

“ CHLORINE NEXT ”



มรส-ปทุมธานี
METROPOLITAN WATERWORKS AUTHORITY

Metropolitan Waterworks Authority





Metropolitan Waterworks Authority

กรมประปานครหลวง
METROPOLITAN WATERWORKS AUTHORITY

Metropolitan Waterworks Authority ,Thailand (MWA) is a State enterprise under Ministry of Interior, established since August 16 , 1967. By Metropolitan Waterworks Authority act., MWA is responsible for providing and producing water supply in Bangkok, Nonthaburi, and Samutprakan provinces





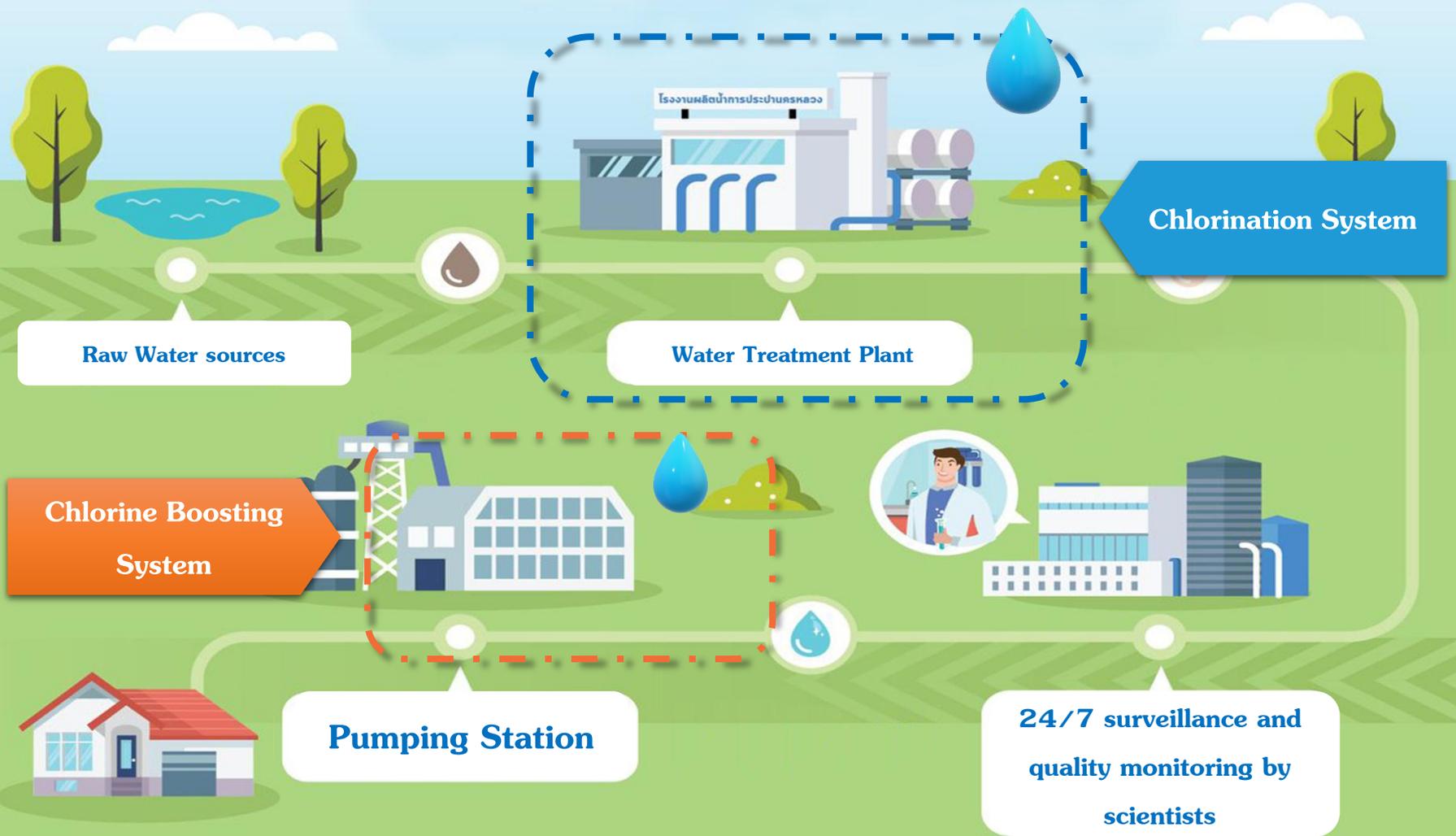
Bangkok

Samutprakan

Nonthaburi



- **Responsible Area : 3,195 km²**
- **Serviced Area : 2,450 km² (76.7%)**
- **Population : 12 million**
- **Production Capacity : 6 million CMD**



Raw Water sources

Water Treatment Plant

Chlorination System

Chlorine Boosting System

Pumping Station

24/7 surveillance and quality monitoring by scientists

Chlorine Boosting at 9 Pumping Stations



Via SCADA System

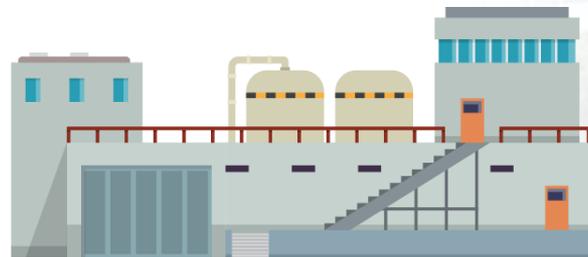
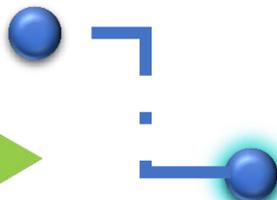
Control At pumping stations : **0.5 - 1.2 mg./L**

At users end : **0.2 mg./L** (WHO guideline for drinking water)

Water Quality Integrated Center



10.00 AM



9 Pumping Stations



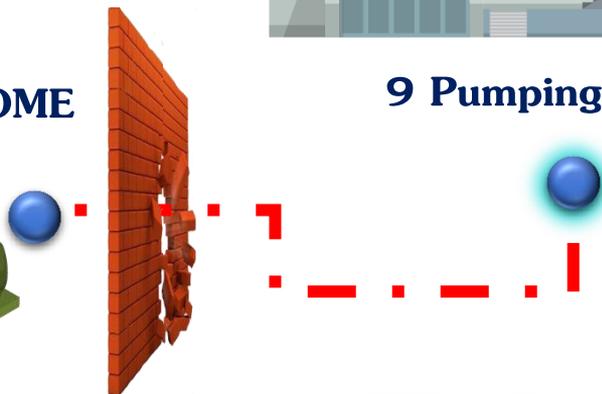
2.00 PM



8.00 PM



HOME



adjustments according
to time period

cannot supply chlorine
afterhours as well as
when the raw water
quality is poor.

Water quality is not
up to the criteria

May be
contaminated

Chlorine Boosting procedure

STEP
01

Predict the water quality from Water Treatment Plant

STEP
02

Calculate the chlorine dosage rate

OC mg/L	% remaining free Res. Cl ₂					
	πρωτογενή (FR 2)		τεταρτογενή (FR 3)			
	απόσπασμα	απόσπασμα	απόσπασμα	απόσπασμα	απόσπασμα	απόσπασμα
20-30	30	25	30	40	35	60
31-55	45	50	50	65	50	70
56-70	60	55	60	70	55	75

$$\text{Litres NaOCl used per Hour} = \frac{\text{InletFlow (M}^3\text{/hr)} \times \text{Desired NaOCl dose (mg/L)}}{\text{Specific Gravity of NaOCl} \times \text{NaOCl Concentration (\%)}} \times 3$$

STEP
03

Adjust the chlorine dosage at the pumping station.



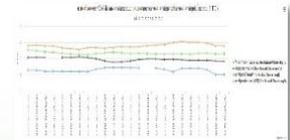
STEP
04

Adjustment report

Αριθμ. Μετρήσεων	Μετρήσεις	Μετρήσεις	Μετρήσεις
1	0.00	0.00	0.00
2	0.00	0.00	0.00
3	0.00	0.00	0.00
4	0.00	0.00	0.00
5	0.00	0.00	0.00
6	0.00	0.00	0.00
7	0.00	0.00	0.00
8	0.00	0.00	0.00
9	0.00	0.00	0.00
10	0.00	0.00	0.00
11	0.00	0.00	0.00
12	0.00	0.00	0.00
13	0.00	0.00	0.00
14	0.00	0.00	0.00
15	0.00	0.00	0.00
16	0.00	0.00	0.00
17	0.00	0.00	0.00
18	0.00	0.00	0.00
19	0.00	0.00	0.00
20	0.00	0.00	0.00
21	0.00	0.00	0.00
22	0.00	0.00	0.00
23	0.00	0.00	0.00
24	0.00	0.00	0.00
25	0.00	0.00	0.00
26	0.00	0.00	0.00
27	0.00	0.00	0.00
28	0.00	0.00	0.00
29	0.00	0.00	0.00
30	0.00	0.00	0.00

STEP
05

Check adjustment performance



Objectives

01

To control free residual chlorine at the reference points.

02

To bring technology to increase the efficiency of chlorine boosting management.

Improvement Steps

CI2 Boosting System

ระบบปรับจ่ายคลอรีนออนไลน์

สถานี

Bangplee

Host

172.16.196.180

OPC Server

KEPware KEPServerEx.V4

OPC Tag Title

ค่า Set Point (WQC:Bangplee: N200_11)

OPC Value

70.000000

กรุณาอย่าลืมทำการรีสตาร์ท SCADA

Write OPC Value



- Any Where

- Any Time

Many Step

Inconvenient

Mobile Application

STEP

1

Web application “CI2 Boosting System”

Development Period

OCT-DEC 18

**Analyze
problem
and user
requirement**

Jan 19

- Assess the readiness of the networking and security of MWA.
- System design

Feb 19

**System
Development**

Feb-Mar 19

**Install and
Test the
system**

Mar 19

**Improvements
and fixes for
system
defects**

May 19

Implementation

Innovation Development Plan & Possibilities

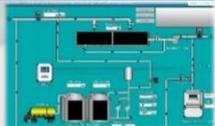


Real Time Water Quality Information

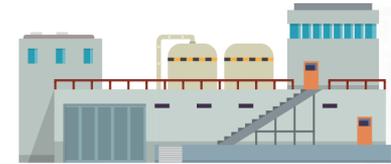
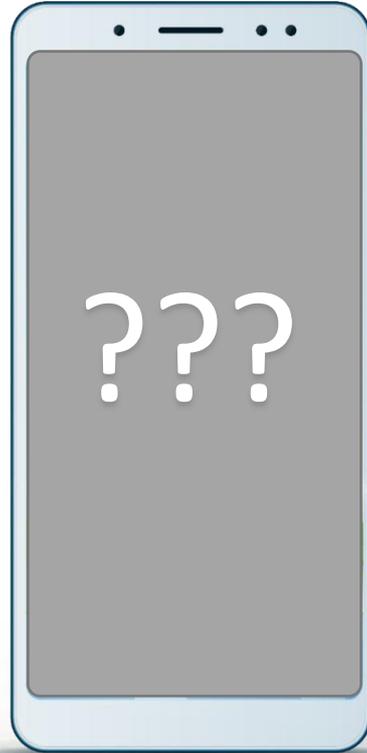


Chlorine Plus

(Free Residual Chlorine forecasting web application)



Chlorine Boosting System



Chlorine Boosting at Pumping Stations

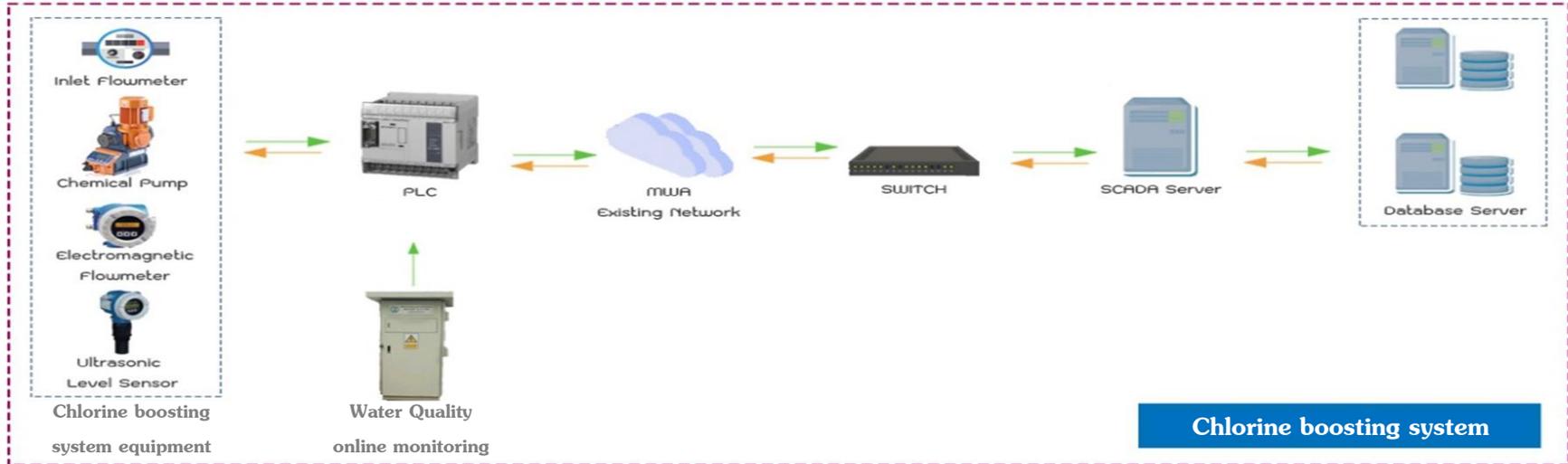
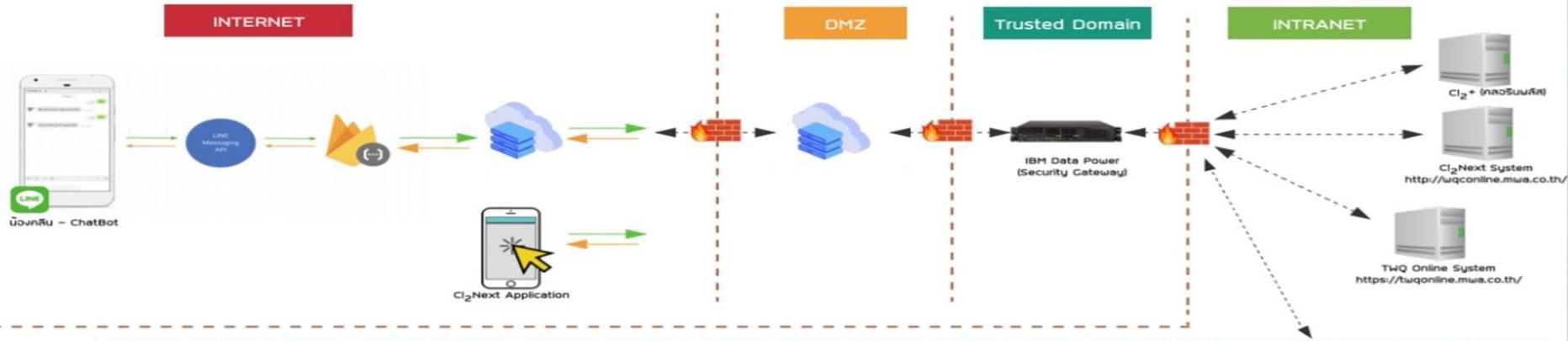
Station	Chlorine	Residual	Chlorine
Station 1	0.50	0.10	0.40
Station 2	0.75	0.15	0.60
Station 3	0.60	0.12	0.48
Station 4	0.80	0.18	0.62
Station 5	0.90	0.20	0.70
Station 6	0.70	0.14	0.56
Station 7	0.65	0.13	0.52
Station 8	0.85	0.17	0.68
Station 9	0.78	0.16	0.62
Station 10	0.95	0.22	0.73

Chlorine Boosting Report

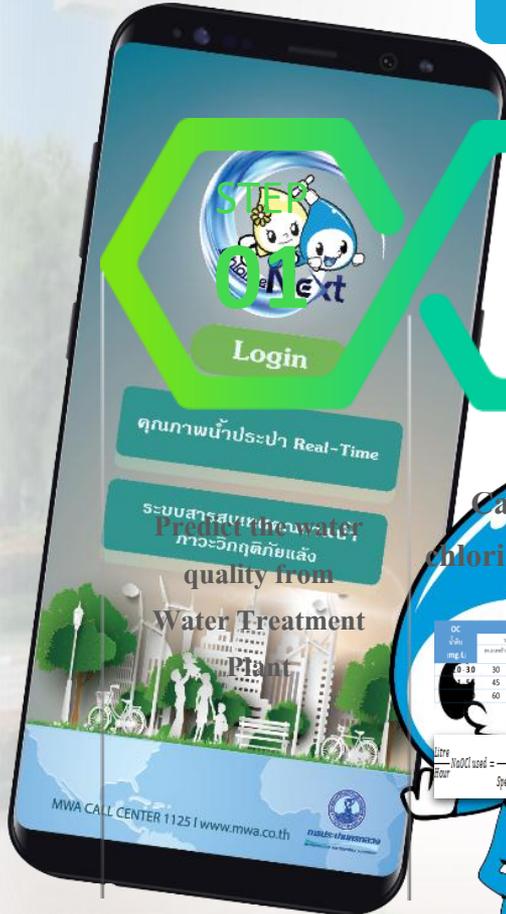
Parameter	Value	Unit
Temperature	22.5	°C
pH	7.8	
Dissolved Oxygen	8.5	mg/L
Total Dissolved Solids	150	mg/L
Total Suspended Solids	25	mg/L
Chlorine Residual	0.5	mg/L
Free Chlorine	0.4	mg/L
Total Chlorine	0.9	mg/L
Ammonia Nitrogen	0.1	mg/L
Nitrite Nitrogen	0.05	mg/L
Nitrate Nitrogen	1.2	mg/L
Orthophosphate	0.05	mg/L
Calcium	120	mg/L
Magnesium	30	mg/L
Hardness	150	mg/L
Chloride	100	mg/L
Sulfate	50	mg/L
Total Hardness	150	mg/L

Water Quality Report

สถาปัตยกรรมระบบ-SCADA Cl₂Next :
Cl₂Next – System Architecture :



Chlorine Next



Calculate the chlorine dosing rate

DC	ค่าเฉลี่ย	ค่าสูงสุด	ค่าต่ำสุด	ค่าเฉลี่ย	ค่าสูงสุด	ค่าต่ำสุด
0-10	30	25	40	35	30	45
10-20	45	50	65	50	45	60
20-30	60	55	70	55	60	65

$$\text{Litres NaOCl used} = \frac{\text{InletFlow} \left(\frac{\text{m}^3}{\text{hr}} \right) \times \text{Desired NaOCl dose} \left(\frac{\text{mg}}{\text{l}} \right)}{\text{Specific Gravity of NaOCl} \left(\frac{\text{kg}}{\text{l}} \right) \times \text{NaOCl Concentration}(\%)}$$

STEP 02

STEP 03

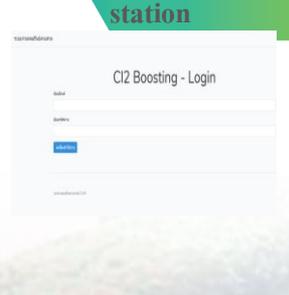
STEP 04

STEP 05

Adjust the chlorine dosing at the pumping station

Adjustment report

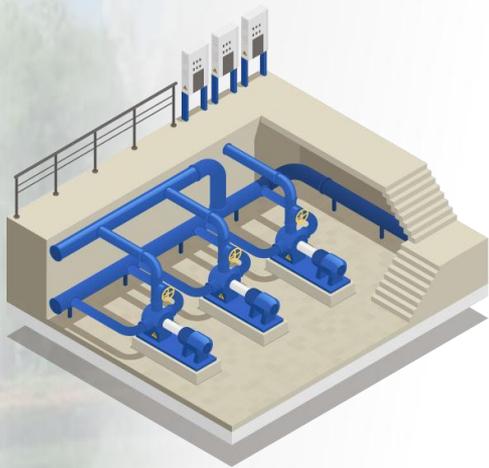
Check adjustment performance



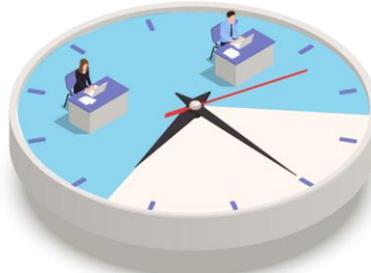
ชื่อ	รหัส	สถานะ	วันที่	เวลา	IP
admin	1234	สำเร็จ	2565	10:00	192.168.1.1
admin	1234	สำเร็จ	2565	10:05	192.168.1.1
admin	1234	สำเร็จ	2565	10:10	192.168.1.1
admin	1234	สำเร็จ	2565	10:15	192.168.1.1
admin	1234	สำเร็จ	2565	10:20	192.168.1.1
admin	1234	สำเร็จ	2565	10:25	192.168.1.1
admin	1234	สำเร็จ	2565	10:30	192.168.1.1
admin	1234	สำเร็จ	2565	10:35	192.168.1.1
admin	1234	สำเร็จ	2565	10:40	192.168.1.1
admin	1234	สำเร็จ	2565	10:45	192.168.1.1
admin	1234	สำเร็จ	2565	10:50	192.168.1.1
admin	1234	สำเร็จ	2565	10:55	192.168.1.1
admin	1234	สำเร็จ	2565	11:00	192.168.1.1



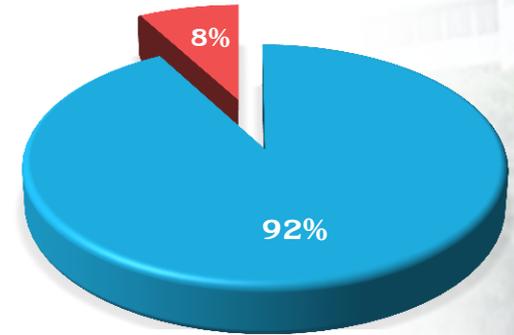
Free Residual Chlorine Percentage at Bang Phli Pumping Station ≥ 0.5 mg/l (Control Criteria at Pumping Station)



Pumping Stations



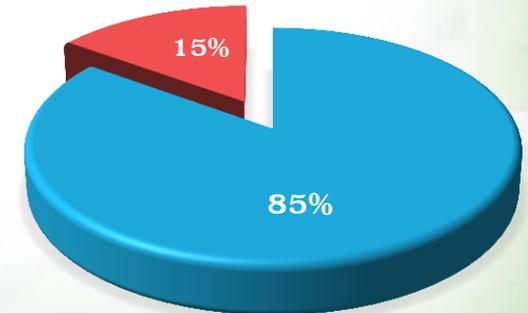
On Duty (8.30 AM – 4.30 PM)



■ on criteria ■ off criteria

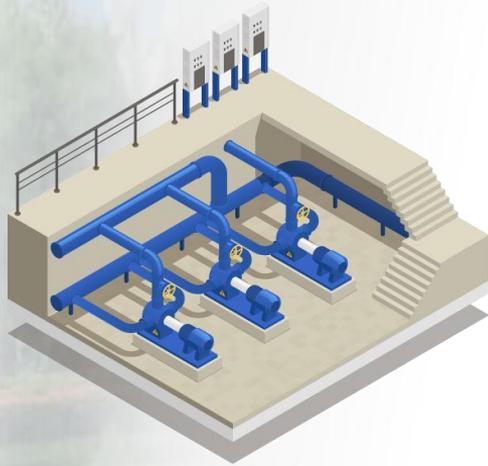


Off Duty (4.30 PM – 8.30 AM)

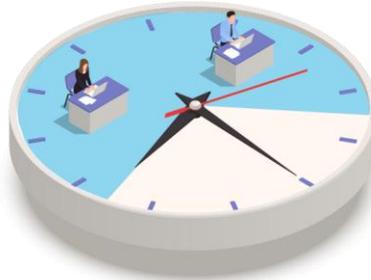


■ on criteria ■ off criteria

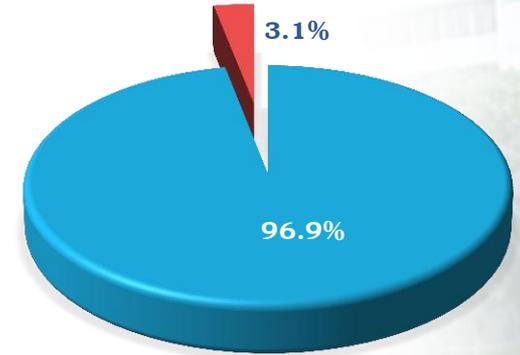
Free Residual Chlorine Percentage at Bang Phli Pumping Station ≥ 0.5 mg/l (Control Criteria at Pumping Station)



Pumping Stations



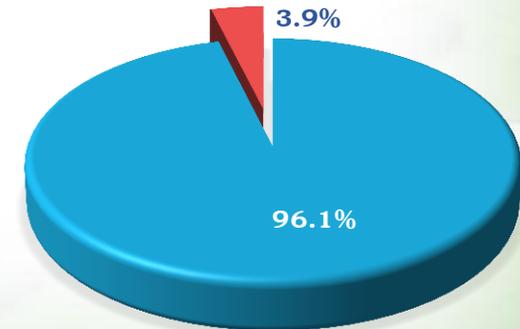
On Duty (8.30 AM – 4.30 PM)



■ on criteria ■ off criteria

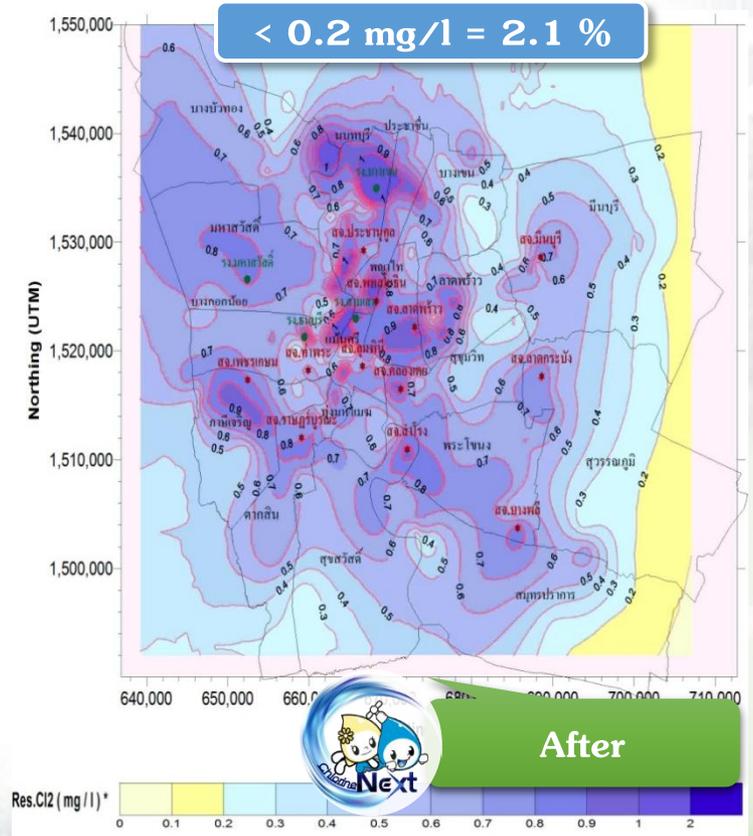
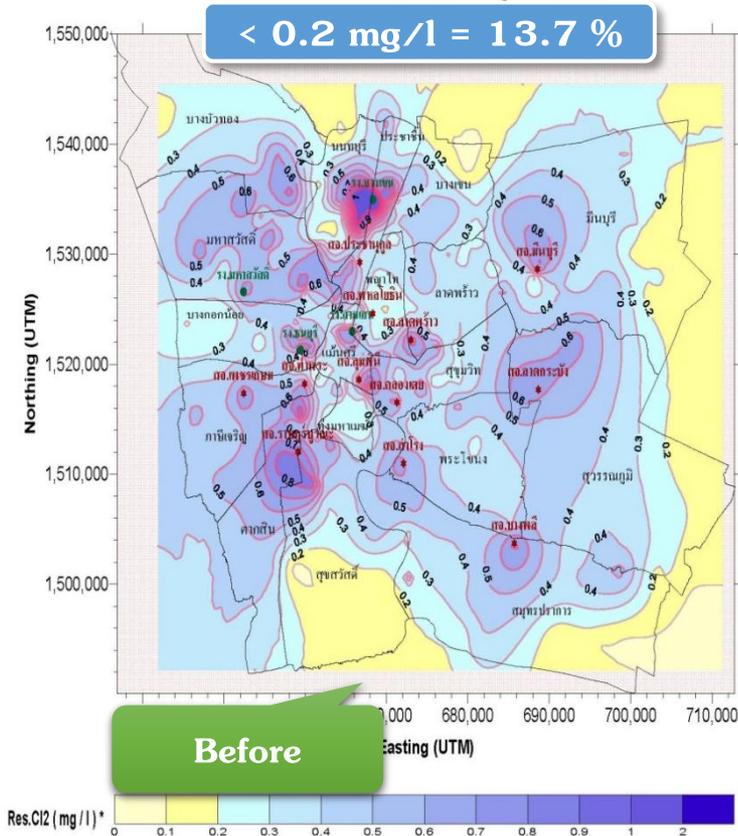


Off Duty (4.30 PM – 8.30 AM)

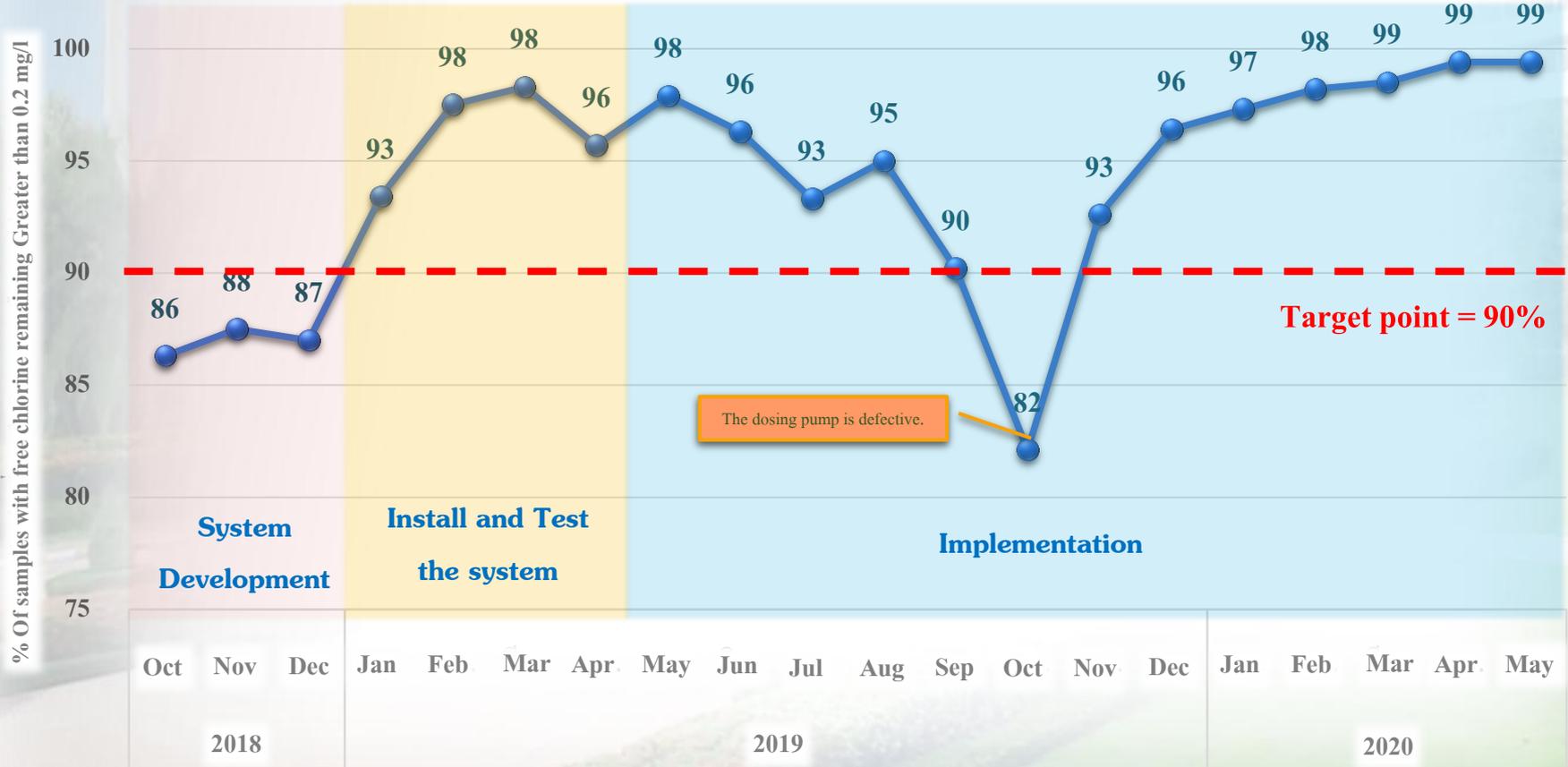


■ on criteria ■ off criteria

Chlorine Contours



% of Samples with Free Chlorine Remaining Greater than 0.2 mg/l (Oct. 2018 - May 2020)



Benefits



Get new innovation to control the free residual chlorine level in the water supply system.



Reduce steps and work time.

30 min.

2 min.



Reduce expenses approximately (Over-Time)

1.8 million baht / year



Benefits

Control the chlorine at the end of the line to be in the criteria regularly.

Responding to Water Safety plans of MWA.

Build a good quality of life. People received safe and clean tap water.



**World Health
Organization**





Chlorine **Next**

THANK YOU