

Water Resources and Environment Department, Metropolitan Waterworks Authority (MWA), Bangkok, Thailand



Ministry of Interior



Metropolitan Waterworks Authority (MWA) Established in 1967 as a State Enterprise under Ministry of Interior.

MISSIONS

Providing Raw Water Sources for Waterworks Activities Producing, Distributing and Selling treated water in Responsible Area Running Other Businesses Related or Beneficial to Waterworks

MWA Responsible Area







Conventional Water Treatment Process



Water Treatment Plants (WTP)



Bangkhen WTP





Samsen WTP



Thonburi WTP



Mahasawat WTP





บริเวณที่มีฝนตกน้อย และมีโอกาสสูงที่จะเกิดภัยแล้ง

18505

www.tmd.go.th

Drought Crisis

Amount of water in the dam is very low.

Not enough for all activities

Need to limit water

consumption

Drought Quite drought Normal

Over the years, there has been a severe drought in Thailand.

WARNING







Areas is not affected by high sea water.

Areas have been affected by high seawater at certain times. (65%)

Number of people affected



Classified by water consumption type





Development of Tool and Methods to Solve

The Saltwater Intrustion Problem of MWA.



Samlae Raw Water Pumping Station --

In the past, the pump at Samlae Raw Water Pumping Station was controlled using the water level at the Royal Thai Navy Headquarters, which is 50 kilometers from Samlae Raw Water Pumping Station.

Royal Thai Navy Headquarters point -



| ะดิจู .ศ.ษ | าลูด (Lat) 13 44 33 น.(N) ลองจีลูด (Long) 100 29 33 อ.(E LibdCom YEAR 202 | | | | | | | | | | | | | | | 0° 29' 3 YEA | 33" D.(8 |
|---------------|--|---------------------|----------|--------------|----------------------|-------------|--------------|----------------|----------|--------------|-------------------|---------------|--------------|---------|-----|-----------------|----------|
| | เมษายน APRIL | | | | | พฤษภาคม MAY | | | | | | มิถุนายน JUNE | | | | | |
| | 1281 TIME | हु। (u.) (M.) TH | | LOB1 TIME | ត្ត៖ (11) HT (M.) | | LOB1 TIME | (山) 時 日本(M) | | 1281 TIME | (山) (山) HT (M) | | 1280 TIME | 81 (LL) | | 1281 TIME | Ra (a. |
| 1 | 0423 | 2.51 | 16 | 0254 | 2.85 | 1 | 0200 | 2.84 | 16 | 0243 | 2.81 | 1 | 0242 | 2.78 | 16 | 0207 | 2.67 |
| VE | 0844 | 2.86 | TH | 1901 | 1.50 | FR | 1840 | 1.27 | SA | 1856 | 1.42 | MO | 1015 | 1.86 | TU | 1040 | 1.51 |
| 0 | 1012 | 1.44 | | | | 2 | | | | | | | 1935 | 1.56 | | 1912 | 1.96 |
| 2 | 0200 | 2.73 | 17 | 0408 | 2.86 | 2 | 0303 | 2.84 | 17 | 0314 | 2.79 | 2 | 0304 | 2.77 | 17 | 0232 | 2.62 |
| н | 0430 | 2.66 | FR | 1951 | 1.58 | SA | 1925 | 1.36 | SU | 1100 | 1.98 | TU | 1059 | 1.56 | WE | 1117 | 1.29 |
| | 1900 | 1.47 | | | | | | | | 1942 | 1.60 | | 2044 | 1.84 | | | |
| 6 | 0715 | 2.83 | 18 | 0457 | 2.88 | 3 | 0351 | 2.85 | 18 | 0343 | 2.78 | 3 | 0322 | 2.79 | 18 | 0257 | 2.59 |
| FR | 2001 | 1.49 | SA | 2102 | 1.65 | SU | 2025 | 1.48 | MO | 1127 | 1.72 | WE | 1145 | 1.28 | TH | 1156 | 1.15 |
| | | | | | | | | | | 2051 | 1.81 | | 2255 | 2.05 | | 1721 | 4.35 |
| | 0639 | 2.87 | 19 | 0524 | 2.89 | 4 | 0428 | 2.88 | 19 | 0410 | 2.76 | 4 | 0348 | 2.80 | 19 | 0005 | 2.30 |
| A. | 2127 | 1.50 | SU | 1222 | 2.04 | MO | 1133 | 1.95 | TU | 1157 | 1.48 | TH | 1235 | 1.08 | FR | 0324 | 2.58 |
| | | | | 1622 | 2.34 | | 2155 | 2.27 | | 2315 | 2.33 | | 1859 | 2.70 | | 1238 | 2.74 |
| 5 | 0533 | 2.93 | 20 | 0534 | 2.88 | 5 | 0456 | 2.90 | 20 | 0432 | 2.74 | 5 | 0005 | 2.19 | 20 | 0053 | 2.34 |
| J | 1224 | 2.35 | MO | 1241 | 1.83 | TU | 1211 | 1.66 | WE | 1230 | 1.31 | FR | 0420 | 2.80 | SA | 0357 | 2.57 |
| | 1430 | 2.41 | | 1731 | 2.47 | | 1714 | 2.48 | | 1846 | 2.54 | | 1330 | 0.96 | | 1324 | 1.01 |
| | 0600 | 2.98 | 21 | 0008 | 1.70 | 6 | 0518 | 2.92 | 21 | 0020 | 2.03 | 6 | 0052 | 231 | 21 | 0139 | 2.37 |
| 0 | 1242 | 2.12 | TU | 0546 | 2.87 | WE | 1255 | 1.40 | TH | 0447 | 2.71 | SA | 0456 | 2.77 | SU | 0433 | 2.56 |
| | 1647 | 2.54 | | 1305 | 1.64 | | 1822 | 2.73 | | 1306 | 1.20 | 0 | 1425 | 0.90 | • | 1414 | 0.97 |
| | 0000 | | 22 | 1827 | 2.62 | - | 0007 | 1.00 | 22 | 1935 | 2.71 | | 2109 | 3.03 | | 2132 | 2.94 |
| τυ | 0629 | 3.00 | WE | 0604 | 2.86 | TH | 0534 | 2.92 | FR | 0500 | 2.70 | SU | 0534 | 2.73 | MO | 0236 | 2.54 |
| | 1320 | 1.88 | | 1335 | 1.50 | \bigcirc | 1343 | 1.21 | | 1345 | 1.14 | | 1515 | 0.87 | | 1500 | 0.91 |
| | 1805 | 2.74 | | 1913 | 2.74 | ~ | 1921 | 2.92 | | 2017 | 2.83 | | 2204 | 3.08 | | 2214 | 2.98 |
| F | 0117 | 1.44 | 23 TH | 0132 | 1.80 | 8 FR | 0120 | 1.95 | 23 54 | 0143 | 2.17 | 8 | 0204 | 2.48 | 23 | 0335 | 2.39 |
| 5 | 1402 | 1.65 | | 1408 | 1.39 | | 1430 | 1.10 | | 1426 | 1.11 | 1110 | 1558 | 0.87 | 10 | 1543 | 0.84 |
| / | 1901 | 2.91 | • | 1952 | 2.84 | | 2019 | 3.04 | • | 2057 | 2.91 | 1000 | 2254 | 3.08 | | 2252 | 2.99 |
| | 0158 | 1.56 | 24 | 0204 | 1.89 | 9 | 0155 | 2.12 | 24 | 0214 | 2.23 | 9 | 0245 | 2.49 | 24 | 0416 | 2.37 |
| н | 1444 | 1.47 | PR | 1442 | 1.34 | - SA | 1517 | 1.05 | 50 | 1507 | 1.09 | 10 | 1634 | 0.87 | VVE | 1617 | 0.79 |
| | 1953 | 3.03 | | 2025 | 2.92 | | 2119 | 3.09 | | 2137 | 2.95 | | | | | 2327 | 2.98 |
|) | 0229 | 1.74 | 25 | 0230 | 1.99 | 10 | 0225 | 2.27 | 25 | 0242 | 2.28 | 10 | 0742 | 2.59 | 25 | 0449 | 2.33 |
| 8 | 0721 | 2.96 | SA | 0647 | 2.78 | SU | 1601 | 2.86 | MO | 0619 | 2.64 | WE | 1703 | 0.91 | TH | 0713 | 2.49 |
| | 2043 | 3.08 | | 2053 | 2.97 | | 2221 | 3.08 | | 2222 | 2.96 | | | | | 2356 | 2.95 |
| | 0250 | 1.95 | 26 | 0251 | 2.10 | 11 | 0259 | 2.40 | 26 | 0313 | 2.32 | 11 | 0013 | 2.97 | 26 | 0521 | 2.25 |
| 1 | 0730 | 2.96 | SU | 0701 | 2.76 | MO | 0715 | 2.82 | TU | 0648 | 2.62 | TH | 0540 | 2.39 | FR | 0759 | 2.44 |
| | 2132 | 3.08 | | 2122 | 3.00 | | 2325 | 3.04 | | 2312 | 2.96 | | 1724 | 0.96 | | 1100 | 0.02 |
| 6 | 0314 | 2.16 | 27 | 0317 | 2.19 | 12 | 0337 | 2.49 | 27 | 0348 | 2.35 | 12 | 0042 | 2.88 | 27 | 0020 | 2.90 |
| J | 0751 | 2.96 | MO | 0718 | 2.74 | TU | 0749 | 2.77 | WE | 0717 | 2.60 | FR | 0618 | 2.30 | SA | 0600 | 2.14 |
| | 2228 | 3.02 | | 2157 | 2.99 | | 1113 | 1.11 | | 1003 | 0.97 | | 1736 | 1.05 | | 1726 | 0.94 |
| 8 | 0344 | 2.35 | 28 | 0348 | 2.29 | 13 | 0025 | 2.98 | 28 | 0001 | 2.94 | 13 | 0102 | 2.81 | 28 | 0041 | 2.84 |
| 0 | 0817 | 2.94 | TU | 0737 | 2.74 | WE | 0421 | 2.54 | TH | 0431 | 2.38 | SA | 0711 | 2.18 | SU | 0651 | 1.99 |
| | 2346 | 2.93 | | 1653 | 2.94 | | 1743 | 1.16 | | 1722 | 0.96 | C | 1746 | 117 | 2 | 1033 | 1 15 |
| 1 | 0418 | 2.52 | 29 | 0424 | 2.40 | 14 | 0118 | 2.91 | 29 | 0049 | 2.91 | 14 | 0120 | 2.75 | 29 | 0057 | 2.79 |
| J | 0843 | 2.88 | WE | 0800 | 2.73 | TH | 1803 | 1.22 | FR | 0531 | 2.38 | SU | 0829 | 2.00 | MO | 0756 | 1.80 |
| | 1754 | 1.36 | | 1727 | 1.20 | C | | | | 0826 | 2.50 | | 1125 | 2.05 | | 1157 | 2.12 |
| 3 | 0121 | 2.86 | 30 | 0026 | 2.87 | 15 | 0205 | 2.85 | 30 | 0132 | 2.86 | 15 | 0141 | 271 | 30 | 0102 | 2.75 |
| Ē | 0458 | 2.66 | TH | 0505 | 2.52 | FR | 1825 | 1.30 | SA | 1815 | 1.12 | MO | 1000 | 1.76 | TU | 0915 | 1.56 |
| 2 | 0856 | 2.79 | | 0826 | 2.70 | | | | D | | | | 1332 | 1.93 | | 1344 | 2.10 |
| | 1826 | 1.43 | | 1802 | 1.21 | | | | 31 | 0212 | 2.82 | | 1831 | 1.64 | | 1845 | 1.79 |
| | | | | | | | | | SU | 0920 | 2.14 | | | | | | |
| | | | | | | | | | | 1130 | 2.19 | | | | | | |

Development of tool and methods of MWA.





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3.7





Real Time data from the MWA measurement system



Automatic water quality and level meter In Chao Phraya River and raw water canal to monitor the raw water in real time



Water level in Chao Phraya River in front of raw water pumping station.



The actual water level data from the instrument compare

with water level forecast from the Hydrographic Department in Thailand

Required data for the development of the tool





Water Management Data



Salinity forecast in Chao Phraya River



Base Model "Rak Nam" from NECTEC (Thailand's National Electronics and Computer Technology Center) Forecast of salinity in the Chao Phraya River in front of the raw water pumping station 7 days in advance

Anti Salinity Tool (AnSaT)



Real time data from measurement system of MWA. Water levels prediction in Chao Phraya River at MWA's raw water pumping station from the Hydrographic Department.

Salinity forecast in Chao Phraya River at MWA's raw water pumping station from the Nectec.

Plan to manage raw water pump to avoid saltwater



All of data is integrated into machine learning using the LSTM (Long short-term memory) tool. Produces a tool called "AnSaT"

Main component of AnSaT at Samlae Pumping Station













Applications of AnSaT tool

for solving salinity problem of MWA.

Applications of AnSaT



MWA can prepare enough reserve water in the raw water canal and notify the water treatment plant.



Applications of AnSaT





AnSaT forecast period of time that high salinity in raw water at Samlae pumping station.

- The raw water pump can <u>avoid pumping</u> saltwater into the raw water canal. By reducing the pumping during the high salinity in raw water
- AnSaT <u>Reduce</u> the impact on tap water quality

Case : Normal (Salinity < 0.25 g/l) 23 **Applications of AnSaT** Chao Phraya Dam $Q = 70 \text{ m}^{3/\text{s}}$ Water Treatment Plant **Raw Water Pumping Station** Customer **Chao Phraya River** 1 $\mathbf{Q} = 60 \, \mathrm{m}^3/\mathrm{s}$ **Raw Water Canal** $= 10 \text{ m}^{3/\text{s}}$ Khlong Lad Pho Floodgate

gulf of Thailand

Applications of AnSaT Case : Salinity > 0.25 g/l



gulf of Thailand





gulf of Thailand

Water hammer operation results



These Tool & methods can decrease affect from saltwater intrusion for MWA















Thank Y

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Usala

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