April 28, 2016
Tokyo Electric Power Company Holdings, Inc.

Progress of Landside Impermeable Wall freezing: Phase 1 of the first stage

TEPCO

○The purpose of the Landside Impermeable Wall construction lies not in freezing soil to form a underground wall but in keeping groundwater from flowing into the reactor/turbine buildings, which leads the prevention of new contaminated water being generated.
○By closing the entire seaside line in Phase 1 of the first stage, it is expected that the flow of groundwater into the bank protection area will be prevented. As a result, the groundwater levels around the buildings will rise and the risks will be reduced of contaminated water leaking from the buildings if the set groundwater levels inside and outside of the buildings are reversed.
○How freezing of the Landside Impermeable Wall on the seaside line has progressed will be evaluated by checking the difference in groundwater levels inside and outside of the wall.

Changes in soil temperatures over time

Note
- Average Soil Temperature (AST) of medium-grained sandstone layer (blue line): average value of thermometer temperatures measured at 1m intervals except for the areas between ground surface and Ground Level 2m and the areas around the first muddy layer boarder.
- Average Soil Temperature (AST) of alternating strata layer (red line): Average value of thermometer temperatures measured at 1m intervals except for the areas around the upper and lower parts of the alternating layer boarder.

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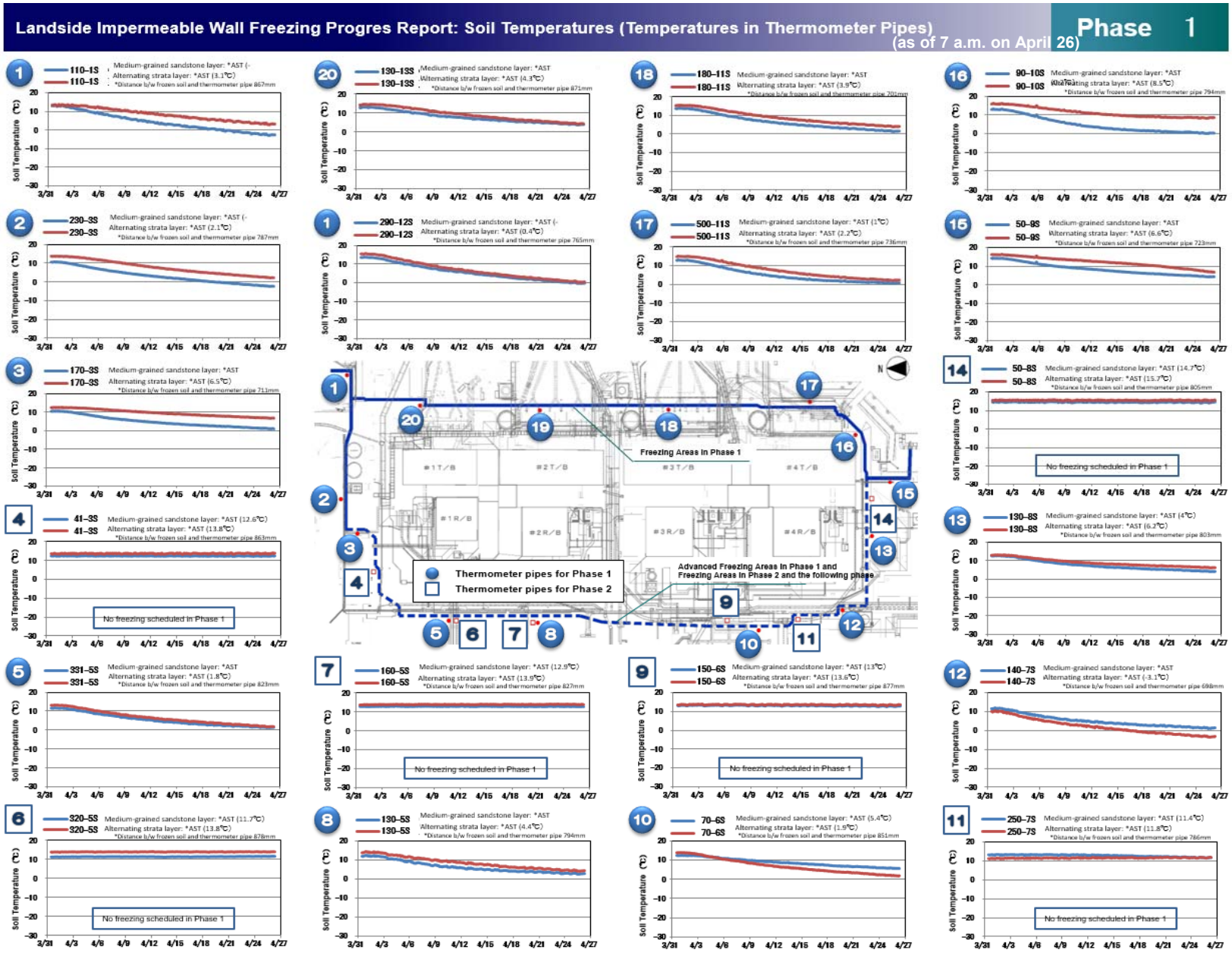
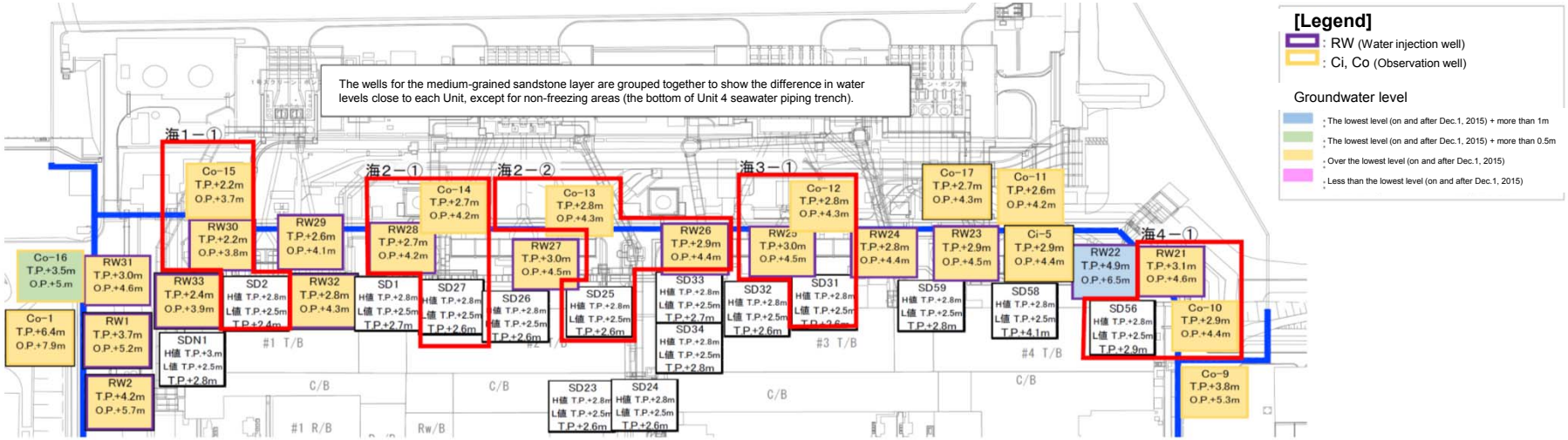
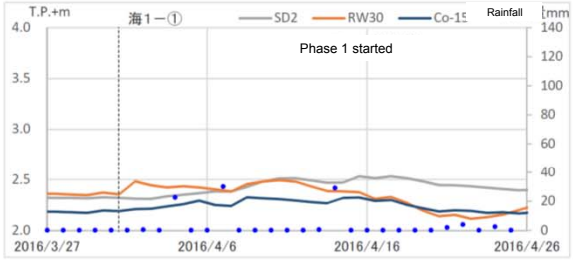


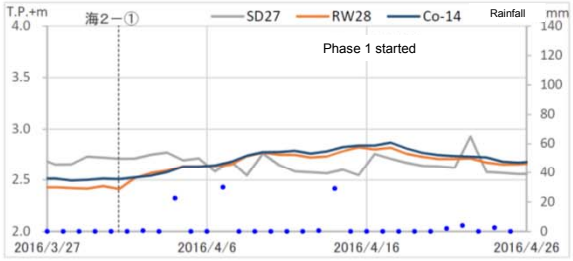
Groundwater levels and hydraulic heads (in the medium-grained sandstone layer 1 on the seaside)

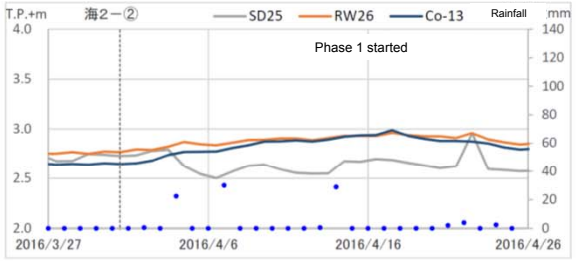
1. Landside Impermeable Wall (groundwater levels around the seaside and the operations of Subdrain pumping system)

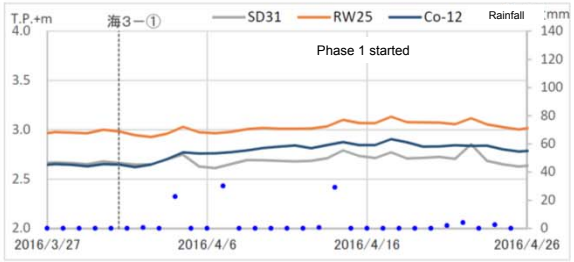


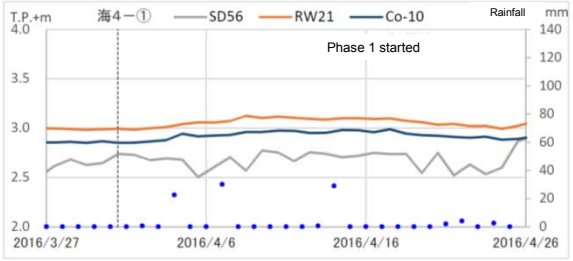
2. Groundwater levels inside and outside of the Landside Impermeable Wall







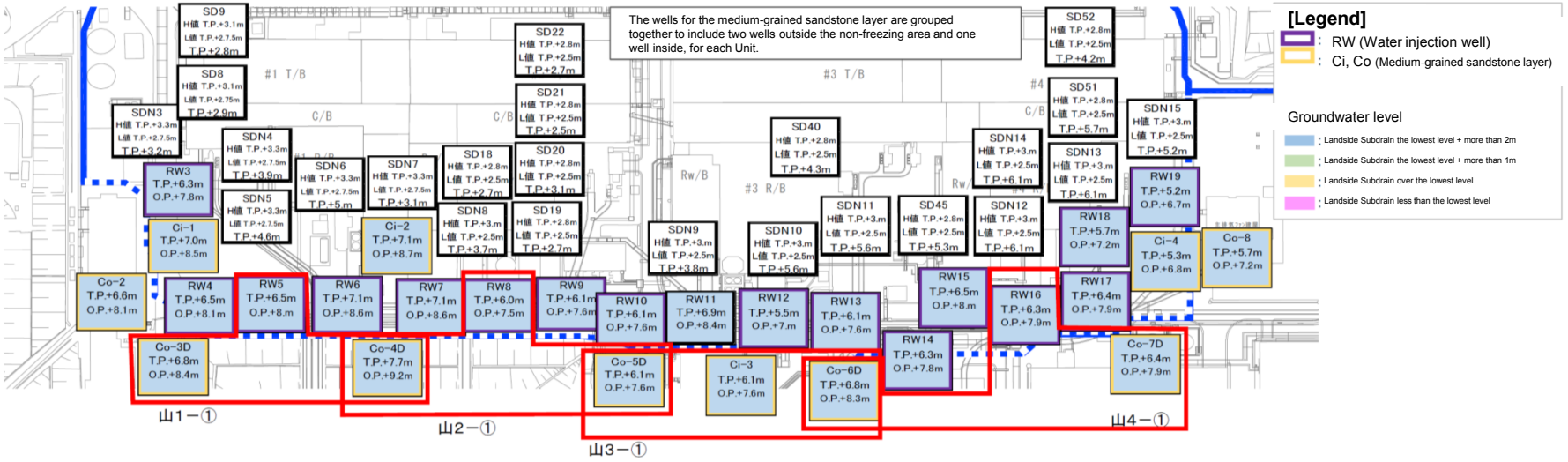




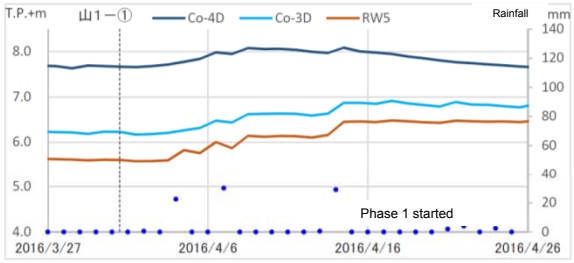
The data of groundwater levels are as of 12 p.m. on April 26.

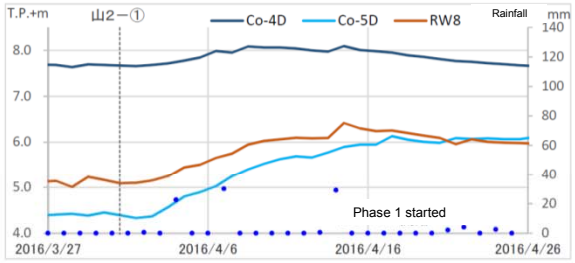
Groundwater levels and hydraulic heads (in the medium-grained sandstone layer 2 on the landside)

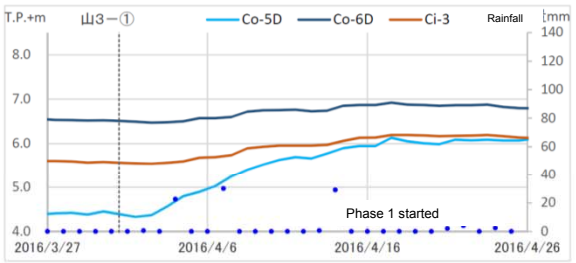
3. Landside Impermeable Wall (groundwater levels around the seaside and the operations of Subdrain pumping system)

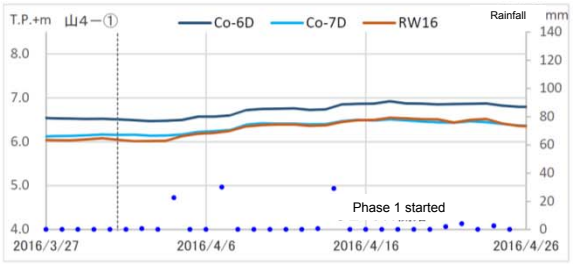


4. Groundwater levels inside and outside of the Landside Impermeable Wall





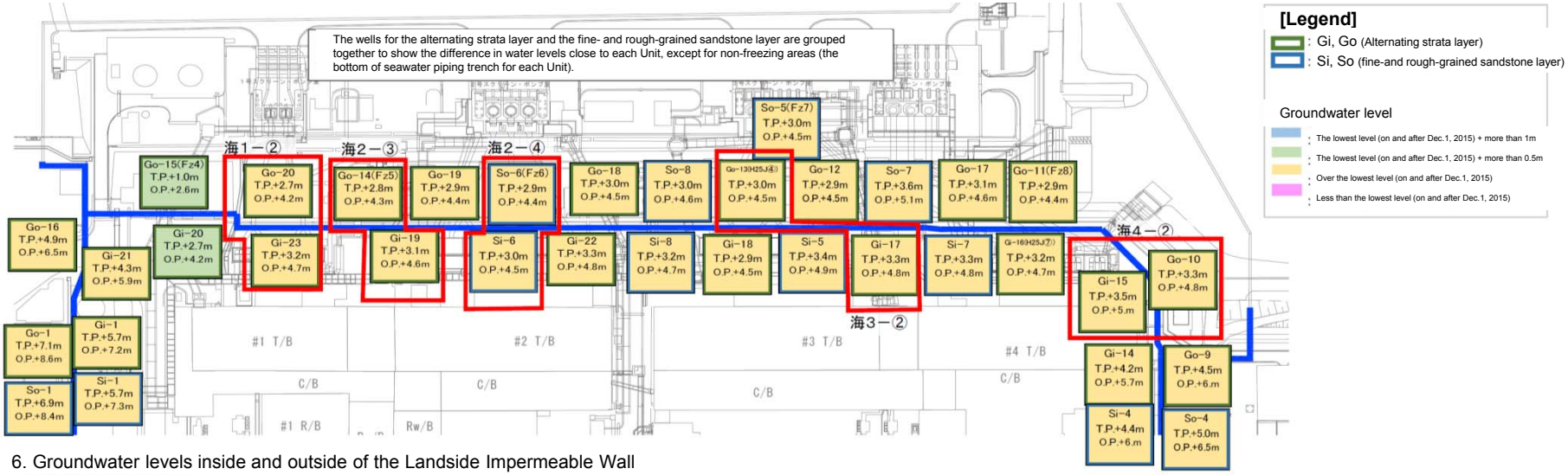




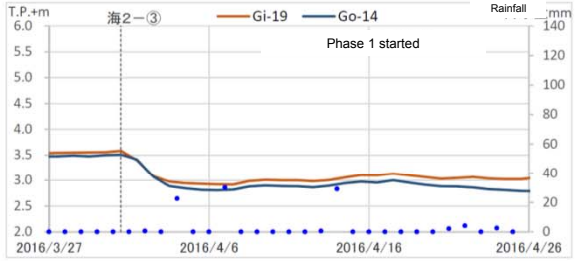
The data of groundwater levels are as of 12 p.m. on April 26.

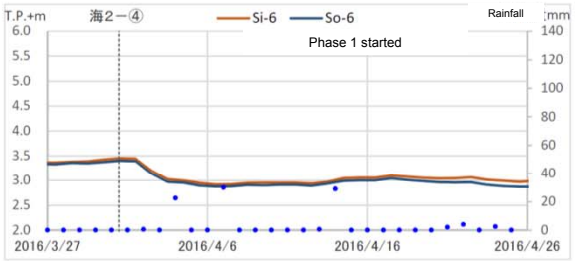
Groundwater levels and hydraulic heads
(in the alternating strata layer and the fine- and rough-grained sandstone layer 1 on the seaside)

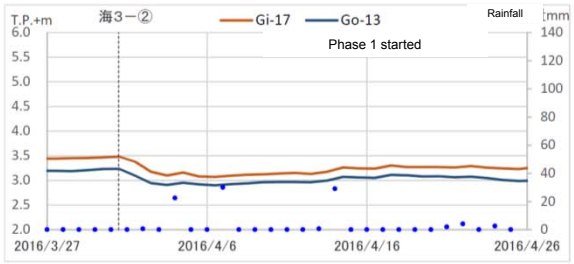
5. Landside Impermeable Wall (groundwater levels around the seaside and the operations of Subdrain pumping system)

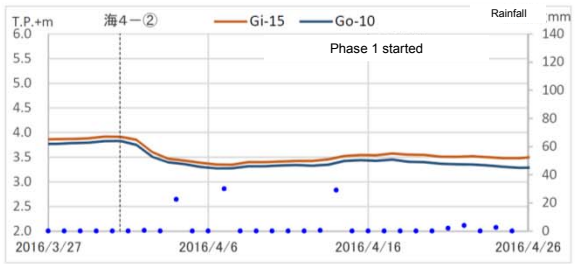


6. Groundwater levels inside and outside of the Landside Impermeable Wall





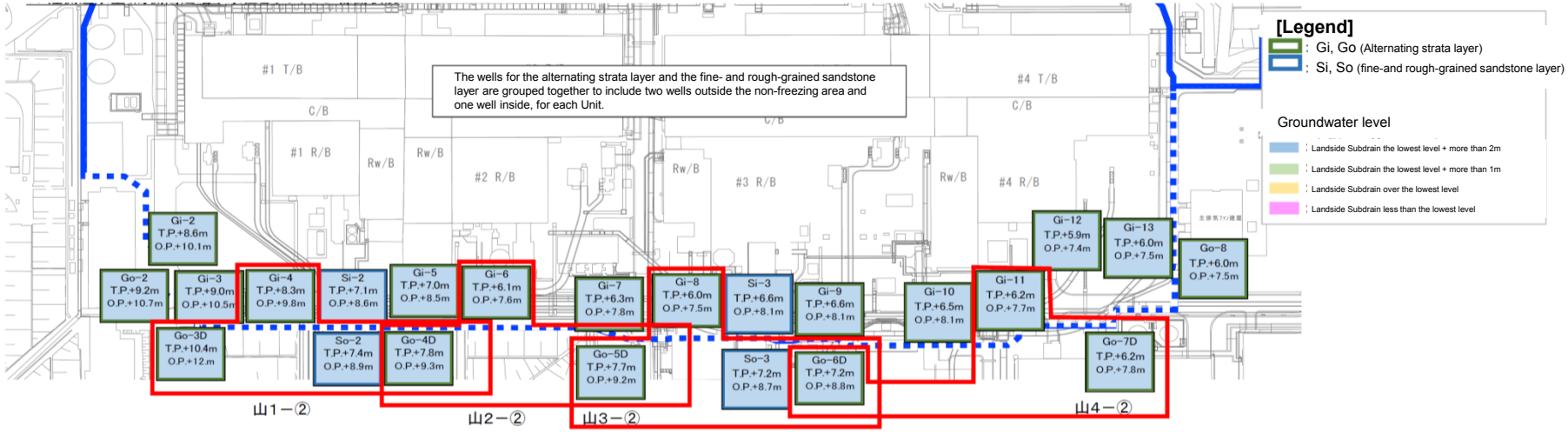




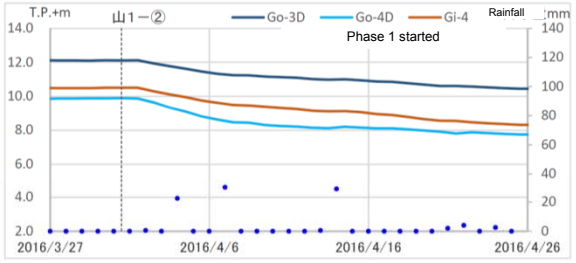
The data of groundwater levels are as of 12 p.m. on April 26.

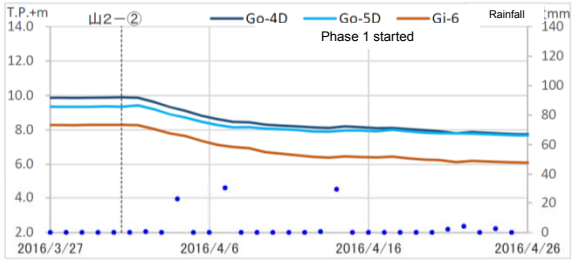
Groundwater levels and hydraulic heads
(in the alternating strata layer and the fine- and rough-grained sandstone layer 1 on the seaside)

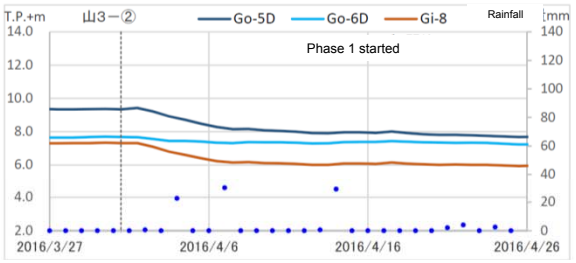
7. Landside Impermeable Wall (groundwater levels around the seaside and the operations of Subdrain pumping system)

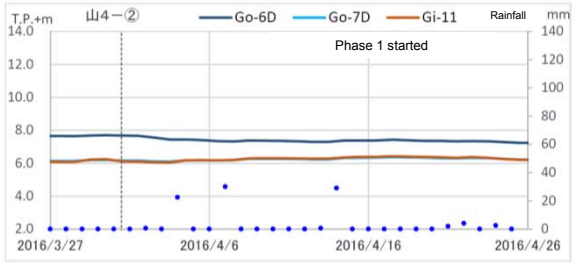


8. Groundwater levels inside and outside of the Landside Impermeable Wall



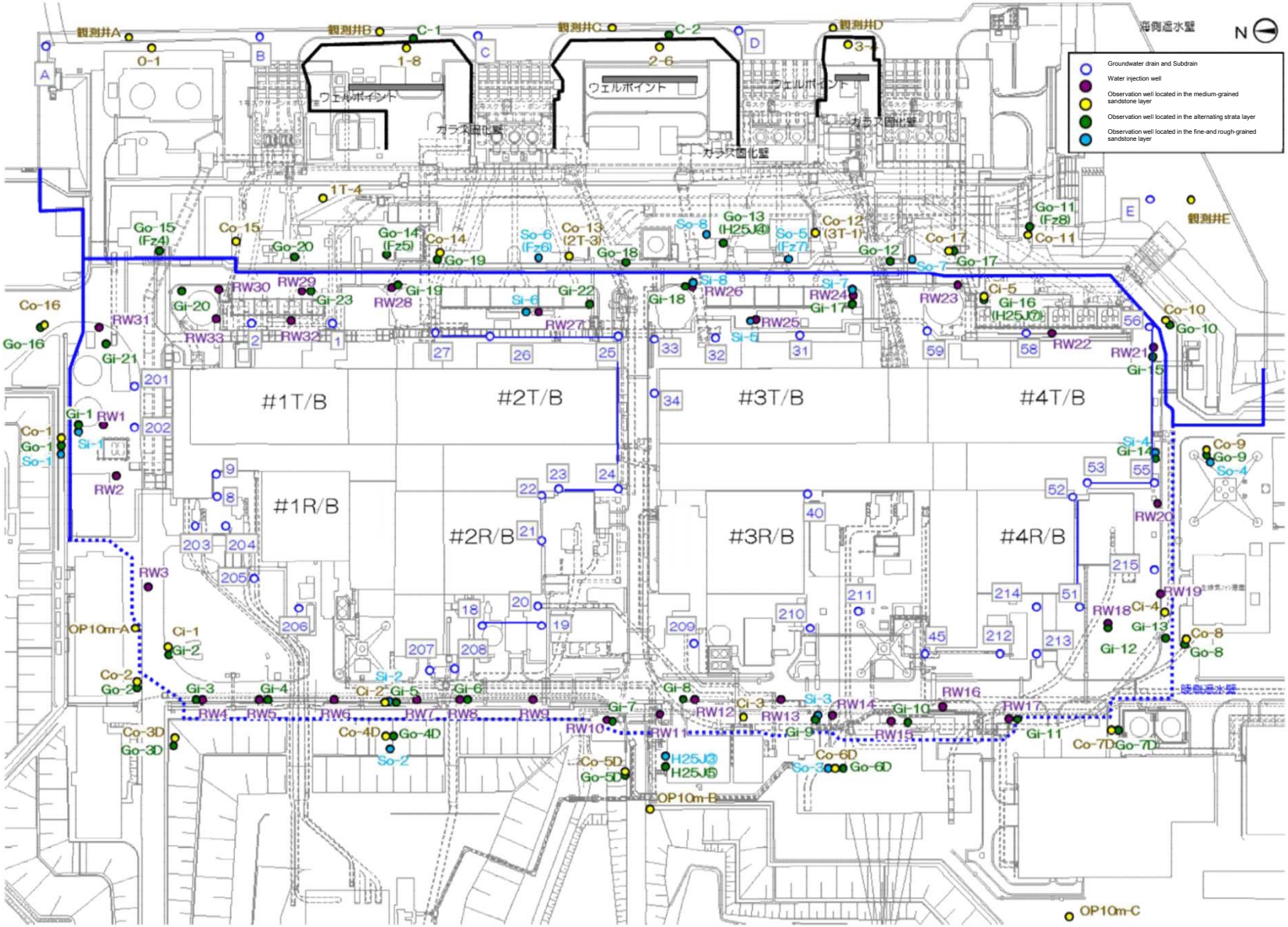






The data of groundwater levels are as of 12 p.m. on April 26.

[Reference] Location map of groundwater level observation wells (as of April 2016)

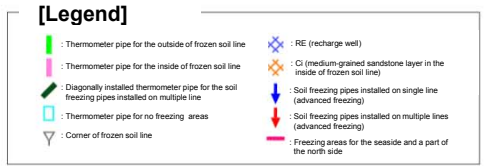


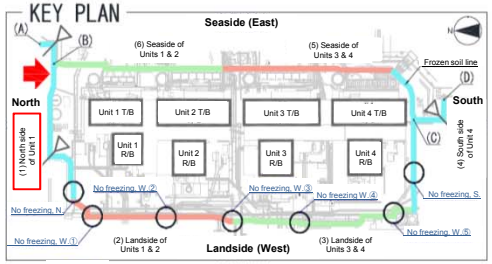
Distribution map of soil temperatures (north side of Unit 1)

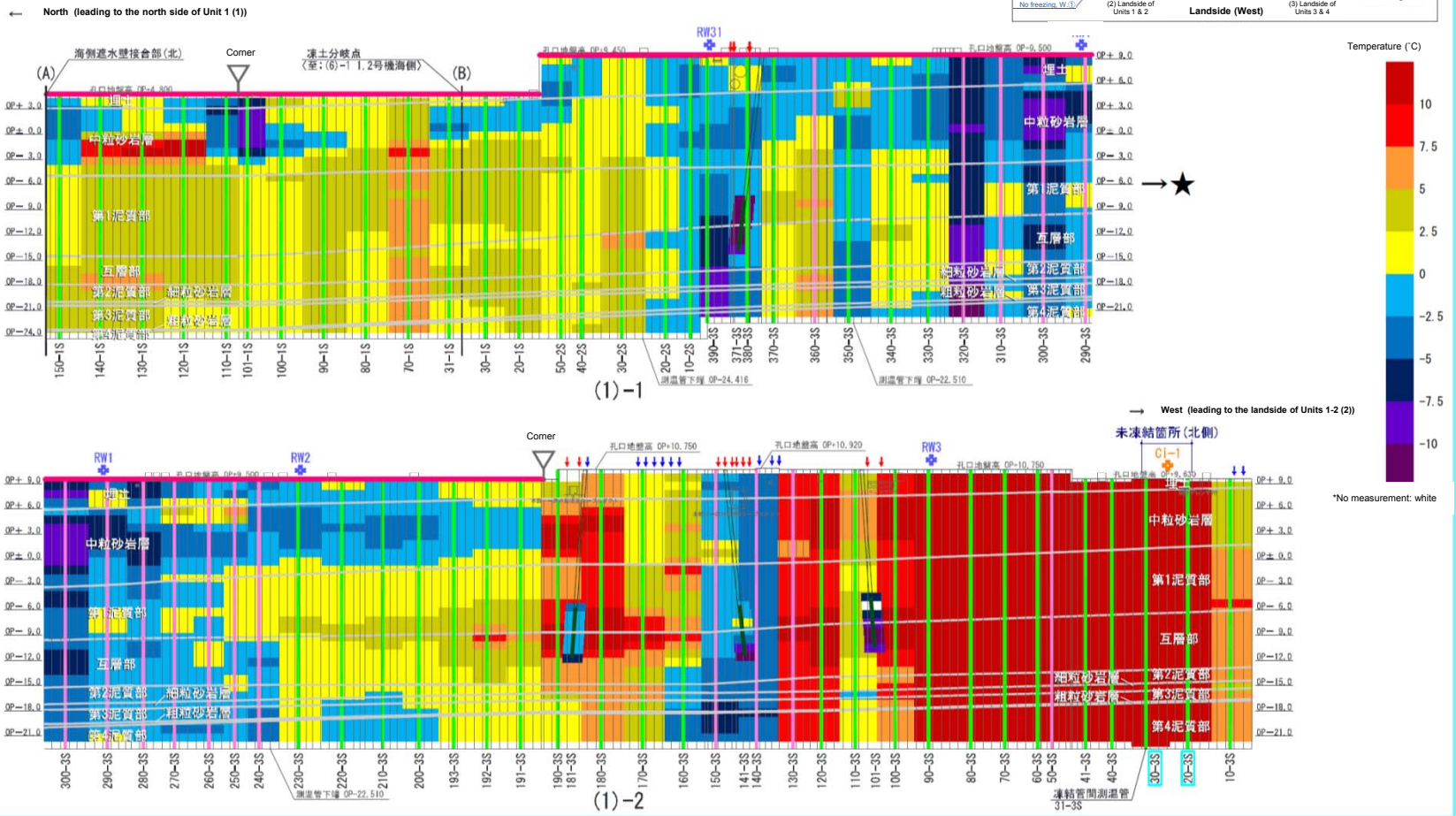
■ Distribution map of soil temperatures

(1) North side of Unit 1 (a view from the north side)

(The temperature data are those as of 7 a.m. on April 26.)





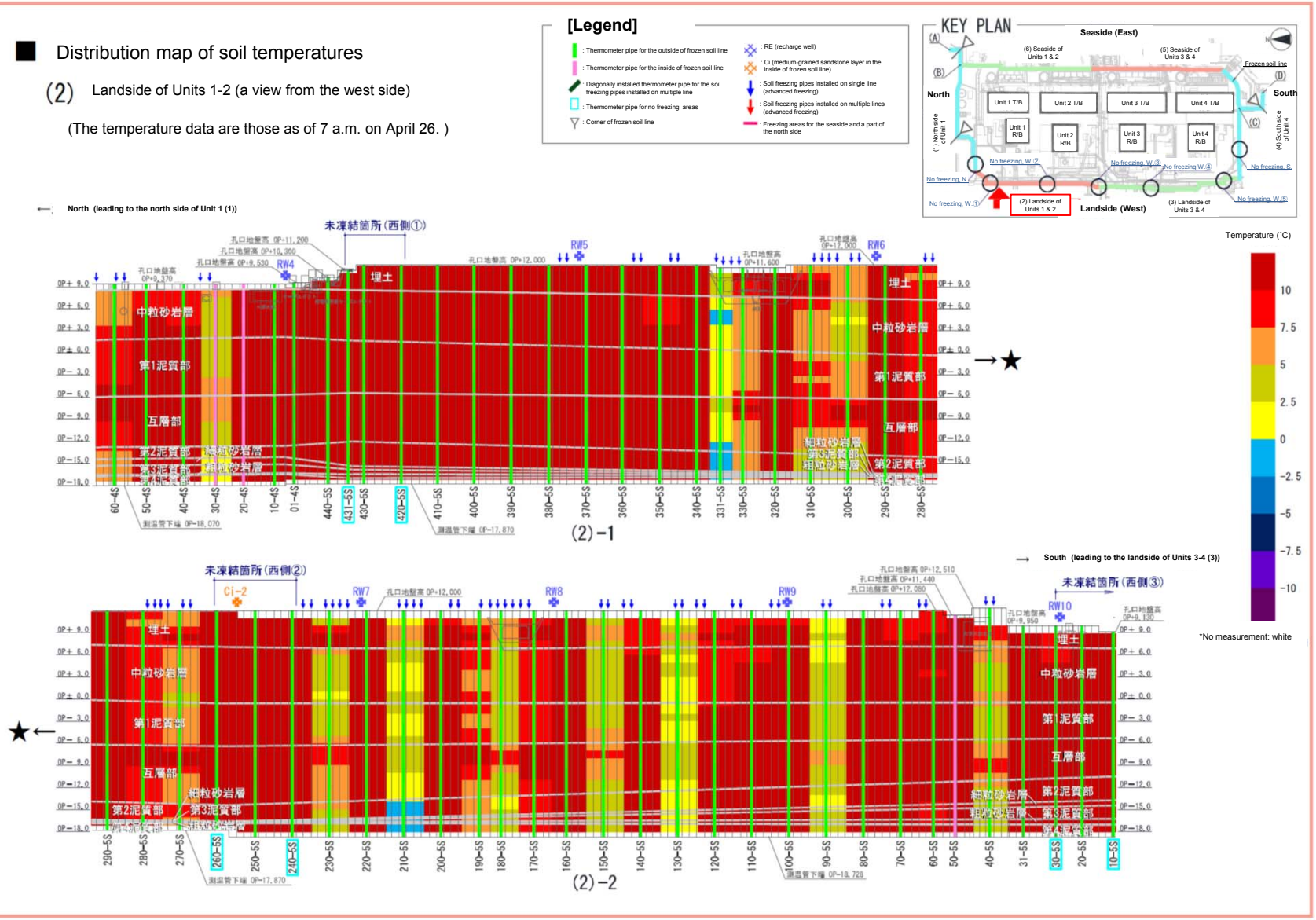


[Reference] Distribution map of soil temperatures (west side of Units 1-2)

■ Distribution map of soil temperatures

(2) Landside of Units 1-2 (a view from the west side)

(The temperature data are those as of 7 a.m. on April 26.)

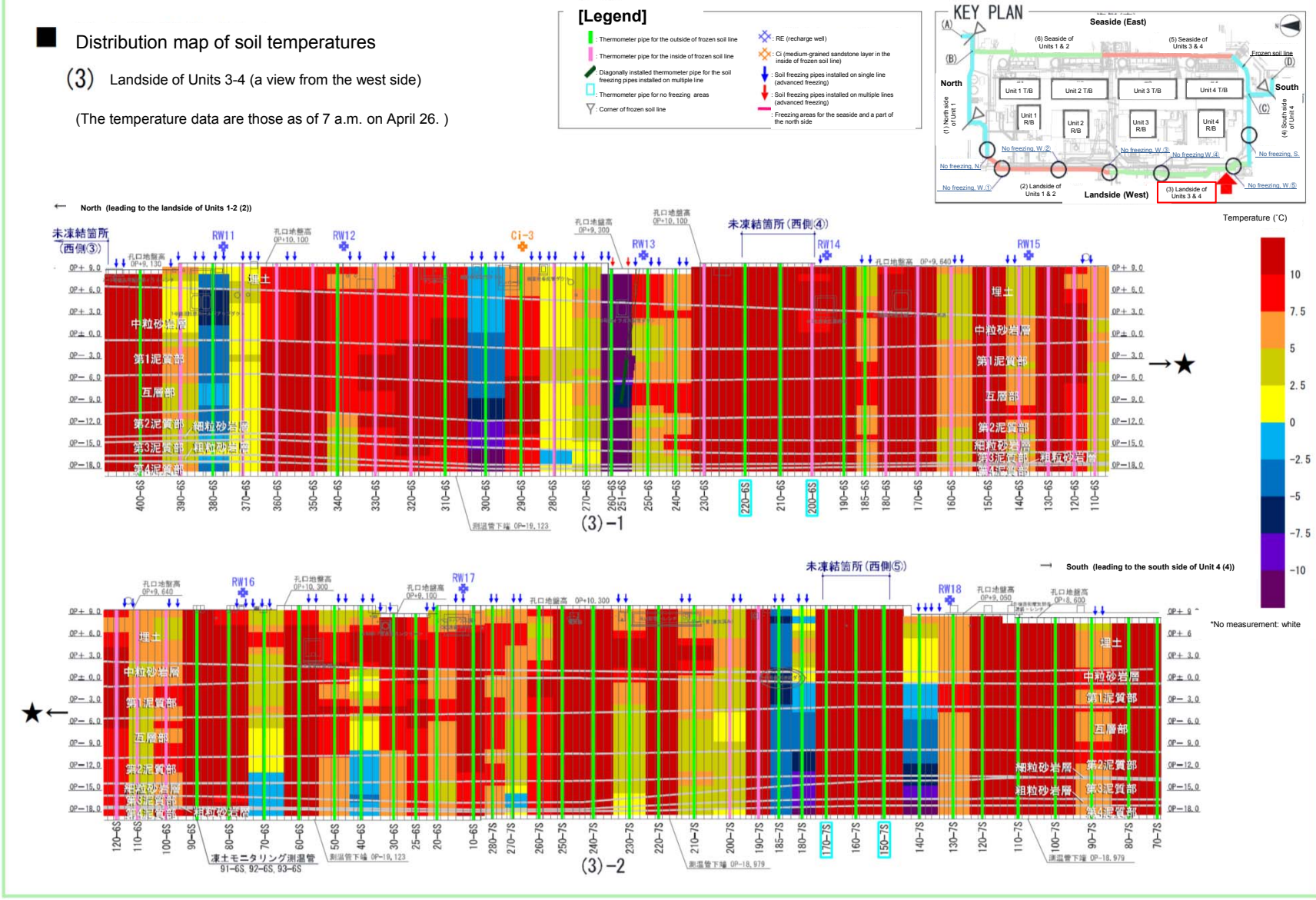


Distribution map of soil temperatures (west side of Units 3-4)

■ Distribution map of soil temperatures

(3) Landside of Units 3-4 (a view from the west side)

(The temperature data are those as of 7 a.m. on April 26.)

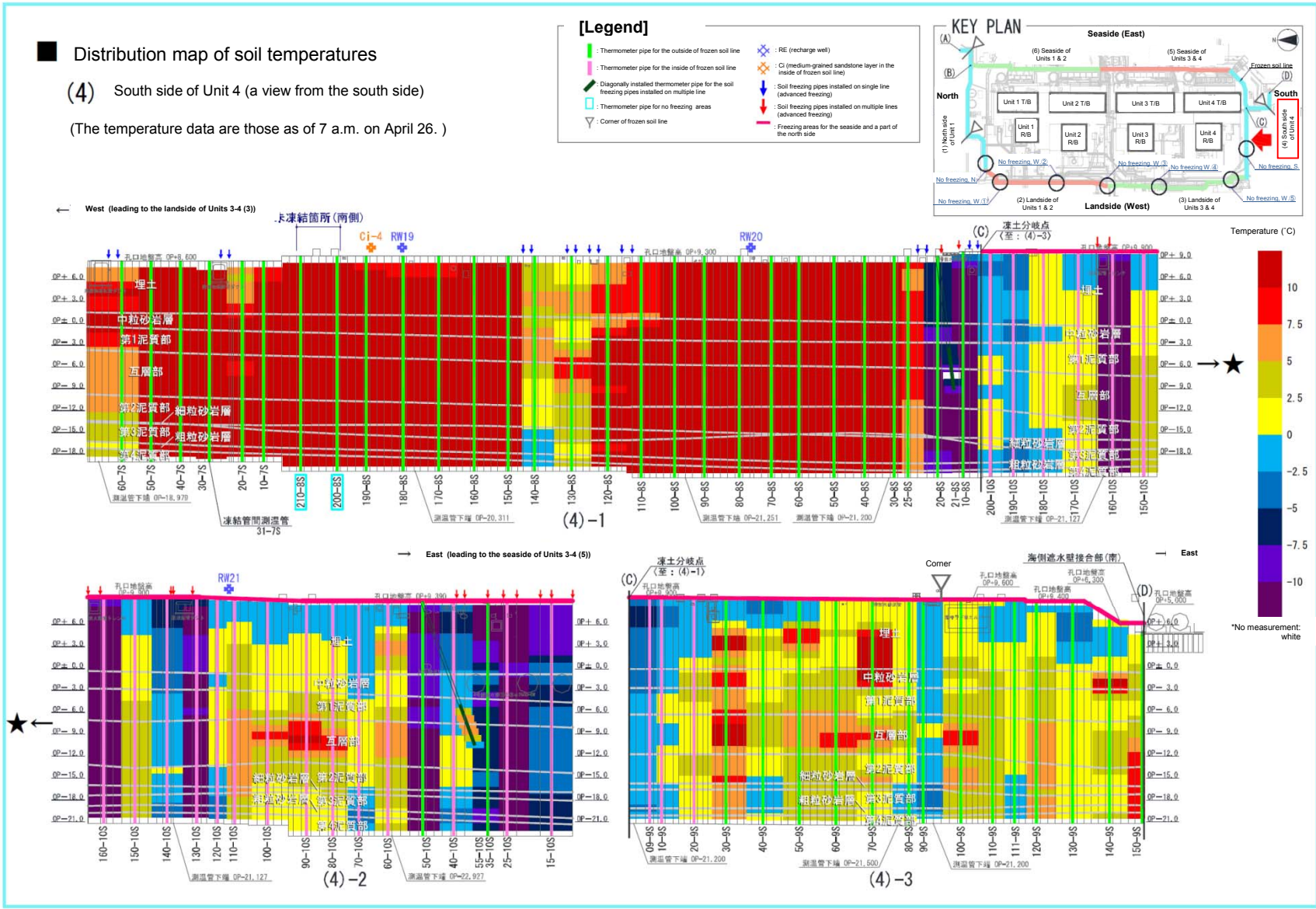


Distribution map of soil temperatures (south side of Unit 4 (1))

■ Distribution map of soil temperatures

(4) South side of Unit 4 (a view from the south side)

(The temperature data are those as of 7 a.m. on April 26.)

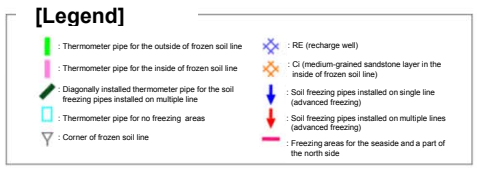


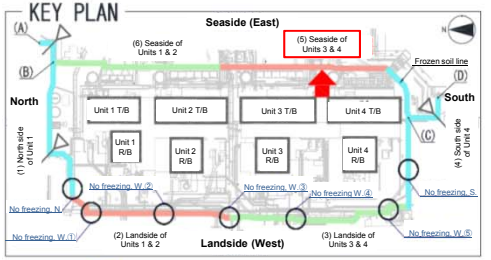
Distribution map of soil temperatures (east side of Units 3-4)

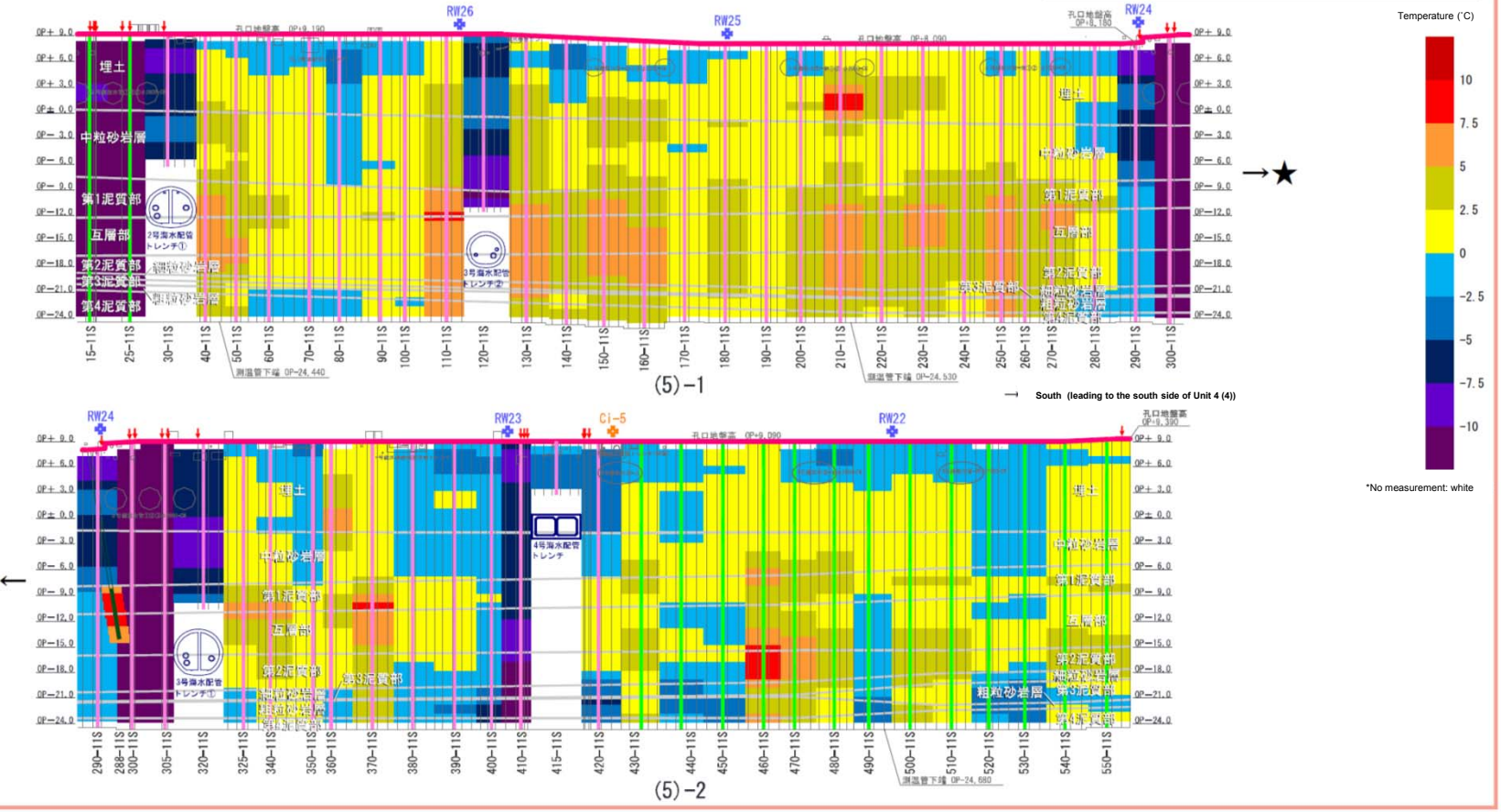
■ Distribution map of soil temperatures

(5) Seaside of Units 3-4
(west side: a view from the inner line of frozen soil)

(The temperature data are those as of 7 a.m. on April 26.)





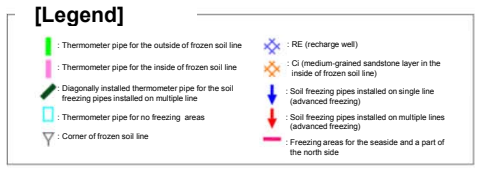


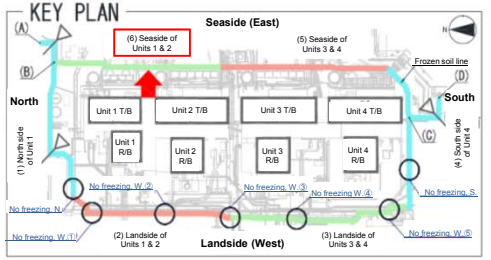
Distribution map of soil temperatures (east side of Units 1-2)

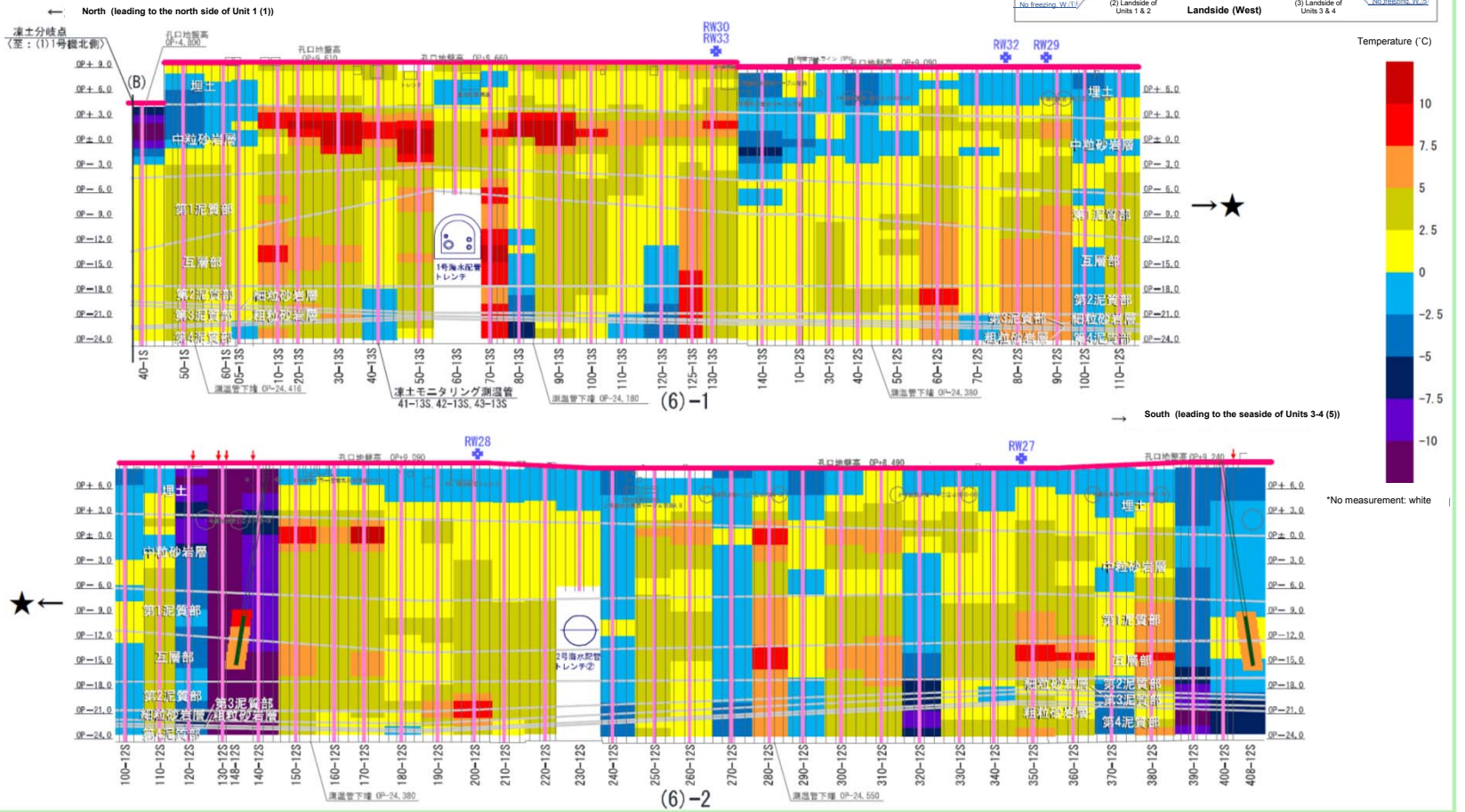
■ Distribution map of soil temperatures

(6) Seaside of Units 1-2
(west side: a view from the inner line of frozen soil

(The temperature data are those as of 7 a.m. on April 26.)

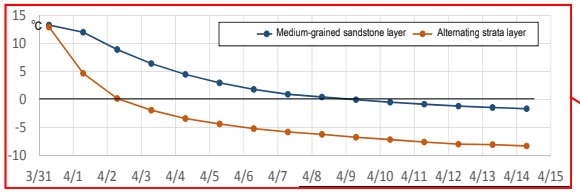




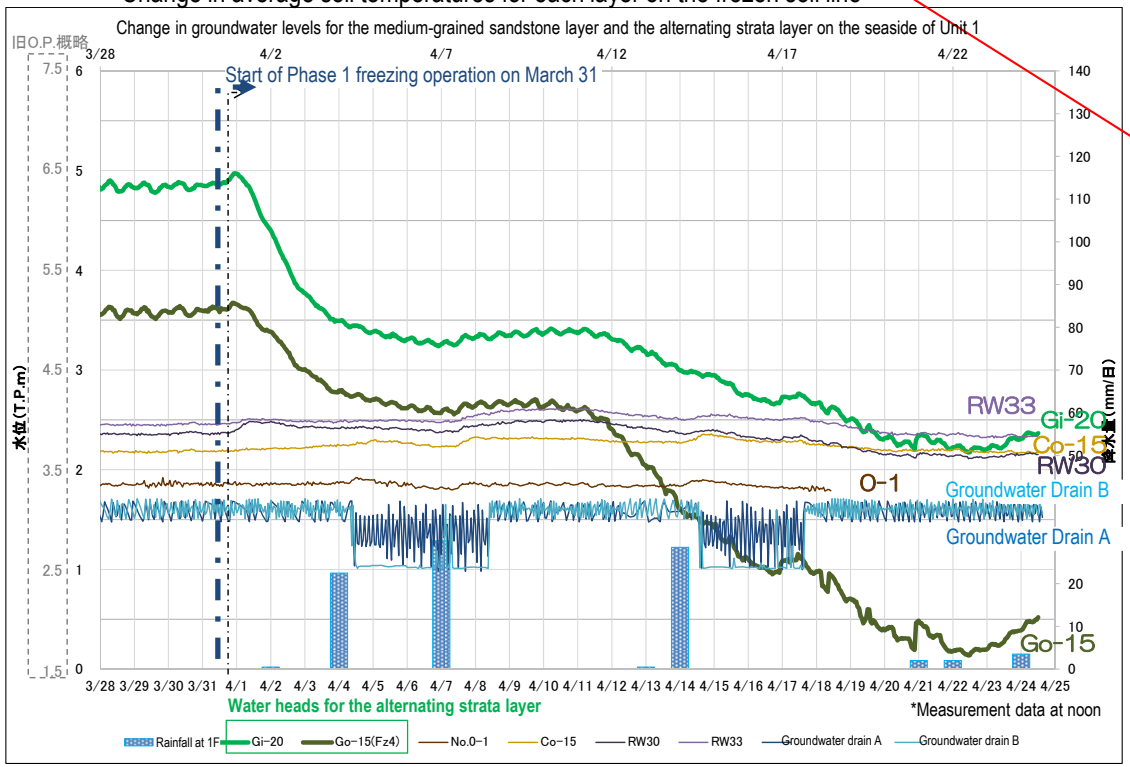


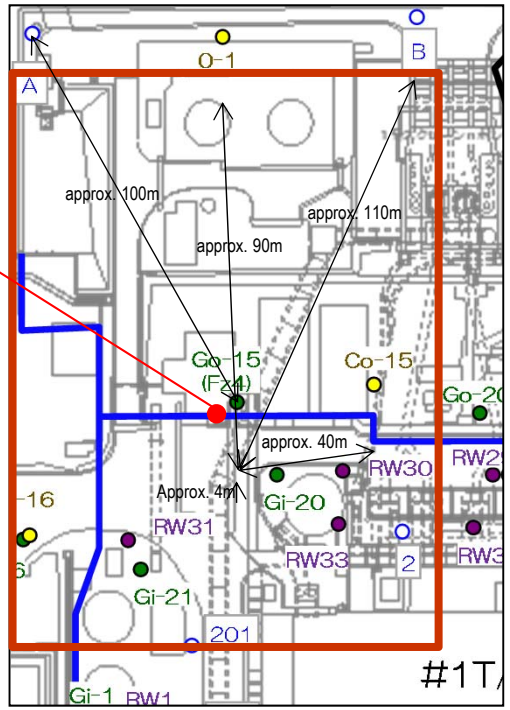
Changes in groundwater levels and hydraulic heads at and around Go-15 on the seaside of Unit 1 after the freezing operations started

・The groundwater levels have been declining at hydraulic head monitoring wells on the seaside of Unit 1 Go-15 and Gi-20 installed in the alternating strata layer after the freezing operations started. The speed of water level declining became slow after the 22mm rainfall on April 4 and the 30mm rainfall on April 7. The similar behaviors were observed in the other parts of the alternating strata layer.
・The groundwater levels started declining again from around April 11, but the declining speed seems to become slower reflecting the influence of rainfall from around April 20 (as of April 24, the groundwater level of Go-15 decreased about 3.1m and that of Gi-20 by about 2.5m compared with that before the freezing operations started on March 31).
・ On the other hand, the groundwater levels around Go-15 in the medium-grained sandstone layer increased after those rainfalls and then started declining again a little.



Change in average soil temperatures for each layer on the frozen soil line





Monitoring Well Location Map on the Seaside of Unit 1

N

○ SD, Groundwater D
● Water injection well
● Monitoring well for the medium-grained sandstone layer
● Monitoring well for the alternating strata layer

Underground objects near the groundwater level monitoring wells Go-15 and Gi-20 (1/2)

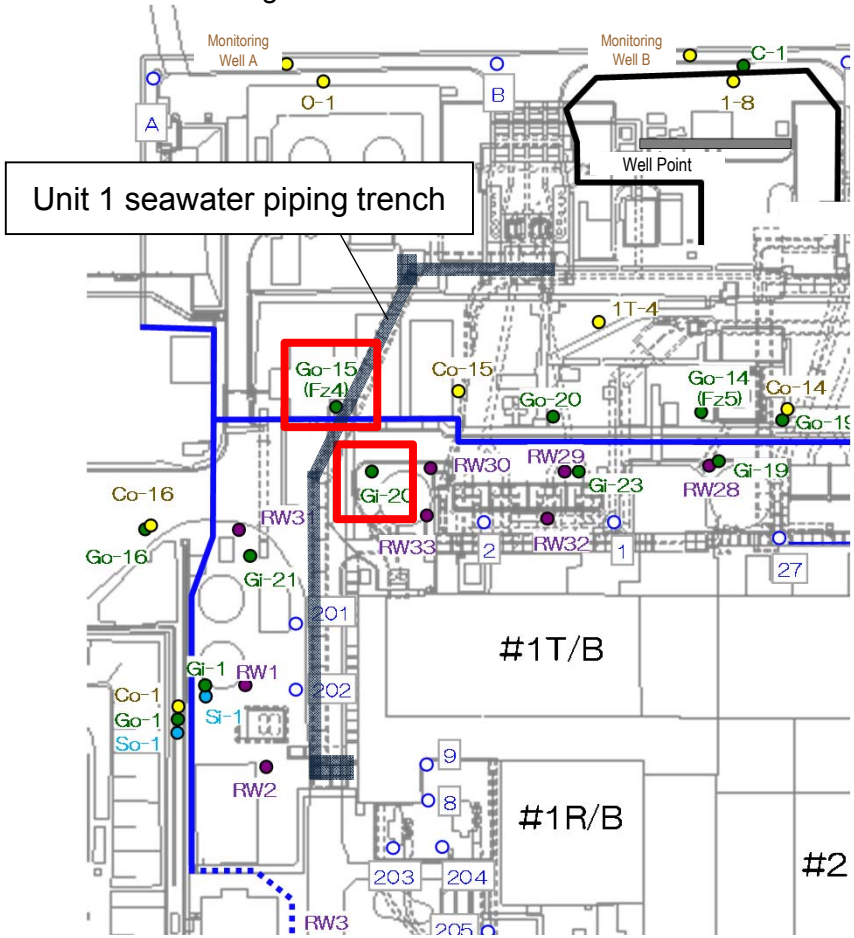
■ **Underground objects near the groundwater level monitoring wells Go-15 and Gi-20**

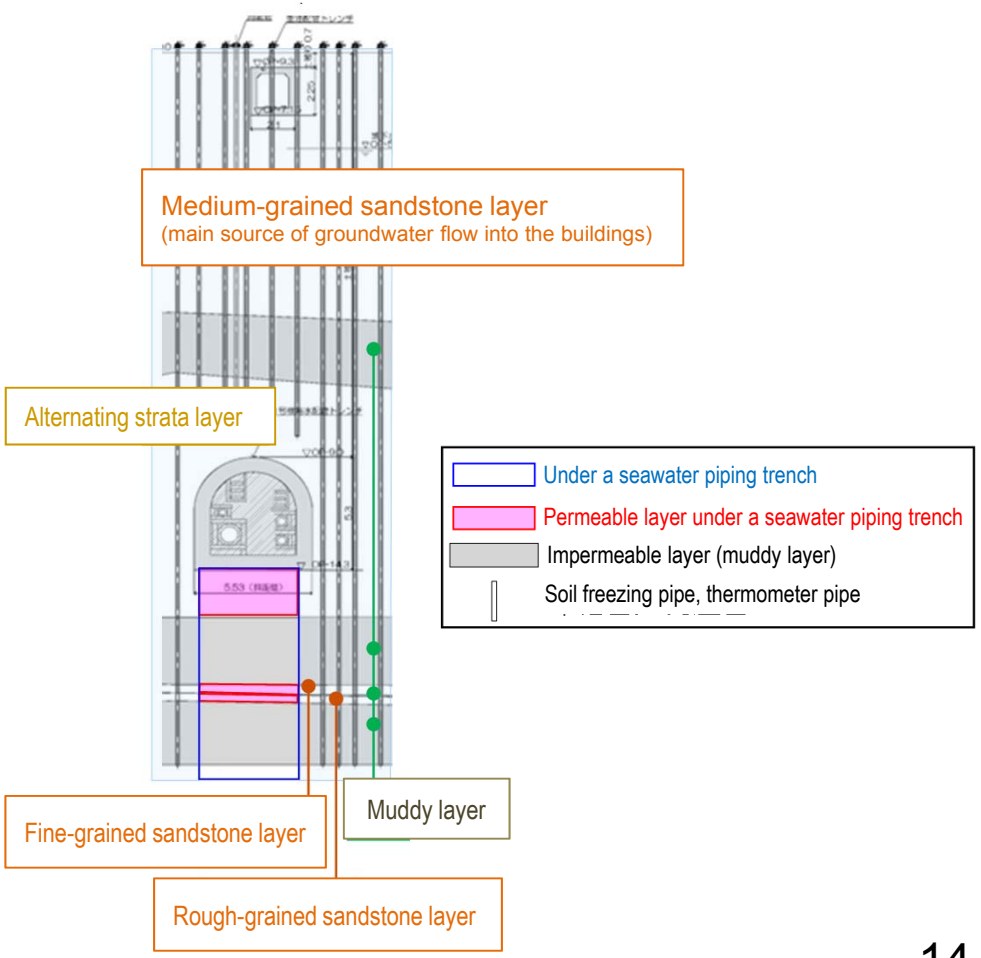
• The Unit 1 seawater piping trench is located near the groundwater level monitoring wells Go-15 and Gi-20. (Refer to the location map on the left below.)

■ **The conditions of Unit 1 seawater piping trench**

・As shown in the image on the right below, at the crossing area with the seaside line of the Landside Impermeable Wall, the soil freezing pipes are buried up to the depth 1m above the top of Unit 1 seawater piping trench no to damage the underground object. The bottom of the trench will not be frozen.

・Unlike Units 2-4 seawater piping trenches, the accumulated water inside Unit 1 seawater piping trench is not transferred and the inside of the trench is not filled with cement. Contaminated water retained in the buildings has not flowed into the trench because the mouth of the trench is connected at the higher elevation than the level of the contaminated water in Unit 1.





Underground objects near groundwater level monitoring wells Go-15 and Gi-20 (2/2)

■ Locations of Unit 1 seawater piping trench and the seaside line of the Landside Impermeable Wall

- Around the seaside line of the Landside Impermeable Wall, there are concrete joints created when the trench was constructed.
- A water-stop plates is installed at each concrete joint to prevent the groundwater inflow into the trench.
- As shown below, the water level in the trench remained lower than the groundwater levels in the medium-grained sandstone layer and the alternating strata layer for a long period of time. It is believed that the groundwater has rarely flowed into the trench.

■ Assumption

- The hydraulic heads at Go-15 an Gi-20 could have declined due to the nearby groundwater that flowed into the trench reflecting some influences from Unit 1 seawater piping trench after the freezing operations started.

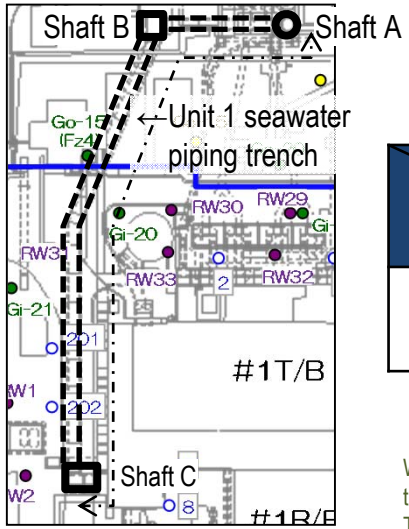
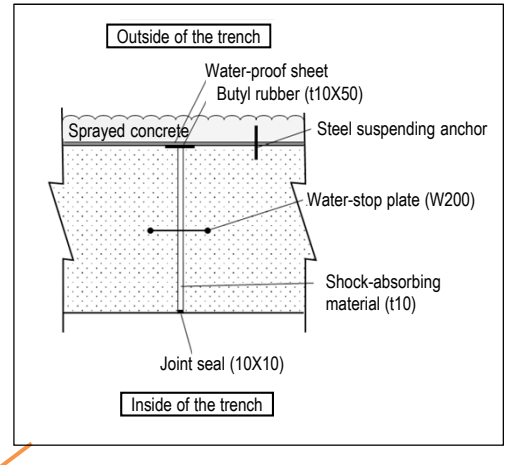
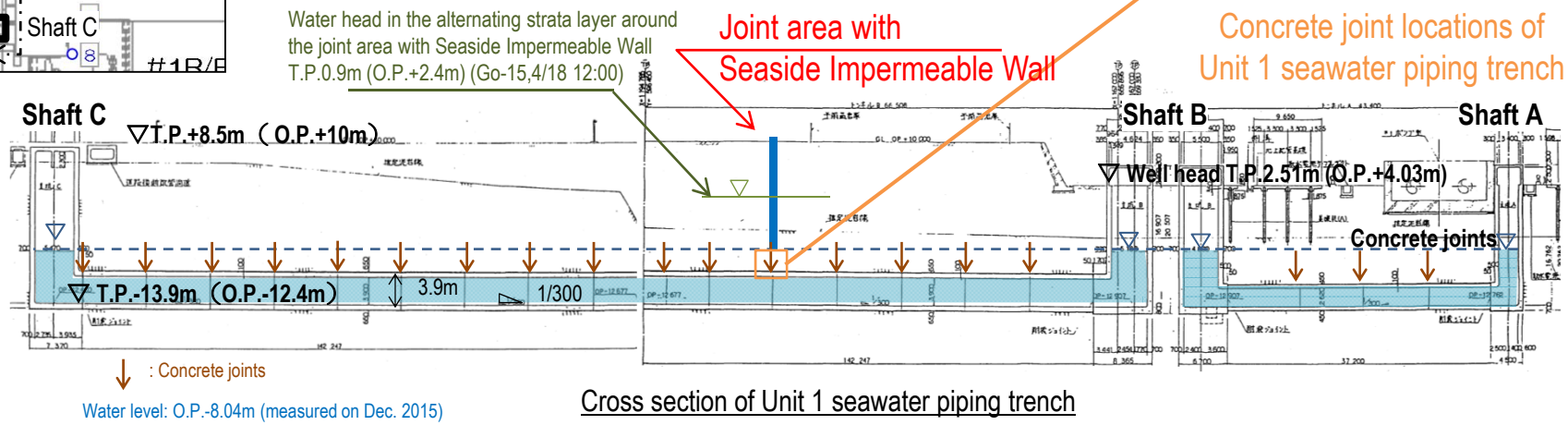


Table. Previous water levels in the shafts of Unit 1 seawater piping trench

	Measurement results of retained water inside Unit 1 trench			
	2012 .2	2013 .12	2014 .12	2015 .12
Water levels in shaft *1 T.P.+m (O.P.+m)	-9.22 (-7.70)	-9.42 (-7.92)	-9.56 (-8.04)	-9.56 (-8.04)

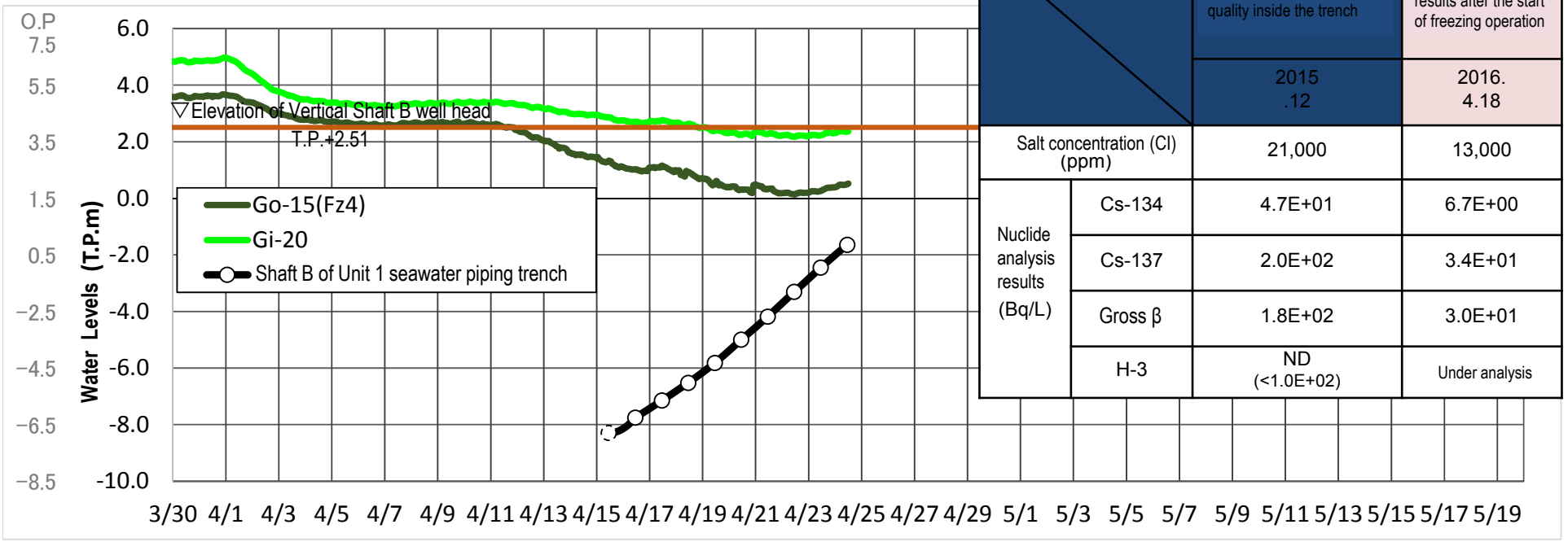




Cross section of Unit 1 seawater piping trench

Decline of groundwater levels in hydraulic head monitoring wells Go-15 and Gi-20 in the alternating strata layer, and changes in accumulated water level in Unit 1 seawater piping trench

- The water level in the vertical shaft B of the Unit 1 seawater piping trench stayed around T.P.-9.5m (O.P.-8m) after the monitoring of water levels started in February 2012, as shown in the previous page. After the freezing operations started, however, the water level has been rising.
- Currently, the water level is measured by hand. Preparation for continuous measurements with an automated water level recording device is underway. (The operations will start at the end of April.)
- Besides, preparation work to transfer accumulated water in the trench (if necessary) is in progress by installing a water transfer facility around the vertical shaft B well head. (The preparation will be completed at the end of April.)
- The salt concentration and radioactive concentrations of the accumulated water inside the trench are declining compared with those before the freezing operations started. This does not conflict with the assumption that the groundwater in the alternating strata layer has flowed into the trench due to some reasons.



Water quality in a shaft of Unit 1 seawater piping trench

		Analysis results of the water quality inside the trench	Additional analysis results after the start of freezing operation
		2015 .12	2016. 4.18
Salt concentration (Cl) (ppm)		21,000	13,000
Nuclide analysis results (Bq/L)	Cs-134	4.7E+01	6.7E+00
	Cs-137	2.0E+02	3.4E+01
	Gross β	1.8E+02	3.0E+01
	H-3	ND (<1.0E+02)	Under analysis

Latest water levels inside the shafts of Unit 1 seawater piping trench