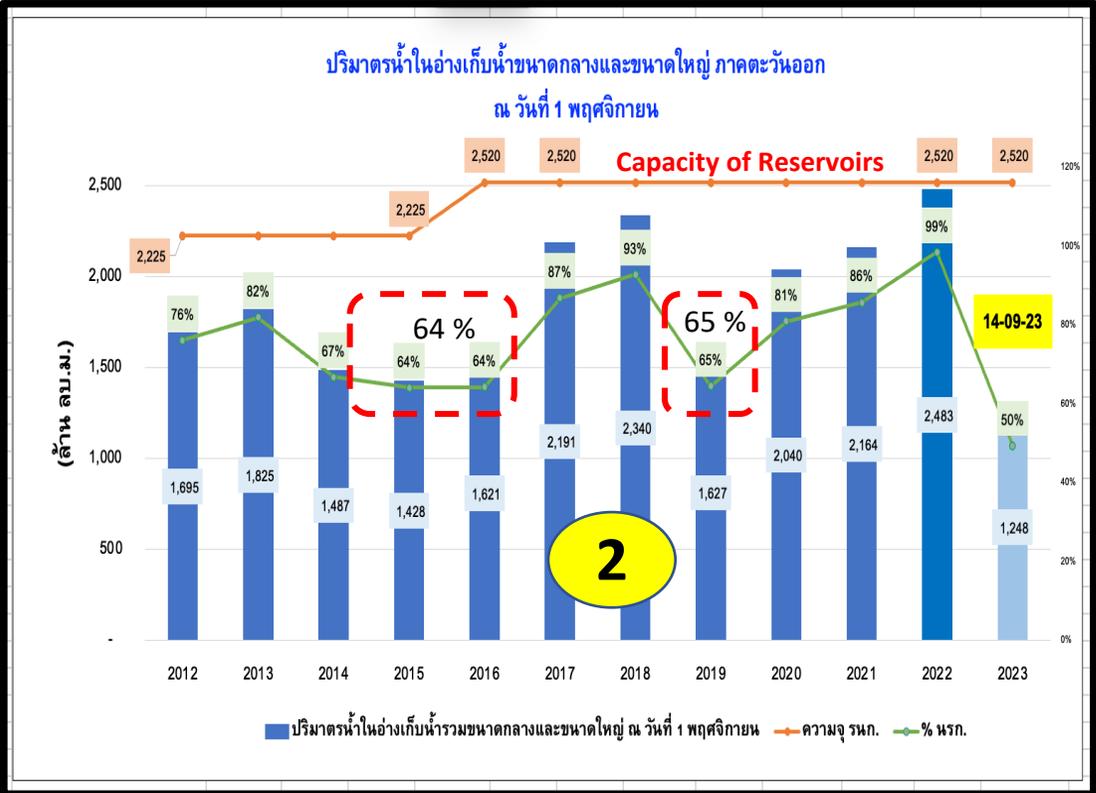
Estimated Water Demand growth in the East Region, Thailand.

(Year 2017, 2027 and 2037)

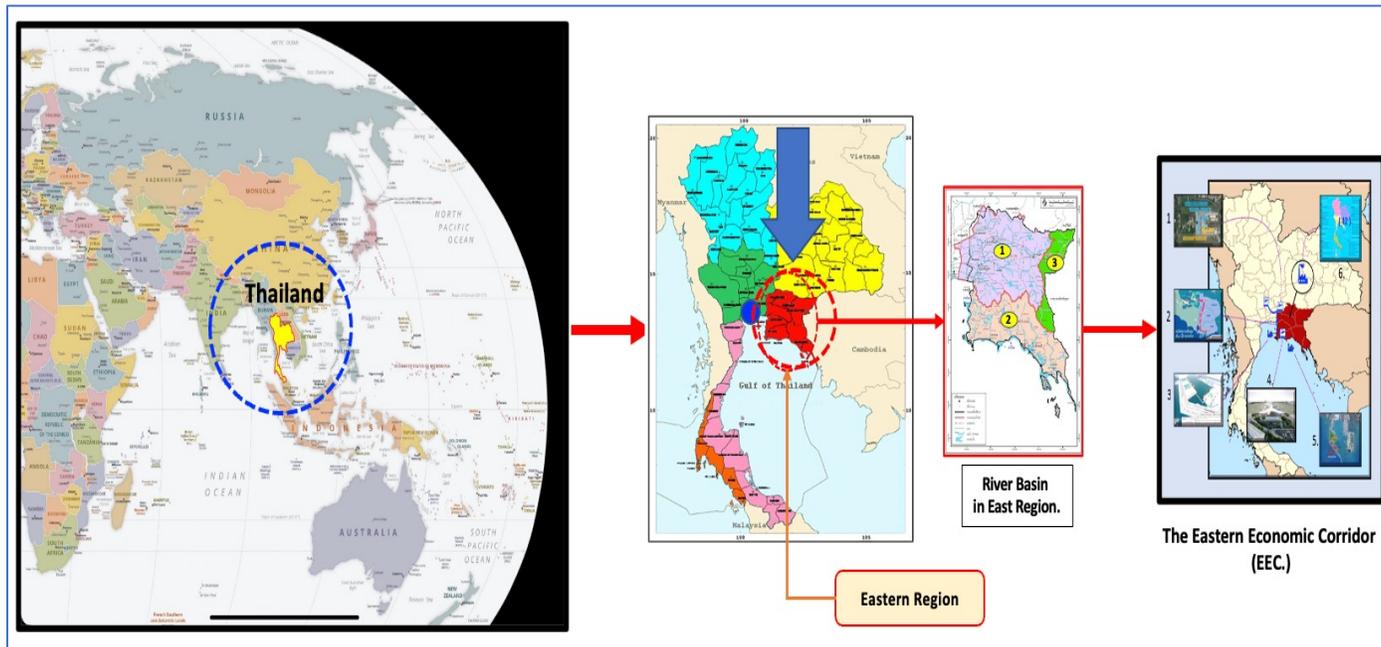


Source : Academic service center, Kasetsart University.

COLLECTED WATER IN ALL DAMS.



Predicted a Severe Drought in the Eastern Region , 2024-2025.



Impending Water Crisis

มาตรการเพื่อบรรเทาและคาดการณ์ผลกระทบในภาคพื้นน้ำปี 2563

ปริมาณน้ำในชั้นปี 2563

- จากปริมาณน้ำในชั้นปี 2548 (ปีน้ำน้อย) ในพื้นที่ภาคพื้นน้ำชั้นปี 2548 (ปีน้ำน้อย) - 2549 -> มีผลกระทบต่อน้ำในชั้นปี 2549 - 2550
- ฤดูแล้งปี 2563 (ปีน้ำน้อย) 135 วัน ถึง 21 พ.ค. 63 -> มีผลกระทบต่อน้ำในชั้นปี 2563 - 2564

คาดการณ์ผลกระทบ

- ภาคการเกษตร: 450 ครัวเรือน (พื้นที่การเกษตร 1,600 ไร่)
- ภาคอุตสาหกรรม: 3,560 ครัวเรือน (พื้นที่อุตสาหกรรม 1.3 ล้านไร่)
- ภาคบริการ: 1,000 ครัวเรือน (พื้นที่บริการ 1.3 ล้านไร่)

มาตรการบรรเทาผลกระทบ

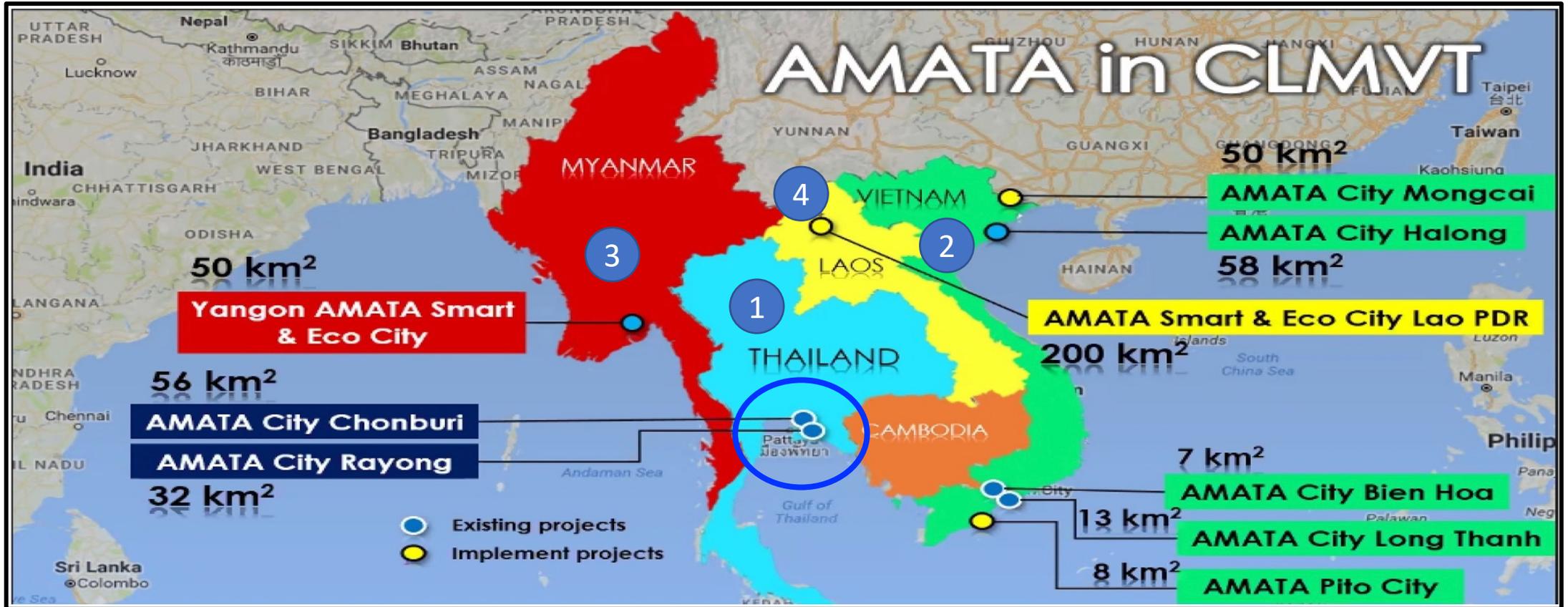
- หน่วยงานที่เกี่ยวข้องจะดำเนินการ (เช่น โครงการชลประทานและโครงการ) ลดการใช้น้ำ 10% เพื่อเพิ่มปริมาณน้ำในชั้นปี 2563

The complex block contains a table of water crisis data and two photographs. The table, titled 'Impending Water Crisis', details water levels for 2023 and the predicted impact for 2024-2025. It lists affected households and agricultural/industrial areas. Below the table are two photographs: the top one shows a dam with a reservoir, and the bottom one shows a large, circular water storage tank or treatment facility.

2024-2025

2.) Case Study : Water Security Management for Amata City Industrial Estates, in the Eastern Thailand.

Amata City Industrial Estates in South East Asia



There are more than 1,200 factories operating in Amata City Industrial Estates in Thailand.

Amata U Company Limited.

Mission : Creating Sustainable Development
with
Water security - Environmental friendly - Harmonious society with quality of life.



INDUSTRY.

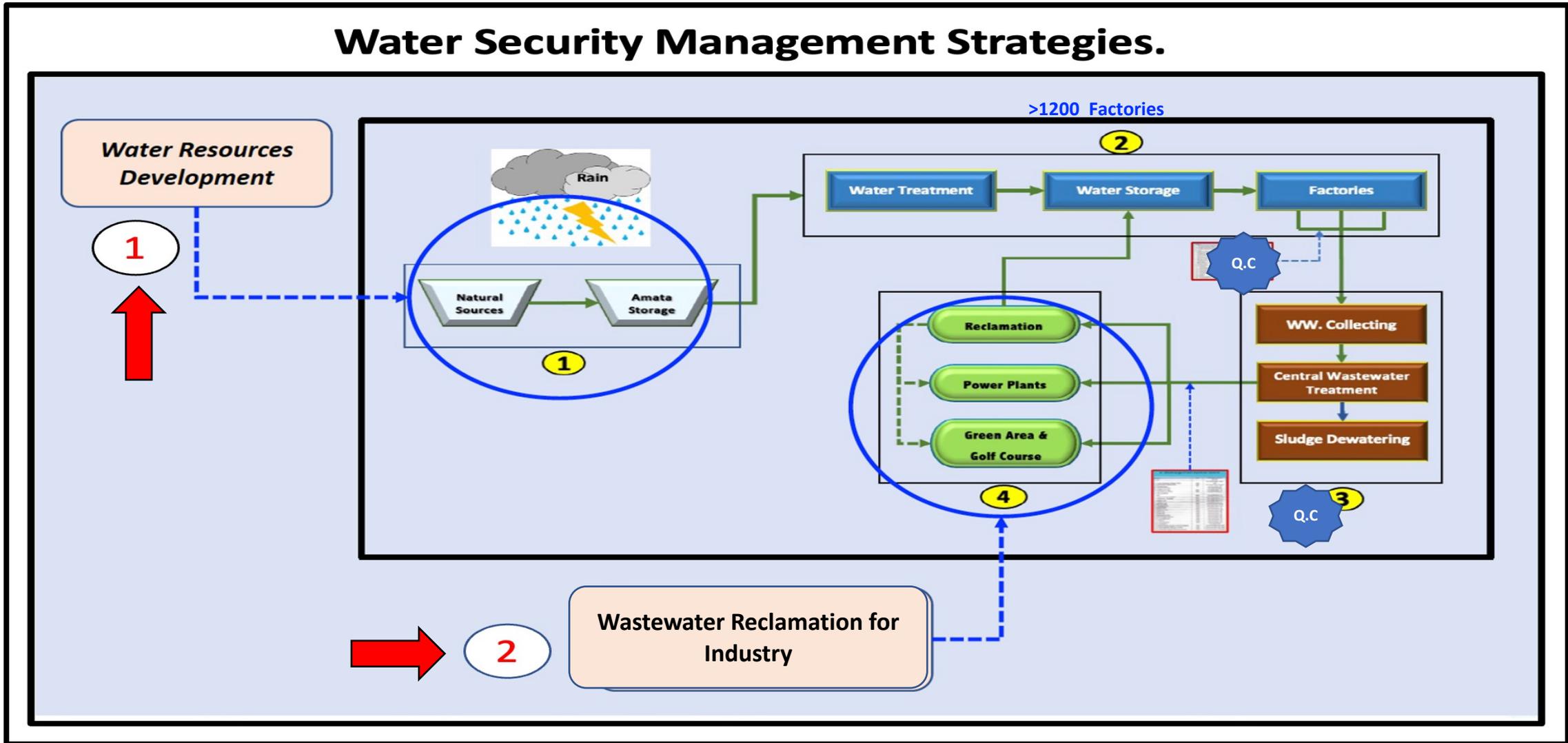


SOCIETY.



ENVIRONMENT.

Water Security Management Strategies.



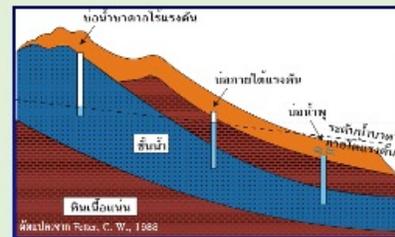
1.

Water Resource Development Strategy. (Alternative sources of water)

1. **Surface water development .** (พัฒนาแหล่งน้ำผิวดิน)
2. **Groundwater development .** (พัฒนาแหล่งน้ำใต้ดิน)
3. **Wastewater Reclamation .** (การหมุนเวียนน้ำเสียกลับมาใช้ใหม่)
4. **Seawater Desalination .** (การผลิตน้ำจืดจากน้ำทะเล)



(1) Surface water



(2) Groundwater



(3) Wastewater Reclamation

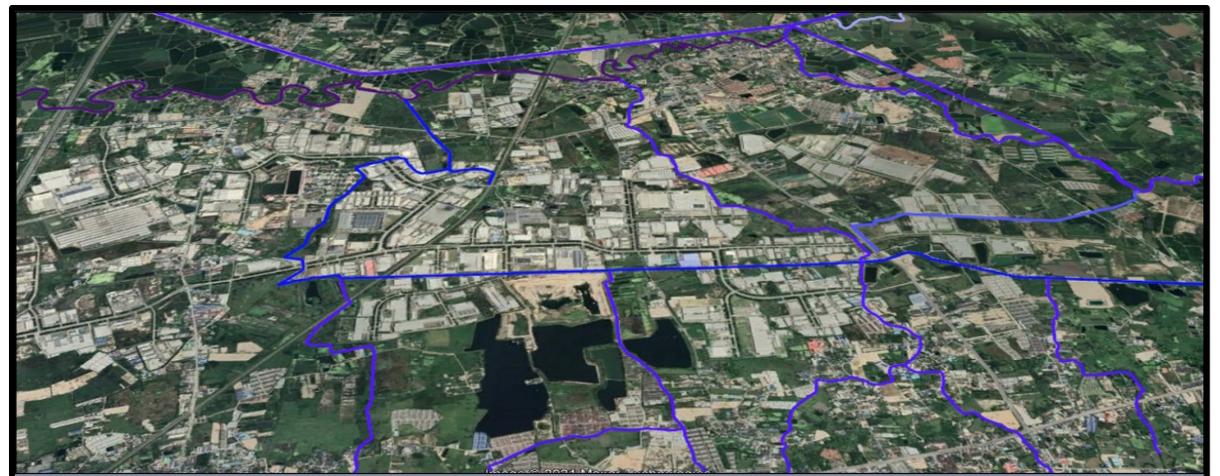
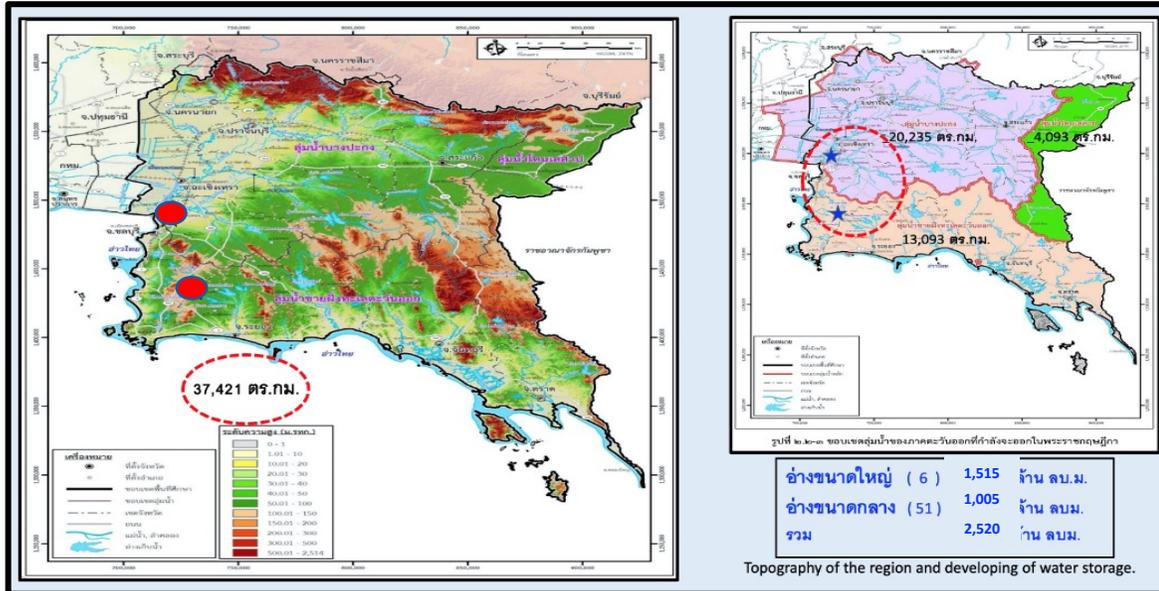


(4) Seawater Desalination

Since 2005, Alternative water resources has been being developed [sequentially](#).

Water Resources Development in Amata City Industrial Estates

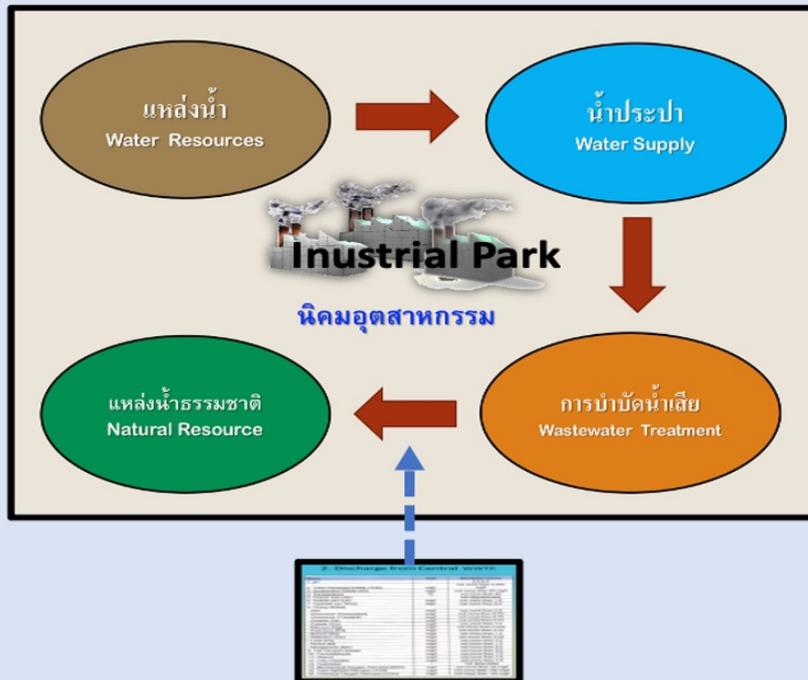
(Amata's Strategic Location)



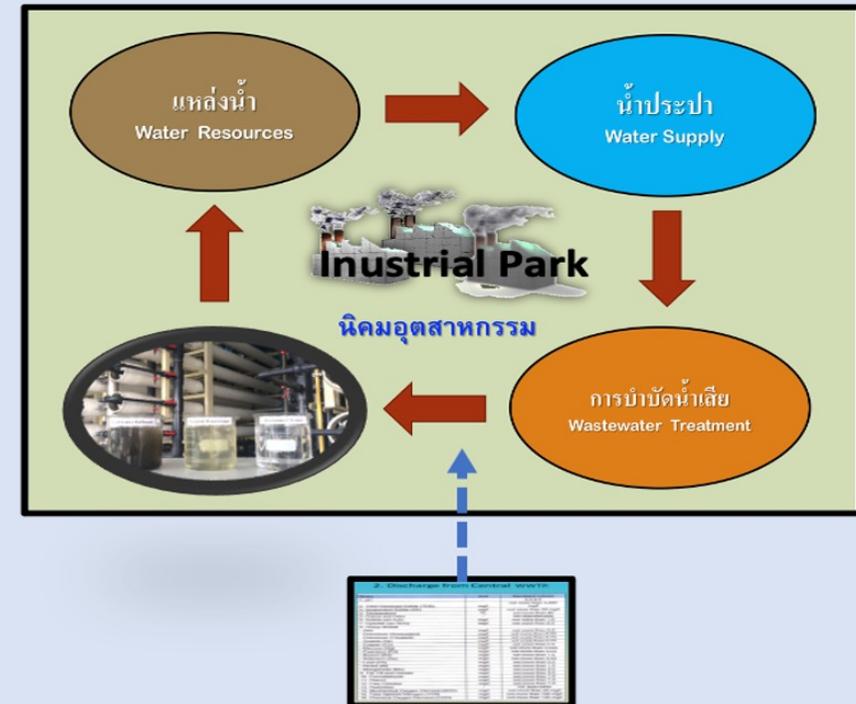
2.

Wastewater Reclamation system for Industry.

Linear Consumption.

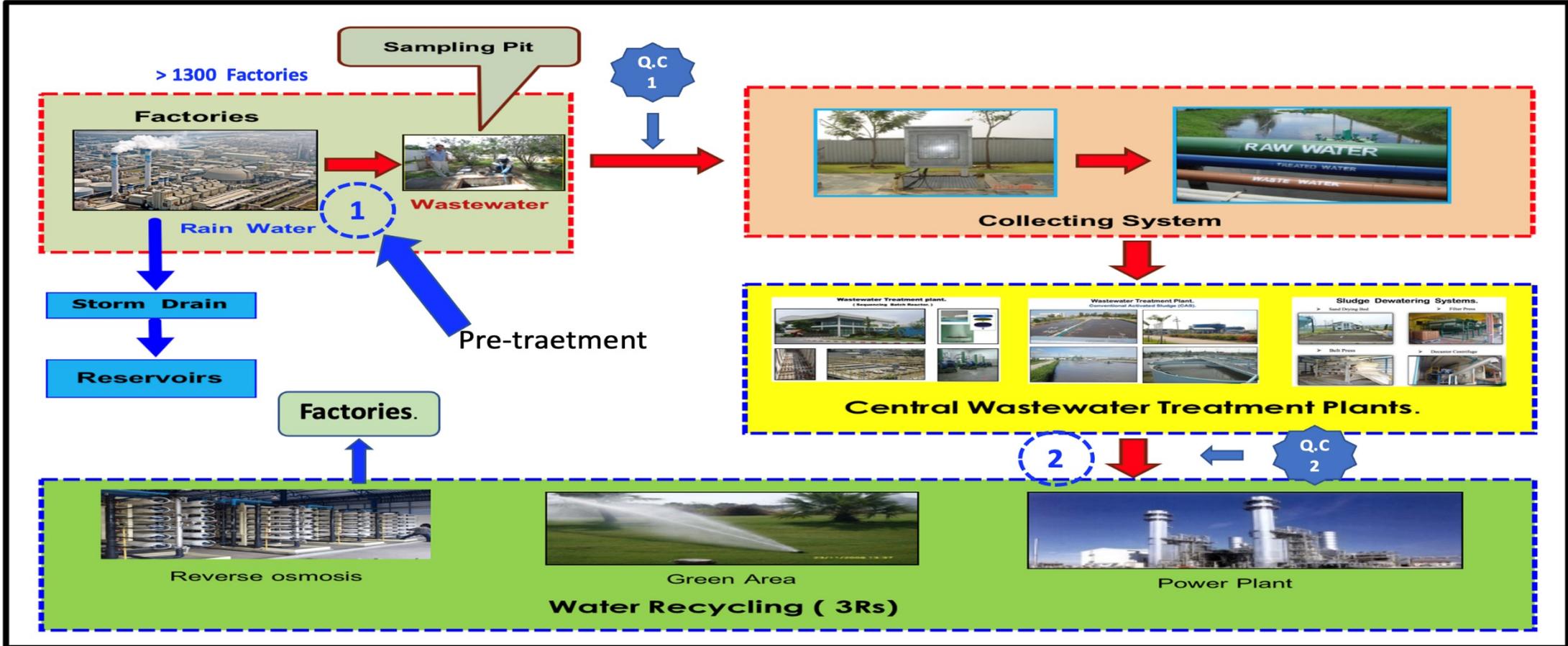


Circular Economy System.



Transition of water management system from a linear consumption to a Circular Economy System in Water Management , Since 2008.

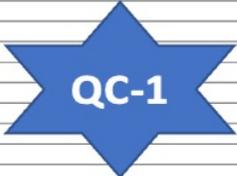
Wastewater Management system for Amata City Industrial Estate.



Wastewater-Discharged Quality Standard for Industrial Estate

QC-1. Discharge from factories.

Items	Unit	Standard values
1. Biochemical Oxygen Demand (BOD)	mg/l	not more than 500
2. Chemical Oxygen Demand (COD)	mg/l	not more than 750
3. Suspended Solid (SS)	mg/l	not more than 200
4. Total Dissolve Solid (TDS)	mg/l	not more than 3000
5. Total Kjeldahl Nitrogen (TKN)	mg/l	not more than 100
6. pH	-	5.5 – 9.0
7. Heavy Metal		
- Mercury (Hg)	mg/l	not more than 0.005
- Selenium (Se)	mg/l	not more than 0.02
- Cadmium (Cd)	mg/l	not more than 0.03
- Lead (Pb)	mg/l	not more than 0.2
- Arsenic (As)	mg/l	not more than 0.25
- Chromium (Cr ³⁺)	mg/l	not more than 0.75
- Chromium (Cr ⁶⁺)	mg/l	not more than 0.25
- Barium (Ba)	mg/l	not more than 1.0
- Nickel (Ni)	mg/l	not more than 1.0
- Copper (Cu)	mg/l	not more than 1.0
- Zinc (Zn)	mg/l	not more than 5.0
- Manganese (Mn)	mg/l	not more than 5.0
- Silver (Ag)	mg/l	not more than 1.0
8. Total iron	mg/l	not more than 10
9. Fluoride (F)	mg/l	not more than 5
10. Sulfide	mg/l	not more than 1.0
11. Cyanide as HCN	mg/l	not more than 0.2
12. Formaldehyde	mg/l	not more than 1.0
13. Phenols Compound	mg/l	not more than 1.0
14. Chloride asCL ₂	mg/l	not more than 2000
15. Free Chlorine	mg/l	not more than 1.0
16. Pesticide	-	not allowed
17. Temperature	°C	not more than 45
18. Color	-	not appear
19. Odor	-	not appear
20. Oil & Grease	mg/l	10.0
21. Radioactive	-	not allowed
22. Surfactant (Synthetic Detergent)	mg/l	not more than 30.0



QC-2. Discharge from Central WWTP.

Items	Unit	Standard values
1. pH	-	5.5-9.0
2. Total Dissolved Solids (TDS)	mg/l	not more than 3,000 mg/l
3. Suspended Solids (SS)	mg/l	not more than 50 mg/l
4. Temperature	°C	not more than 40
5. Colour and Odor	-	not objectionable
6. Sulfide (as H ₂ S)	mg/l	not more than 1.0
7. Cyanide (as HCN)	mg/l	not more than 0.2
8. Heavy Metals		
- Zinc	mg/l	not more than 5.0
- Chromium (Hexavalent)	mg/l	not more than 0.25
- Chromium (Trivalent)	mg/l	not more than 0.75
- Arsenic (As)	mg/l	not more than 0.25
- Copper (Cu)	mg/l	not more than 2.0
- Mercury (Hg)	mg/l	not more than 0.005
- Cadmium (Cd)	mg/l	not more than 0.03
- Barium (Ba)	mg/l	not more than 1.0
- Selenium (Se)	mg/l	not more than 0.02
- Lead (Pb)	mg/l	not more than 0.2
- Nickel (Ni)	mg/l	not more than 1.0
- Manganese (Mn)	mg/l	not more than 5.0
9. Fat, Oil and Grease	mg/l	not more than 5.0
10. Formaldehyde	mg/l	not more than 1.0
11. Phenol	mg/l	not more than 1.0
12. Free Chlorine	mg/l	not more than 1.0
13. Pesticides	-	not detectable
14. Biochemical Oxygen Demand (BOD)	mg/l	not more than 20 mg/l
15. Total Kjeldahl Nitrogen (TKN)	mg/l	not more than 100 mg/l
16. Chemical Oxygen Demand (COD)	mg/l	not more than 120 mg/l



Wastewater Reclamation system in Amata City Industrial Estate.



Saving 40 % of Water resources by Wastewater Reclamation System



Wastewater Reclamation in Amata Industrial Estate.
(Circular Economy Principles in Water Management)

**Wastewater Reclamation System
for Industrial Estates**

*Saving water from natural sources by
up to 40 percent.*



Water Quality



Power Plant.



Green Area in The Parks.



Knowledge Sharing Center.

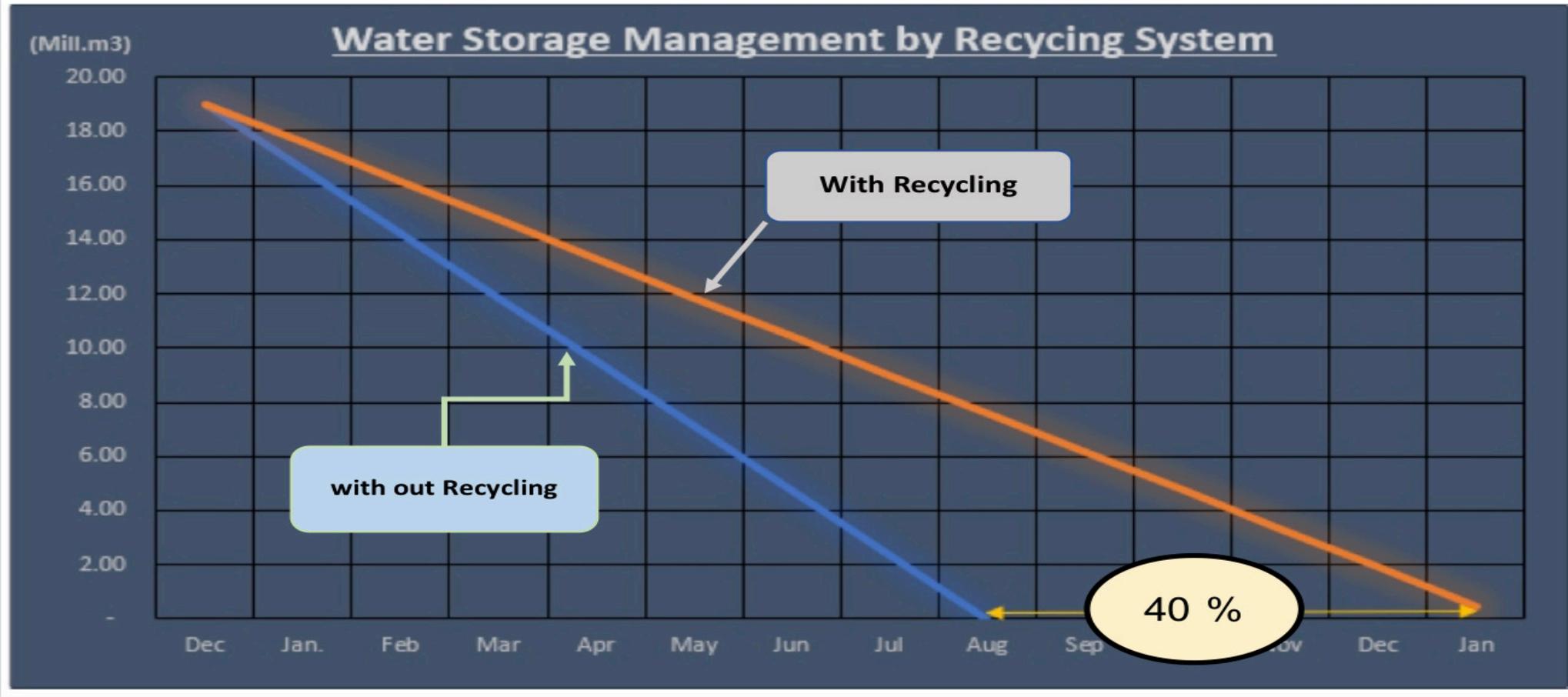


Wastewater Reclamation

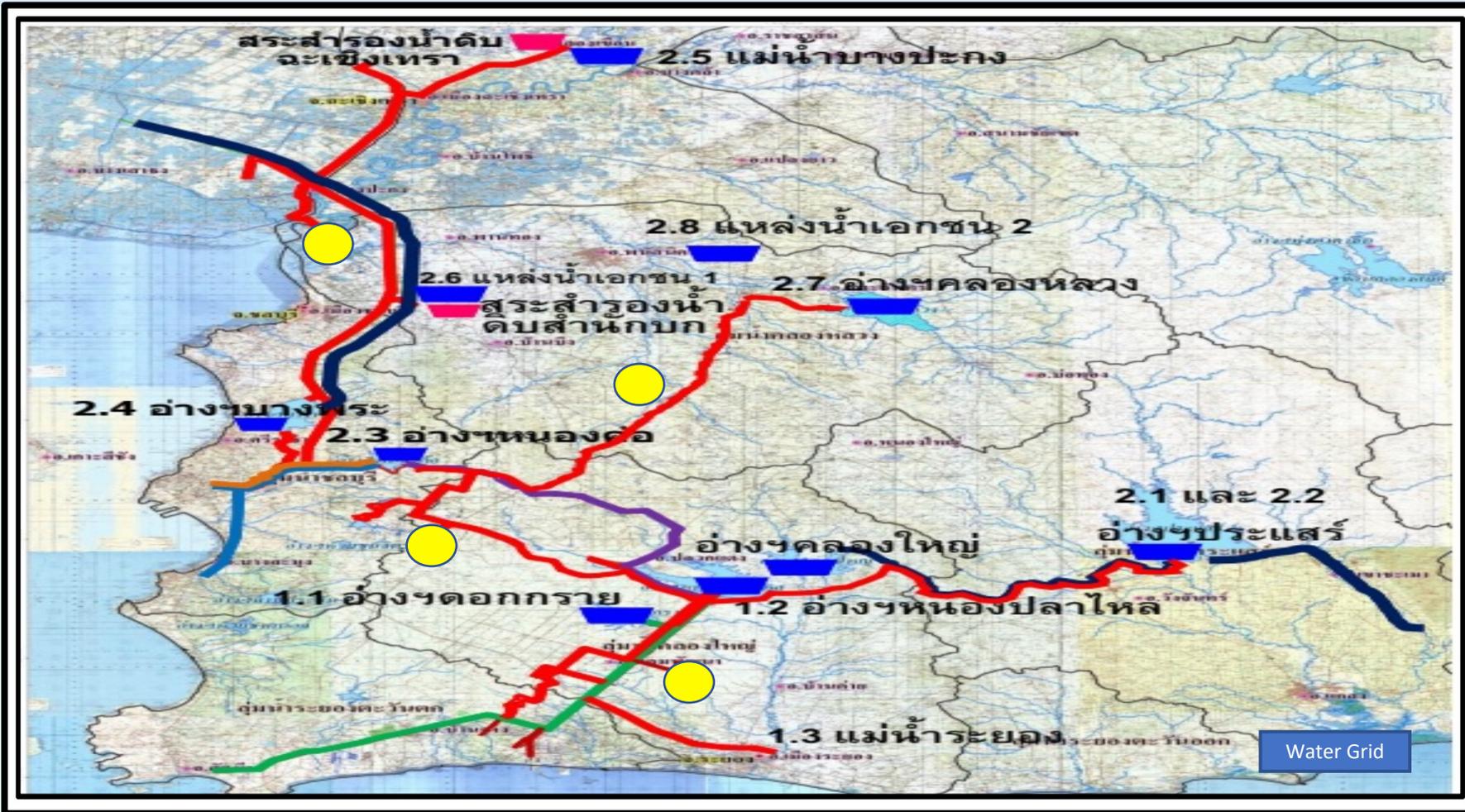


Solar Energy

Wastewater Recycling and Reservoirs Utilization.
จัดการอ่างเก็บน้ำ ร่วมกับ ระบบรีไซเคิลน้ำเสีย



Water Security through Reservoirs and a Water grid management.



Water storage capacity in the eastern region of Thailand!

Reservoirs are vital for water management, including irrigation, flood control, and ensuring a steady supply of water for various sectors such as agriculture, industry, and domestic use.

Having a total capacity of approximately 2520 million cubic meters of water in reservoirs can help mitigate the impact of water crises, such as droughts and floods, and support economic activities in the region.

Water Grid :

A water grid facilitates the transportation of water from reservoirs to areas facing water scarcity across the region. This interconnected network ensures that water can be efficiently transferred to areas in need, minimizing the impact of droughts or other water shortages.

3 Key-Success Factors for Water Security Management. in The Eastern Region, Thailand.

Water Forum 2022 **AMATA**
POSSIBILITIES HAPPEN

Wastewater Reclamation in Amata Industrial Estate.
(Circular Economy Principles in Water Management)

Wastewater Reclamation System for Industrial Estates

Saving water from natural sources by up to 40 percent. **40 %**

Water Quality

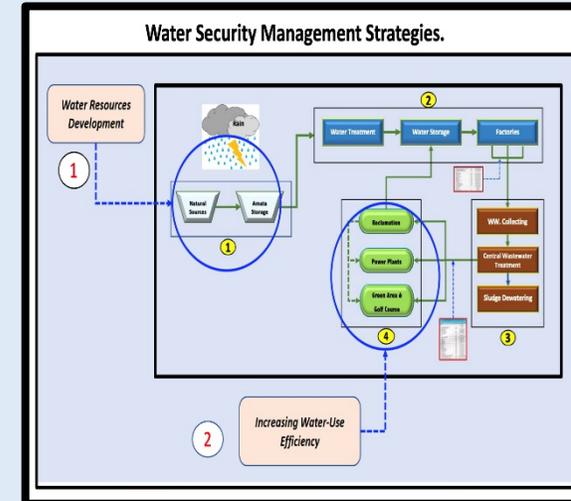
Power Plant.

Green Area in The Parks.

Wastewater Reclamation

Solar Energy

Knowledge Sharing Center.



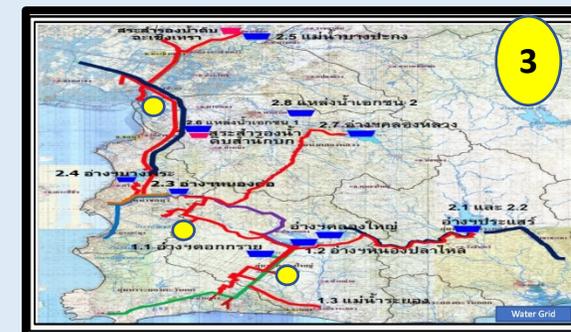
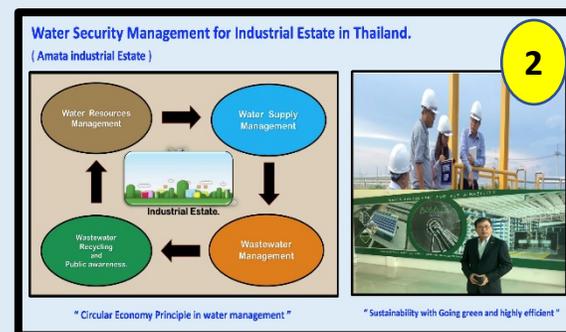
- 1. Water Resource Development :**
Water resource needed to be developed sequentially from surface water , groundwater and seawater desalination
- 2. Wastewater Recyclamation for Industry :**
Implementing a circular economy principle in water management by mean of reduce, reuse and recycle (3Rs.) concept can save water up to 40 % of water-use from natural resources

Water Resources Development Strategies.
(Alternative Water Sources for Industry)

1

1. Surface water development . (พัฒนแหล่งน้ำผิวดิน)
2. Groundwater development . (พัฒนแหล่งน้ำใต้ดิน)
3. Wastewater Reclamation . (การหมุนเวียนน้ำเสียกลับมาใช้ใหม่)
4. Seawater Desalination . (การผลิตน้ำจืดจากน้ำทะเล)

(1) Surface water (2) Groundwater (3) Wastewater Reclamation (4) Seawater Desalination



- 3. Water Grid Management :**
A water grid facilitates the transportation of water from reservoirs to areas facing water scarcity and ensures that water can be efficiently transferred to regions in need, minimizing the impact of droughts or other water shortage.

“ Let’s save the Earth”



Q&A.THANK YOU ...