Progress of Landside Impermeable Wall freezing: Phase 2 of the first stage

September 29, 2016

TEPCO

Tokyo Electric Power Company Holdings, Inc.

Landside impermeable wall

- The purpose of the Landside Impermeable Wall construction lies not in freezing soil to form an underground wall but in keeping groundwater from flowing into the reactor/turbine buildings and preventing new contaminated water from being generated.
- By closing less than 95 percent of the mountain side of the Landside Impermeable Wall in Phase 2 of the first stage, it is expected that the amount of groundwater flowing into the areas around the reactor/turbine buildings will be reduced. This will help keep groundwater from being contaminated during the first stage.
- Throughout the first stage, how freezing of the Landside Impermeable Wall has progressed will be checked by monitoring the difference in groundwater levels inside and outside of the wall and the amount of groundwater pumped up by the subdrain and groundwater drain systems and the well point system.

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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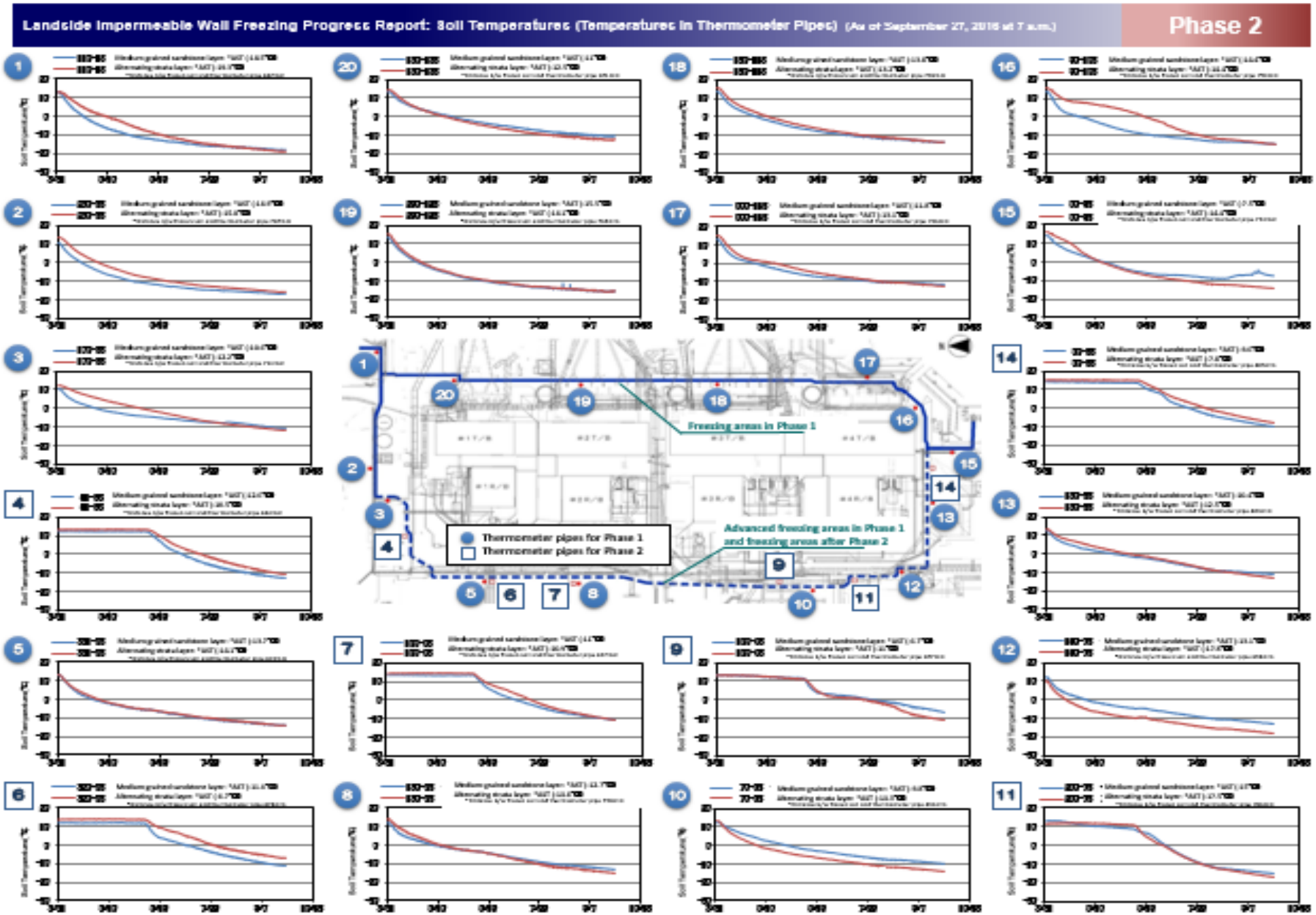
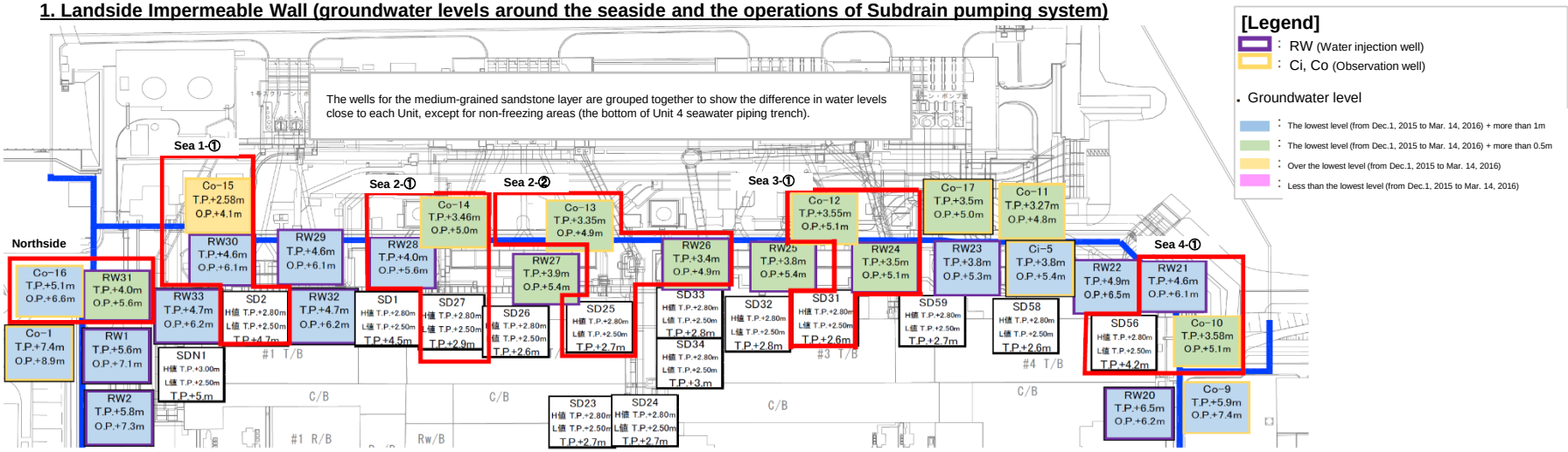


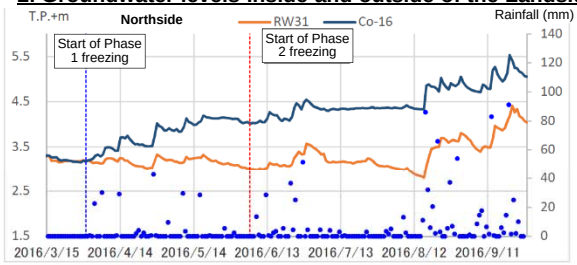
Groundwater levels and hydraulic heads
(in the medium-grained sandstone layer 1 on the seaside)

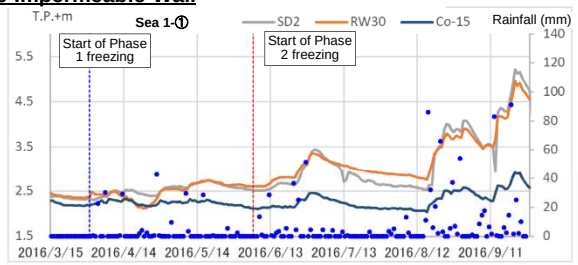
Monitoring items at the beginning of ice wall freezing (Phase 1 Stage 1, seaside, water levels in the middle-grained sandstone layer)

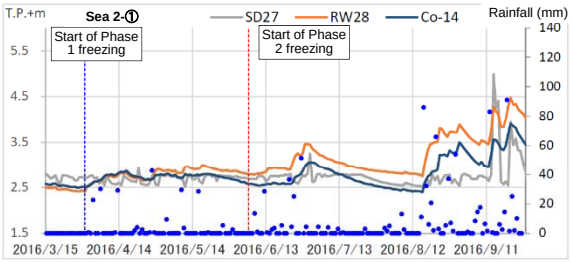
1. Landside Impermeable Wall (groundwater levels around the seaside and the operations of Subdrain pumping system)

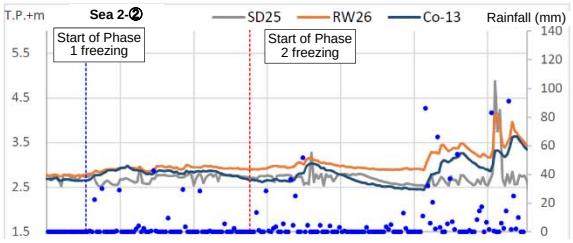


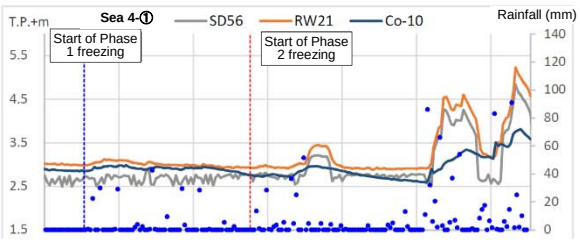
2. Groundwater levels inside and outside of the Landside Impermeable Wall









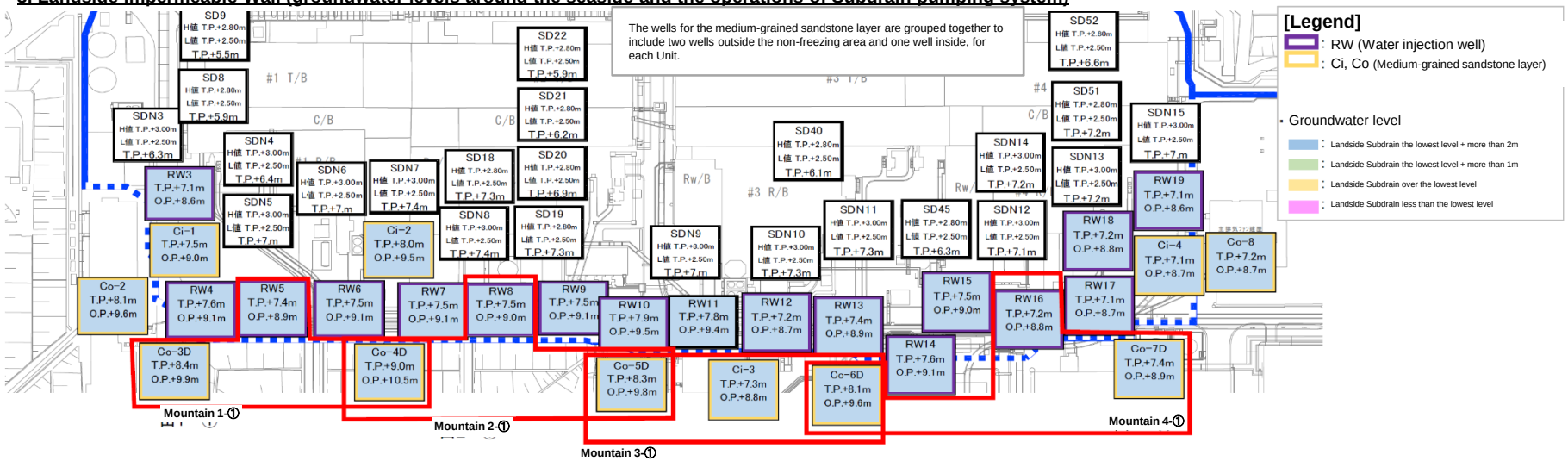


The data of groundwater levels as of 12 p.m. on September 27.

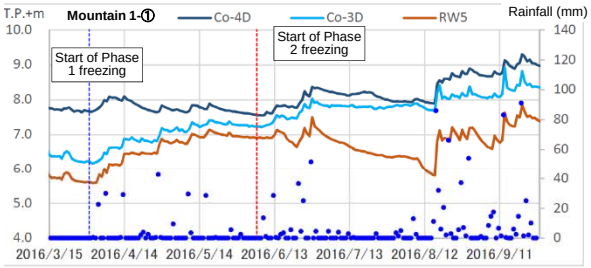
Groundwater levels and hydraulic heads
(in the medium-grained sandstone layer 2 on the landside)

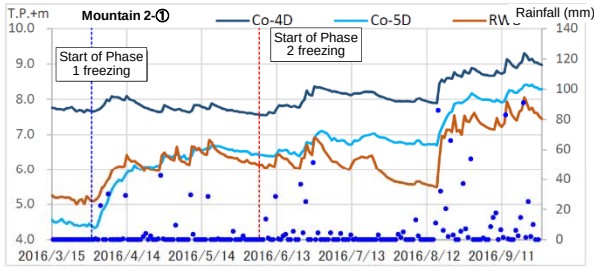
Monitoring items at the beginning of ice wall freezing (Phase 1 Stage 1, seaside, water levels in the middle-grained sandstone layer)

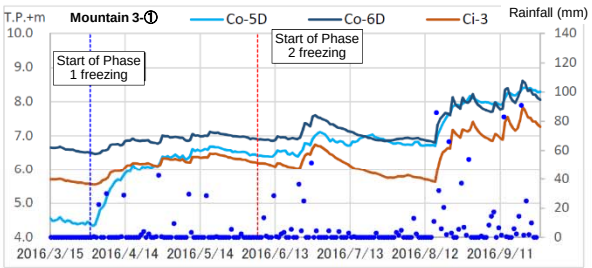
3. Landside Impermeable Wall (groundwater levels around the seaside and the operations of Subdrain pumping system)

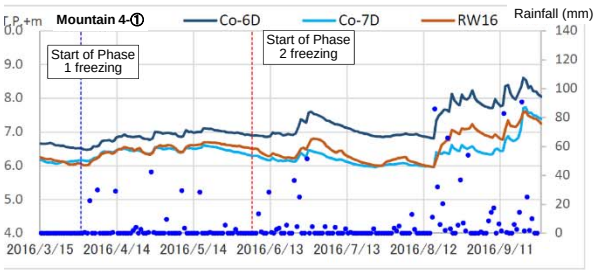


4. Groundwater levels inside and outside of the Landside Impermeable Wall









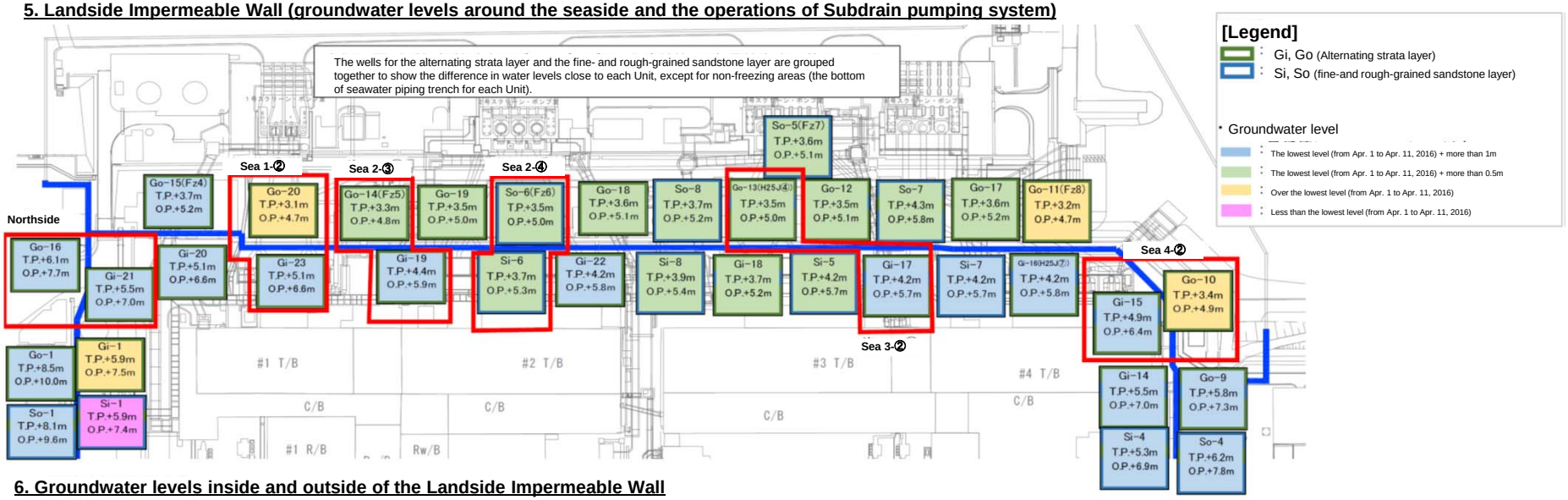
The data of groundwater levels as of 12 p.m. on September 27.

Groundwater levels and hydraulic heads

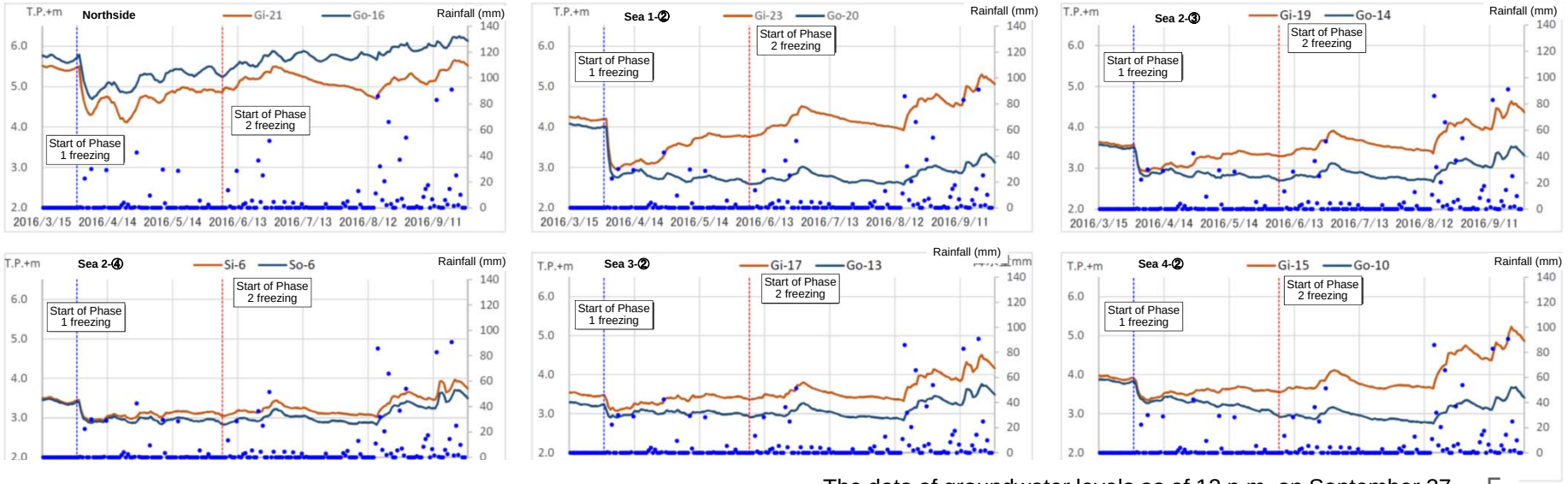
(in the alternating strata layer and the fine- and rough-grained sandstone layer 1 on the seaside)

Monitoring items at the beginning of ice wall freezing (Phase 1 Stage 1, seaside, water levels in the alternating strata layer and the fine- and rough-grained sandstone layer)

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



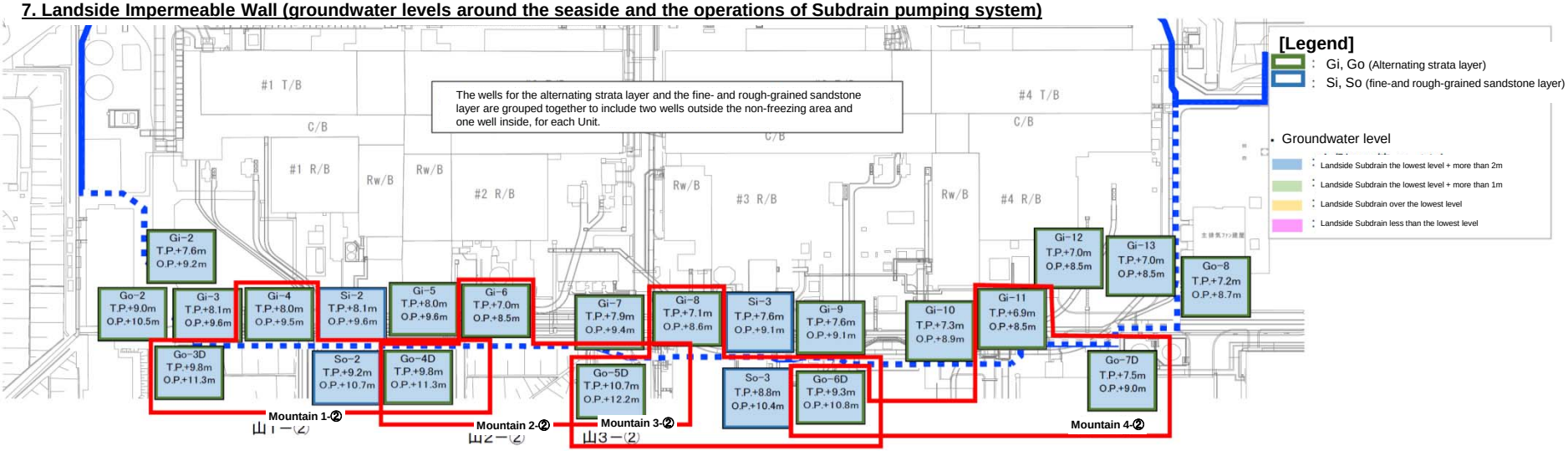
6. Groundwater levels inside and outside of the Landside Impermeable Wall



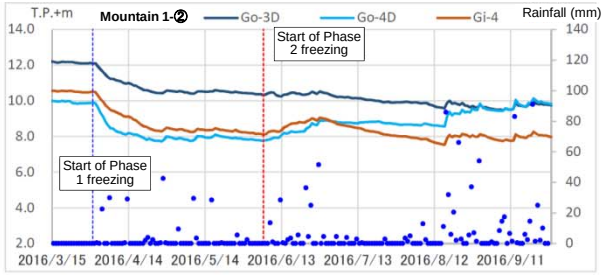
Groundwater levels and hydraulic heads
(in the alternating strata layer and the fine- and rough-grained sandstone layer 2 on the landside)

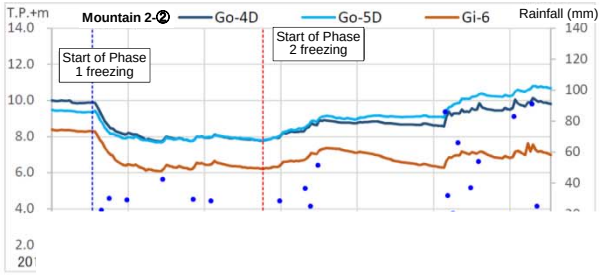
Monitoring items at the beginning of ice wall freezing (Phase 1 Stage 1, seaside, water levels in the alternating strata layer and the fine- and rough-grained sandstone layer)

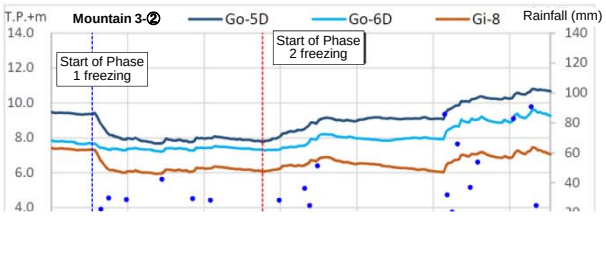
7. Landside Impermeable Wall (groundwater levels around the seaside and the operations of Subdrain pumping system)

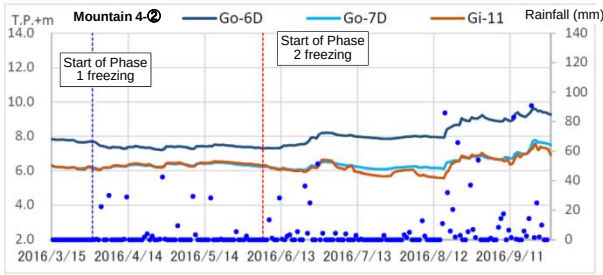


8. Groundwater levels inside and outside of the Landside Impermeable Wall



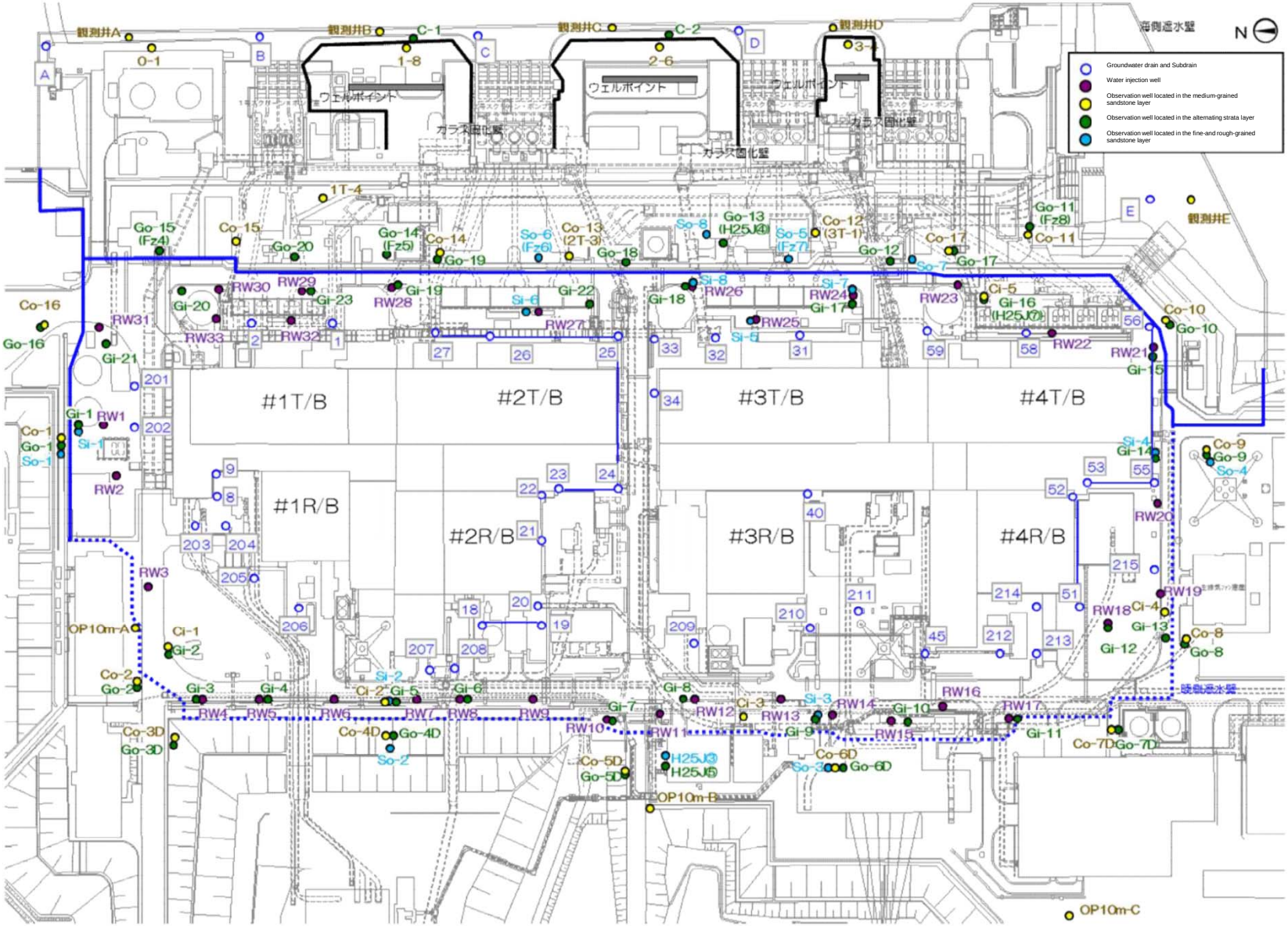






The data of groundwater levels as of 12 p.m. on September 27.

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

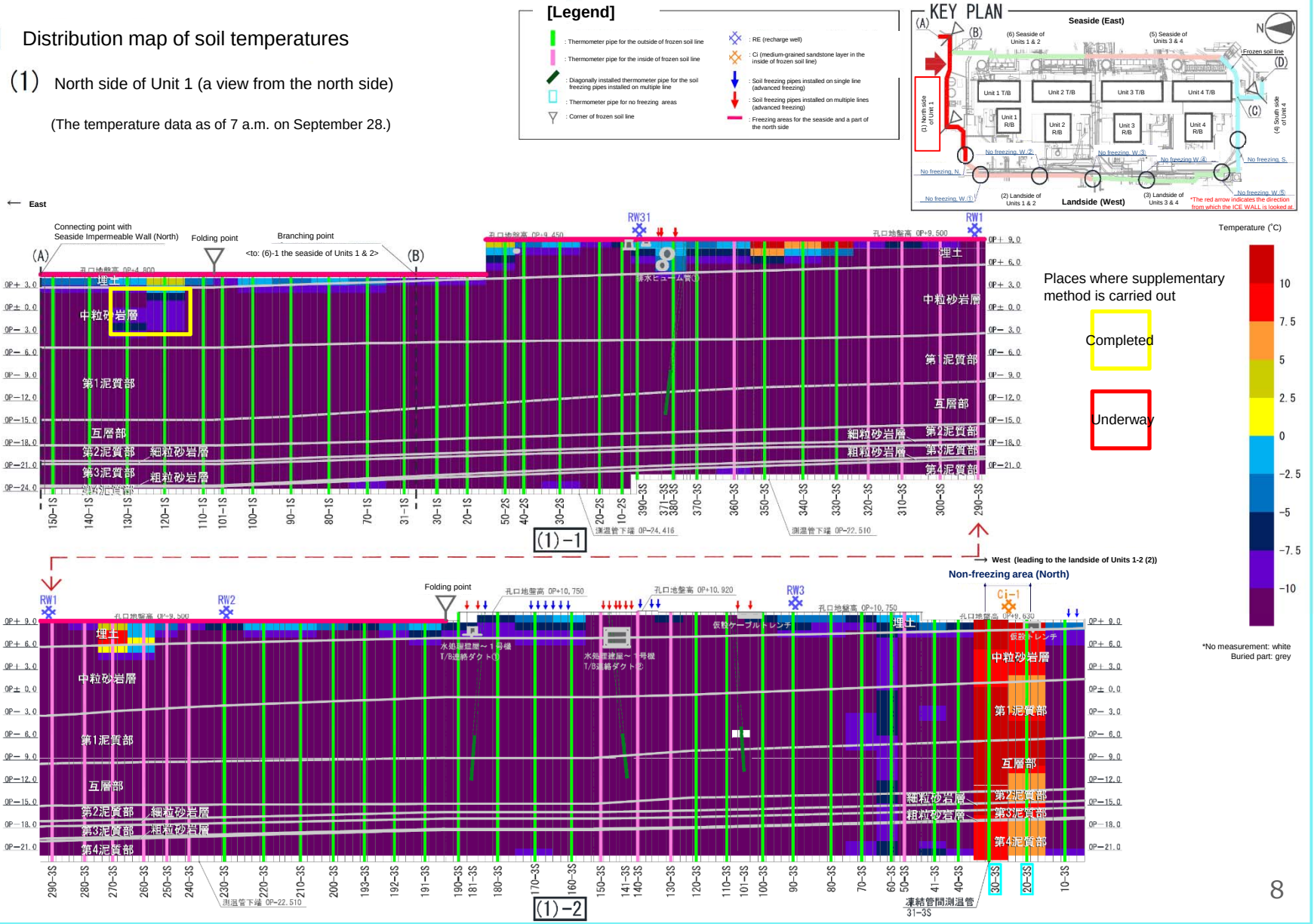


[Reference] Distribution map of soil temperatures (north side of Unit 1)

■ Distribution map of soil temperatures

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

(The temperature data as of 7 a.m. on September 28.)

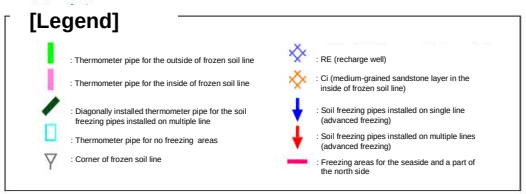


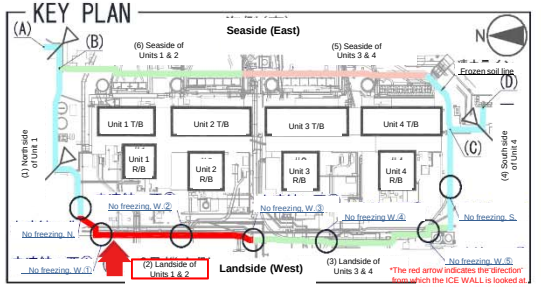
[Reference] Distribution map of soil temperatures (west side of Units 1-2)

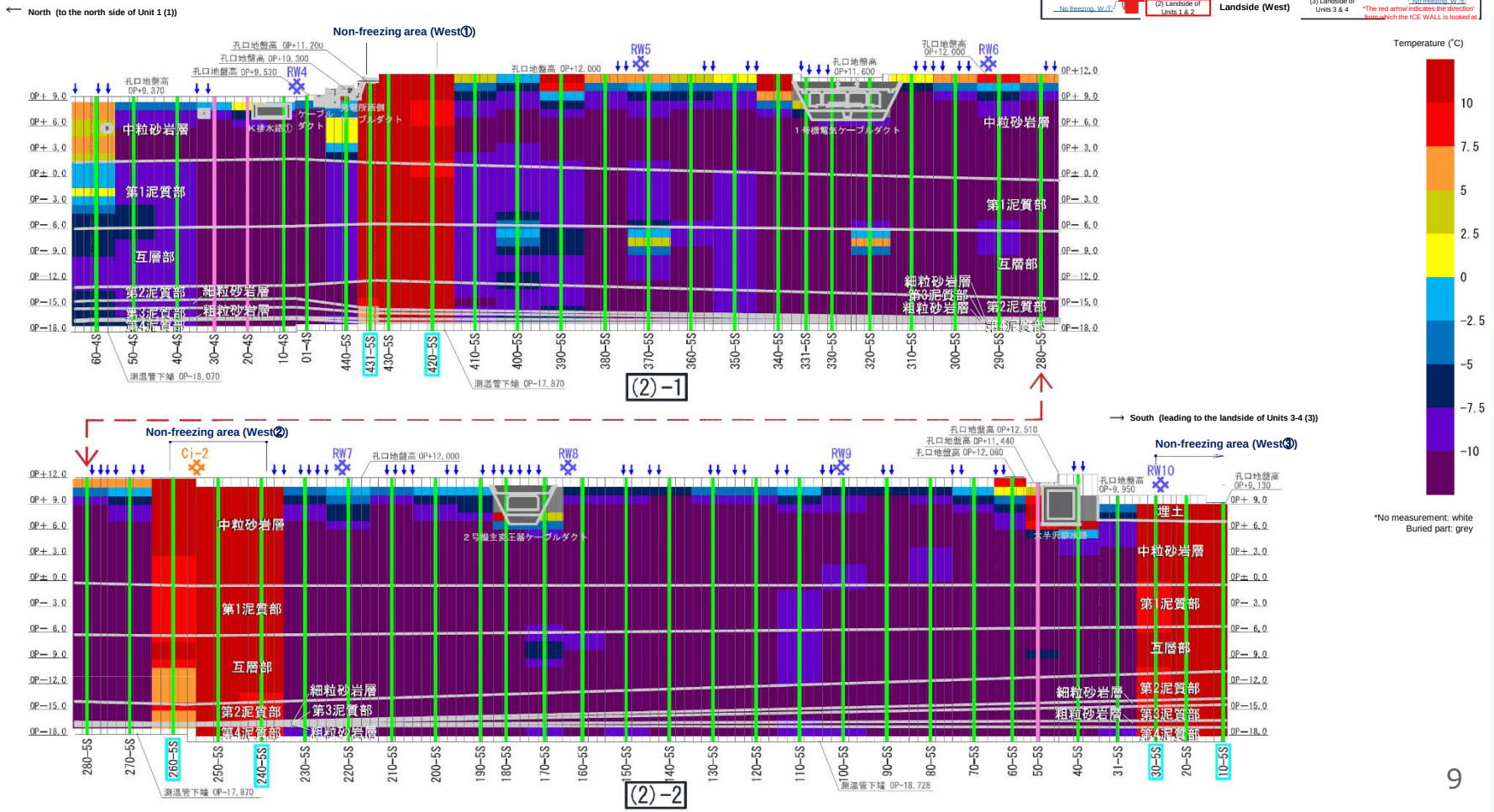
■ Distribution map of soil temperatures

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

(The temperature data as of 7 a.m. on September 28.)





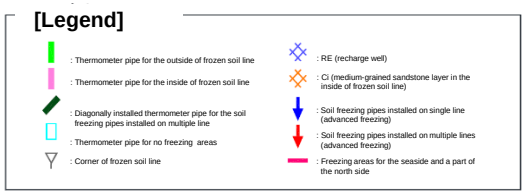


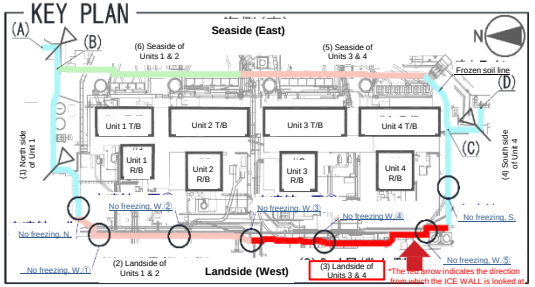
[Reference] Distribution map of soil temperatures (west side of Units 3-4)

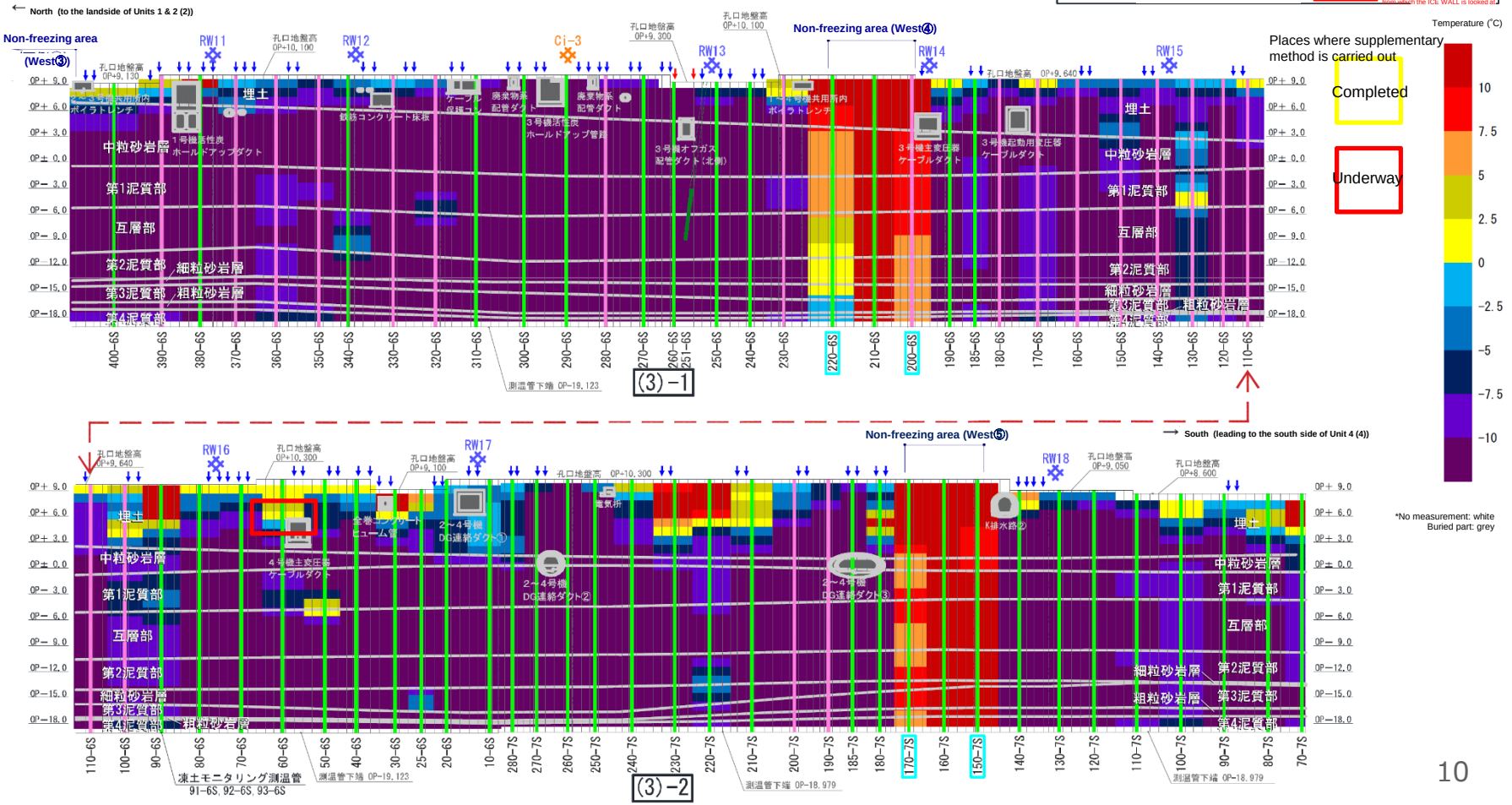
■ Distribution map of soil temperatures

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

(The temperature data as of 7 a.m. on September 28.)





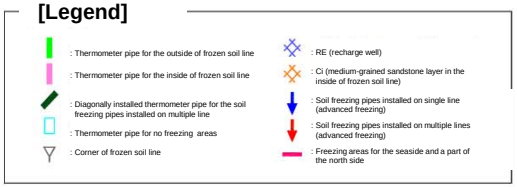


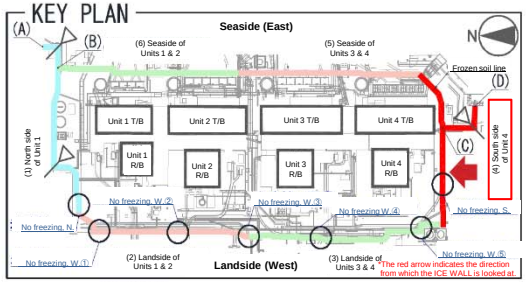
[Reference] Distribution map of soil temperatures (south side of Unit 4)

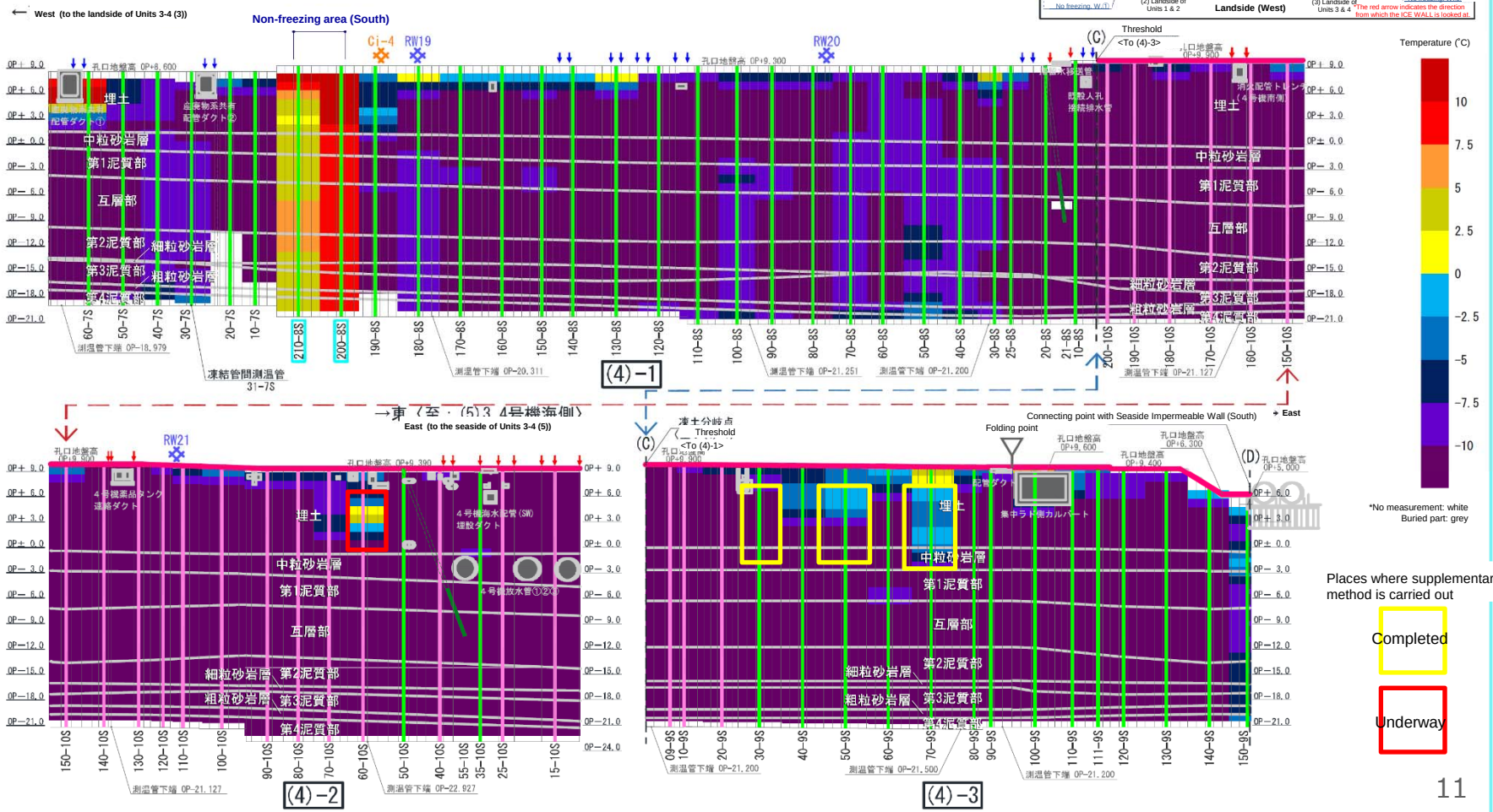
■ Distribution map of soil temperatures

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

(The temperature data as of 7 a.m. on September 28.)







Places where supplementary method is carried out

Completed

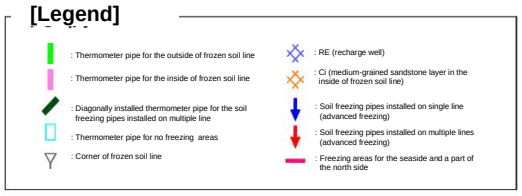
Underway

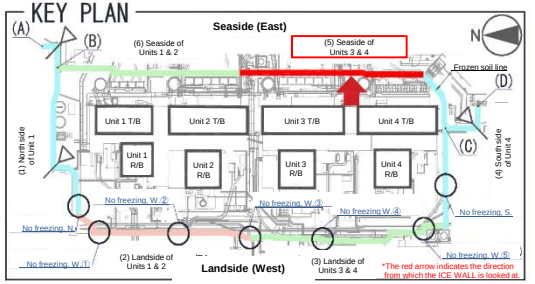
[Reference] Distribution map of soil temperatures (east side of Units 3-4)

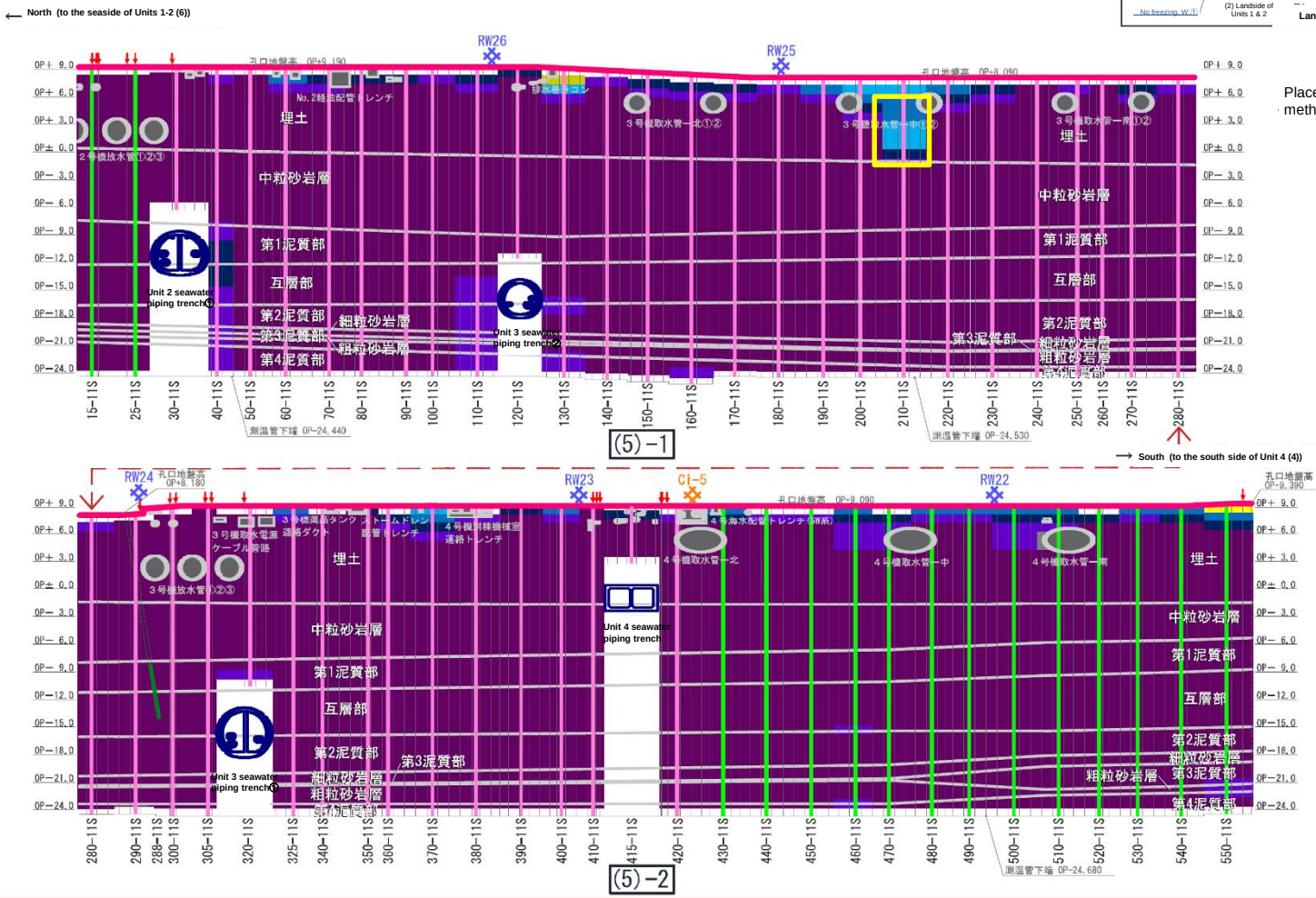
■ Distribution map of soil temperatures

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

(The temperature data as of 7 a.m. on September 28.)







Places where supplementary method is carried out

Completed

Underway

Temperature (℃)

10
7.5
5
2.5
0
-2.5
-5
-7.5
-10

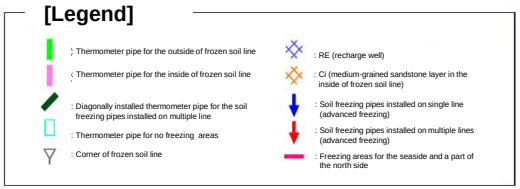
*No measurement: white
Buried part: grey

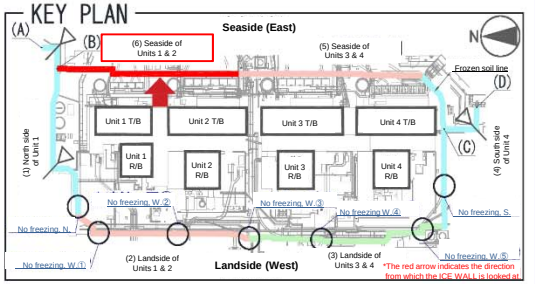
[Reference] Distribution map of soil temperature (east side of Units 1-2)

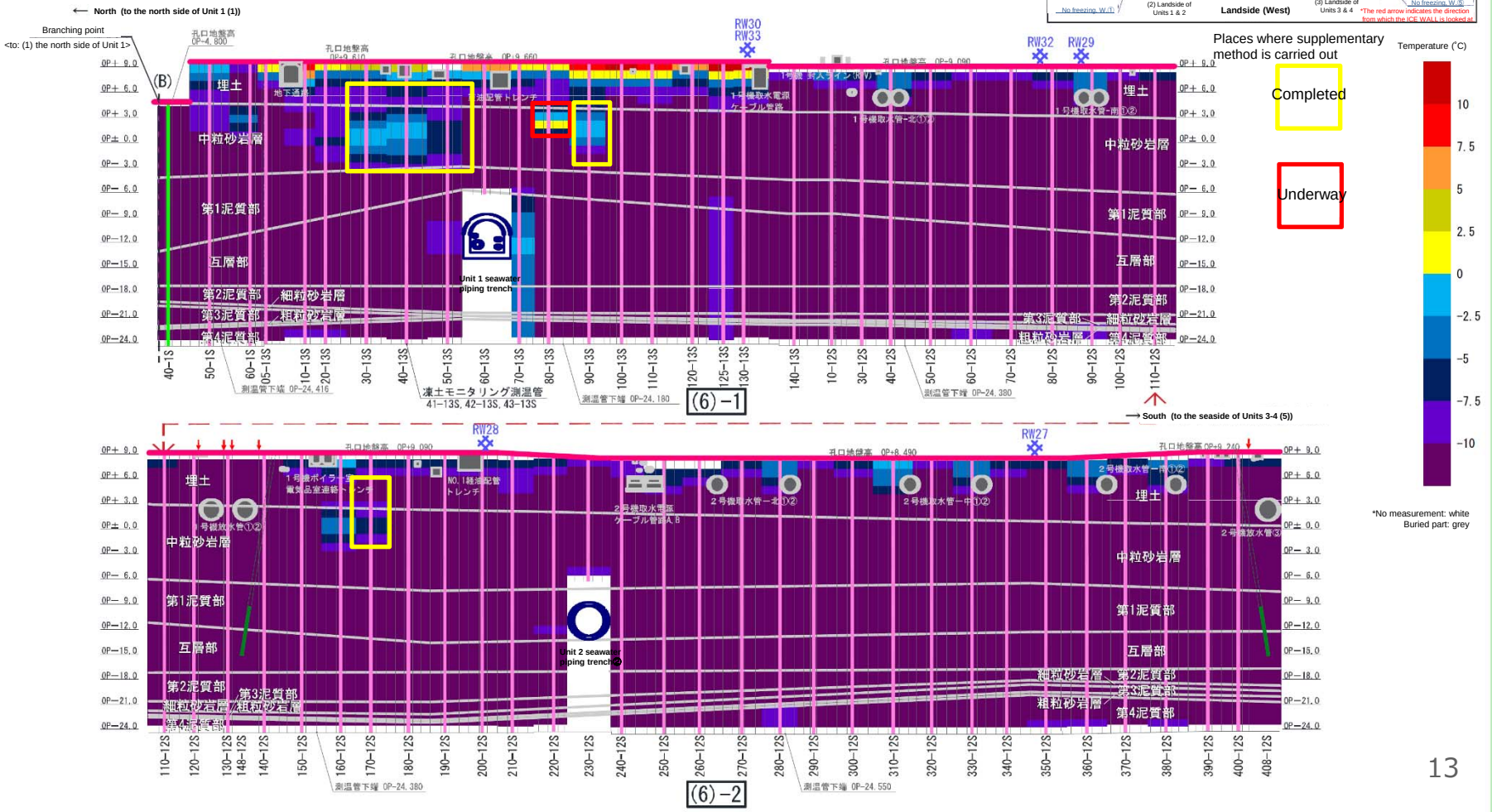
■ Distribution map of soil temperatures

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

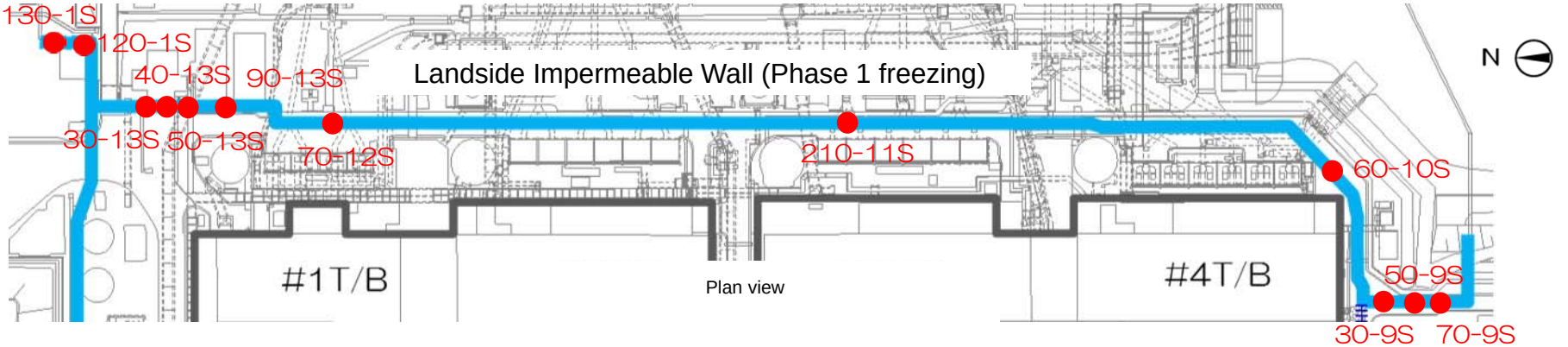
(The temperature data as of 7 a.m. on September 28.)







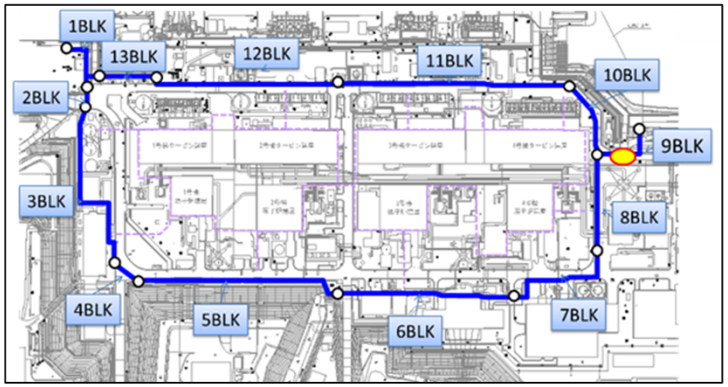
Application of supplementary methods to assist freezing on the seaside

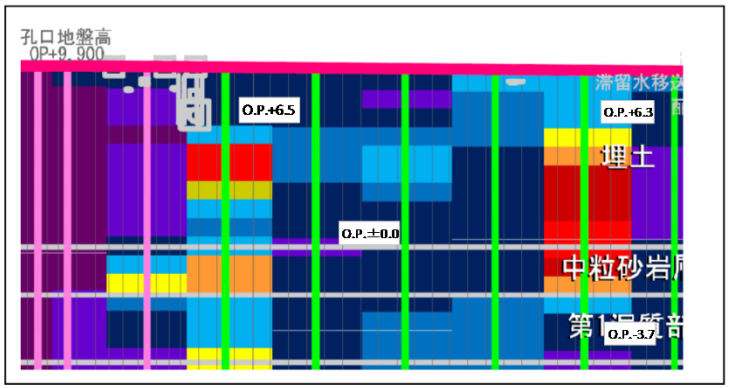


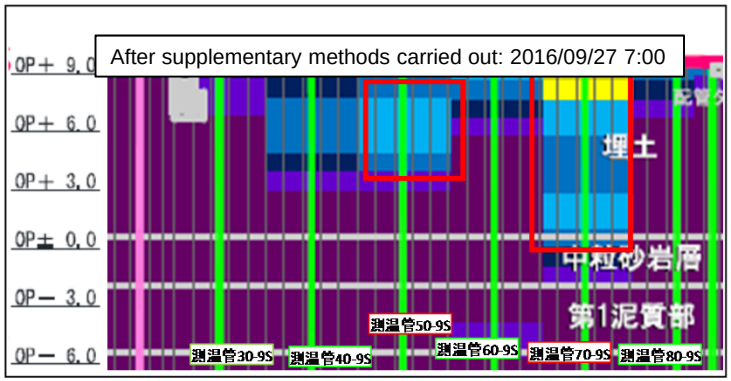
Block No.	Thermometer pipe No.	Details of suspension-type cement to be injected	Go below 0°C*	Details of solution-type chemicals to be injected
1 BLK	130-1 S	Normal cement	Yes	—
	120-1 S		Yes	—
9BLK	30-9 S		Yes	—
	50-9S	Normal cement and superfine cement	Yes	Waterglass
	70-9 S		Yes	
10BLK	60-10S		Expected	
11BLK	210-11S		Yes	
12BLK	170-12 S	Normal cement	Yes	—
13BLK	30-13 S	Normal cement and superfine cement	Yes	Waterglass
	40-13 S		Yes	
	50-13 S		Yes	—
	90-13S		Yes	Waterglass
	80-13S	—	Injection in progress	

*Except for ground surface temperatures

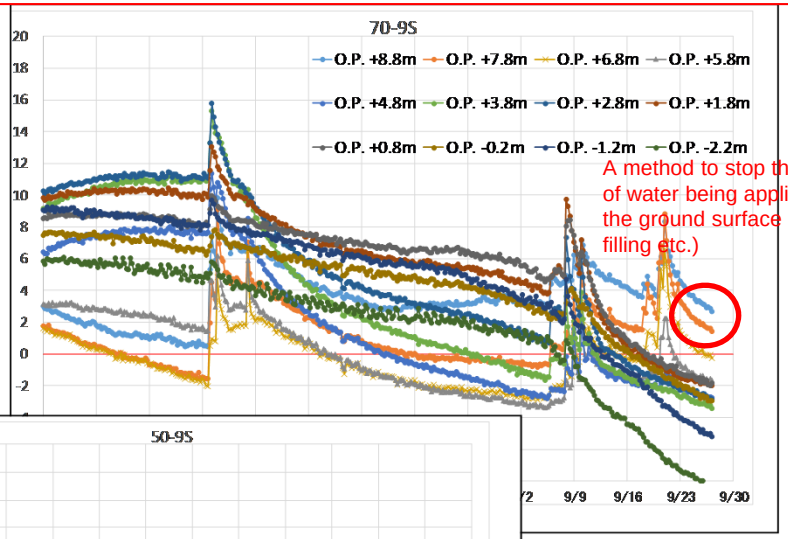
Application of supplementary methods (9BLK)



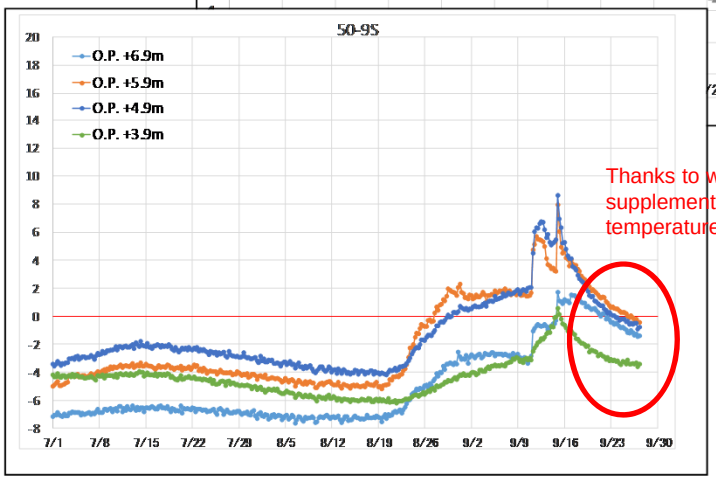




【70-9S】
Work using a supplementary method (solution injection) was completed. The soil temperatures, except for the ground surface, went below 0°C, and are still falling. Another work to stop the flow of water, like cement filling, is being conducted on the ground surface.
【50-9S】
After phase 2 freezing began, the soil temperatures rose due to rainfall caused by several typhoons. On September 10, work using a supplementary method (solution injection) began and was completed after checking the soil temperatures went below 0°C.

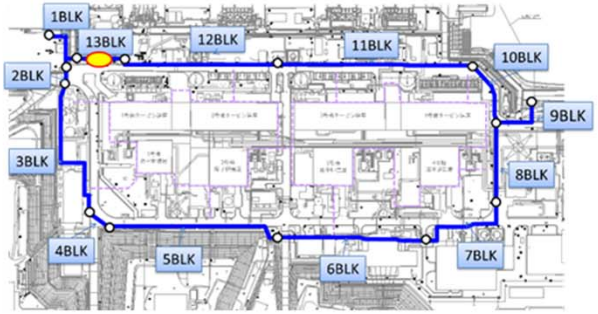


A method to stop the flow of water being applied on the ground surface (cement filling etc.)

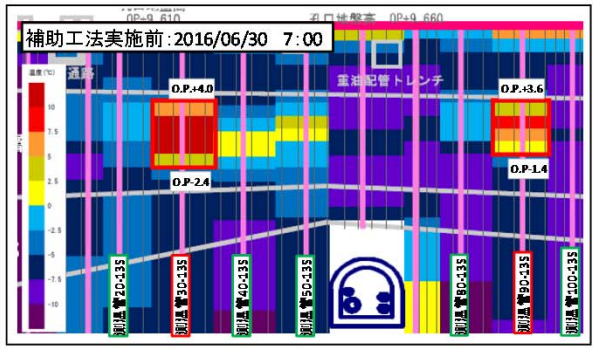


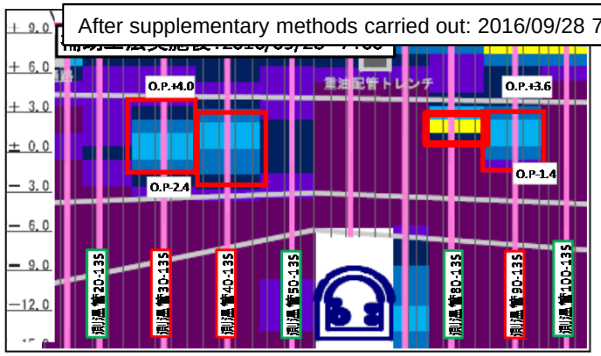
Thanks to work using a supplementary method, soil temperatures went below 0°C.

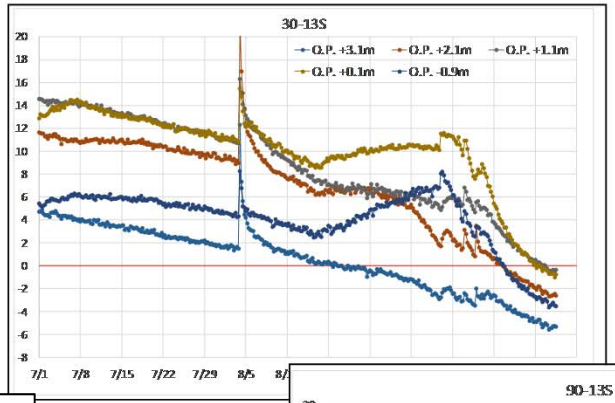
Application of supplementary methods (13BLK)

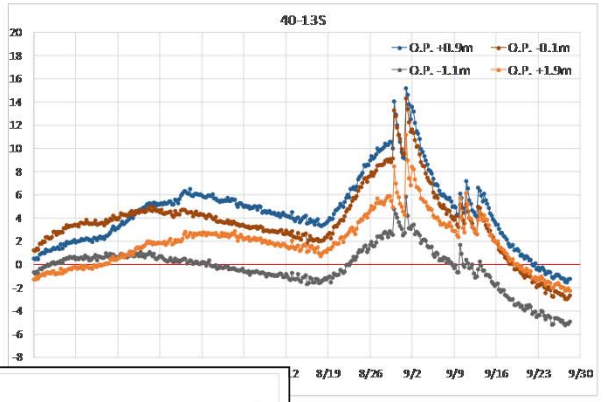


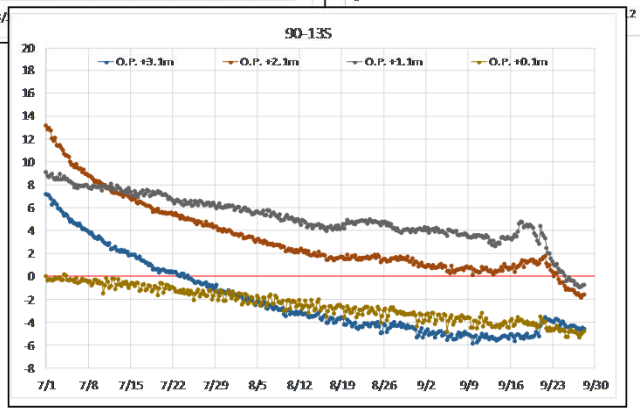
【30-13S】
The soil temperatures went below 0°C thanks to the application of supplementary methods.
【40-13S】
The soil temperatures went below 0°C thanks to the application of supplementary methods.
【90-13S】
The soil temperatures went below 0°C thanks to the application of supplementary methods.
【80-13S】
Work using a supplementary method continues because rise in soil temperature is observed at a point.







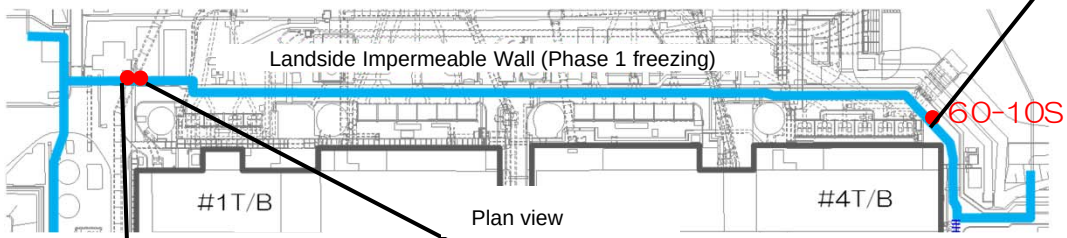




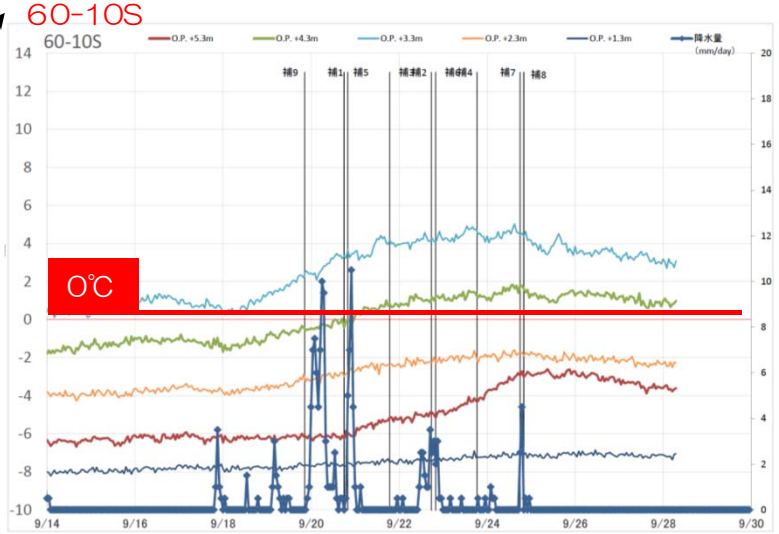
Additional application of supplementary methods ①
in areas where soil temperatures did not drop as expected

Additional application of supplementary methods is in progress in areas where the soil temperatures were expected to fall relatively sooner, but did not.

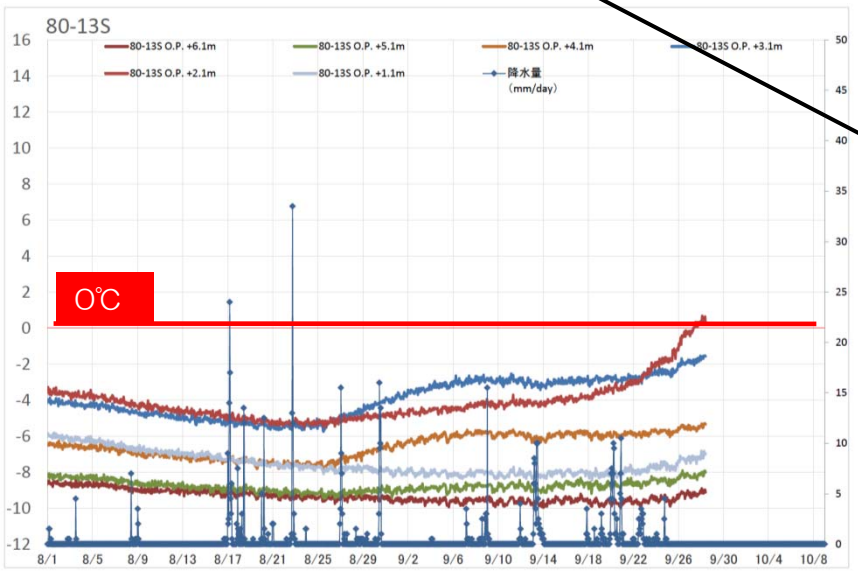
90-13S：Achieved 0°C*, 60-10S：Additional application of supplementary methods in progress



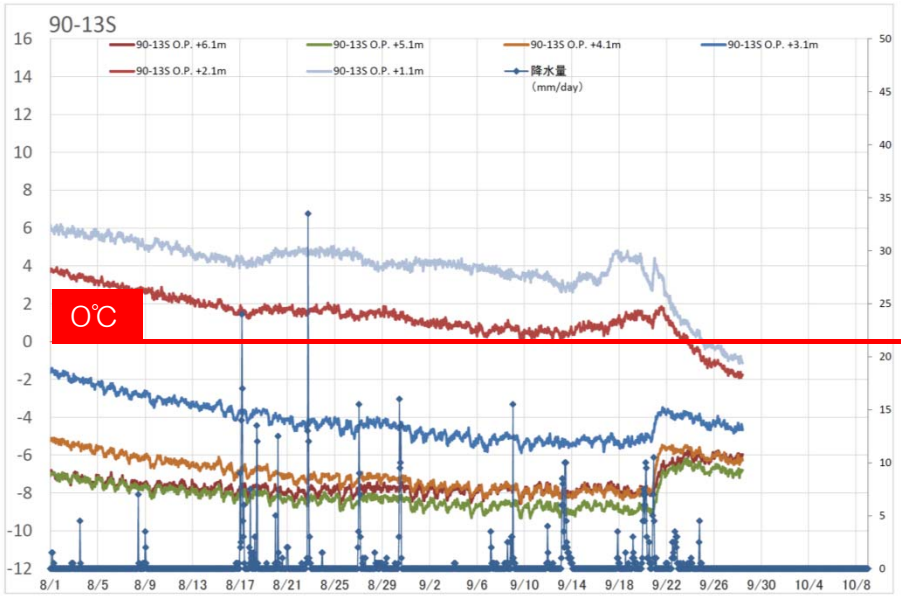
60-10S



80-13S



90-13S

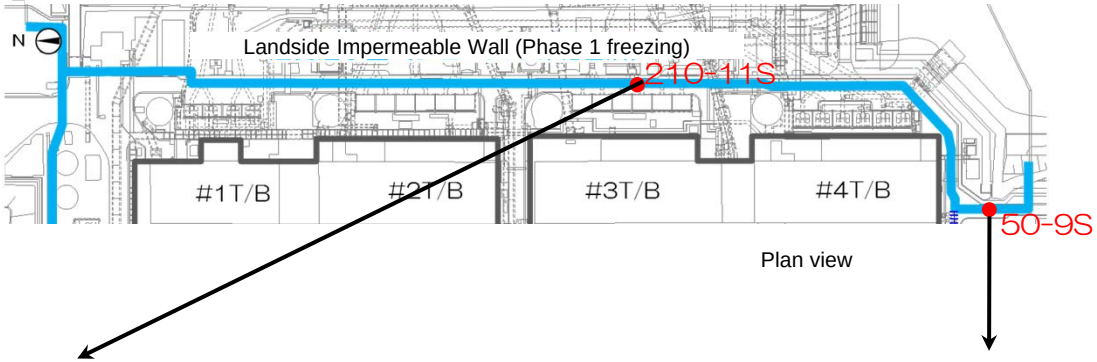


*The soil temperature at 90-13S fell below 0°C. However, the soil temperature at the adjacent 80-13S rose. Groundwater flowed into 80-13S because it lost paces to go due to the success of supplementary method for 90-13S. Therefore, application of supplementary methods at 80-13S continues.

Additional application of supplementary methods ②
in areas where soil temperatures rose from below 0° C to above 0°C

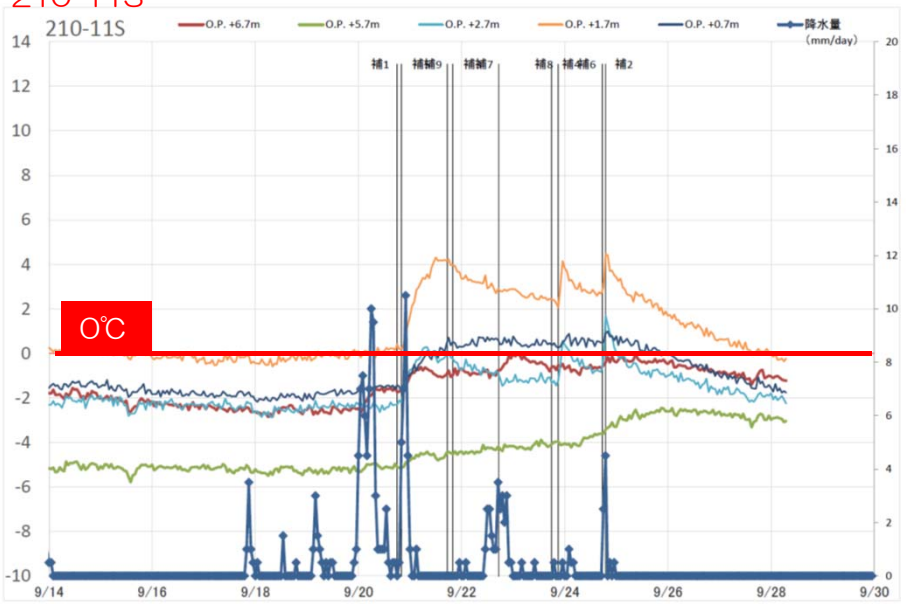
Additional application of supplementary methods was carried out in areas where the soil temperatures had remained a little lower than 0°C, but rose because of typhoon rainfalls.

210-11S：Fell down to 0°C, 50-9S： Fell down to 0°C

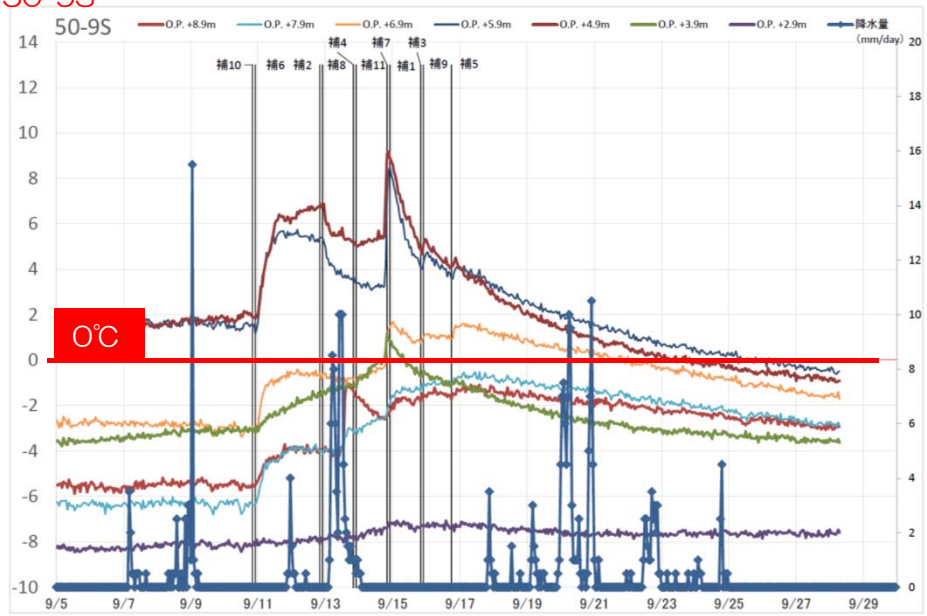


Plan view

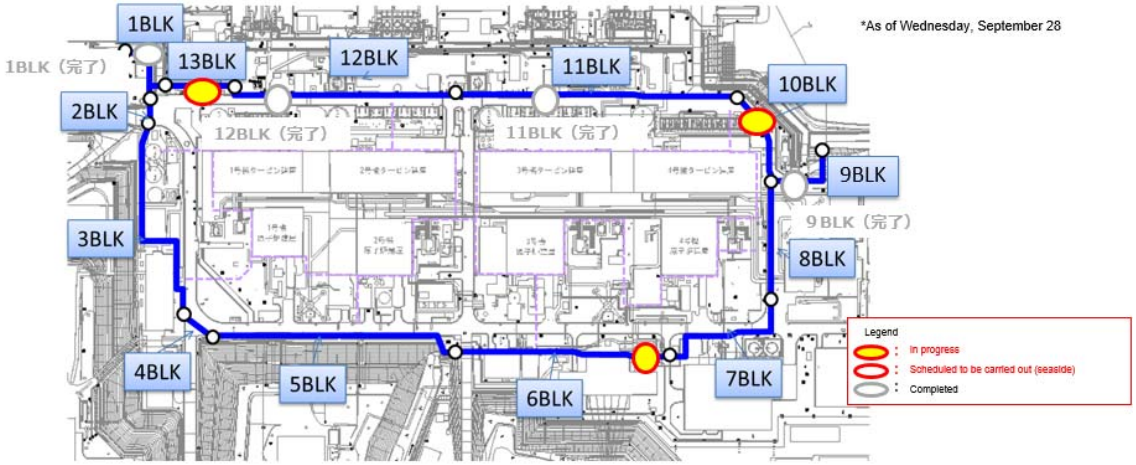
210-11S

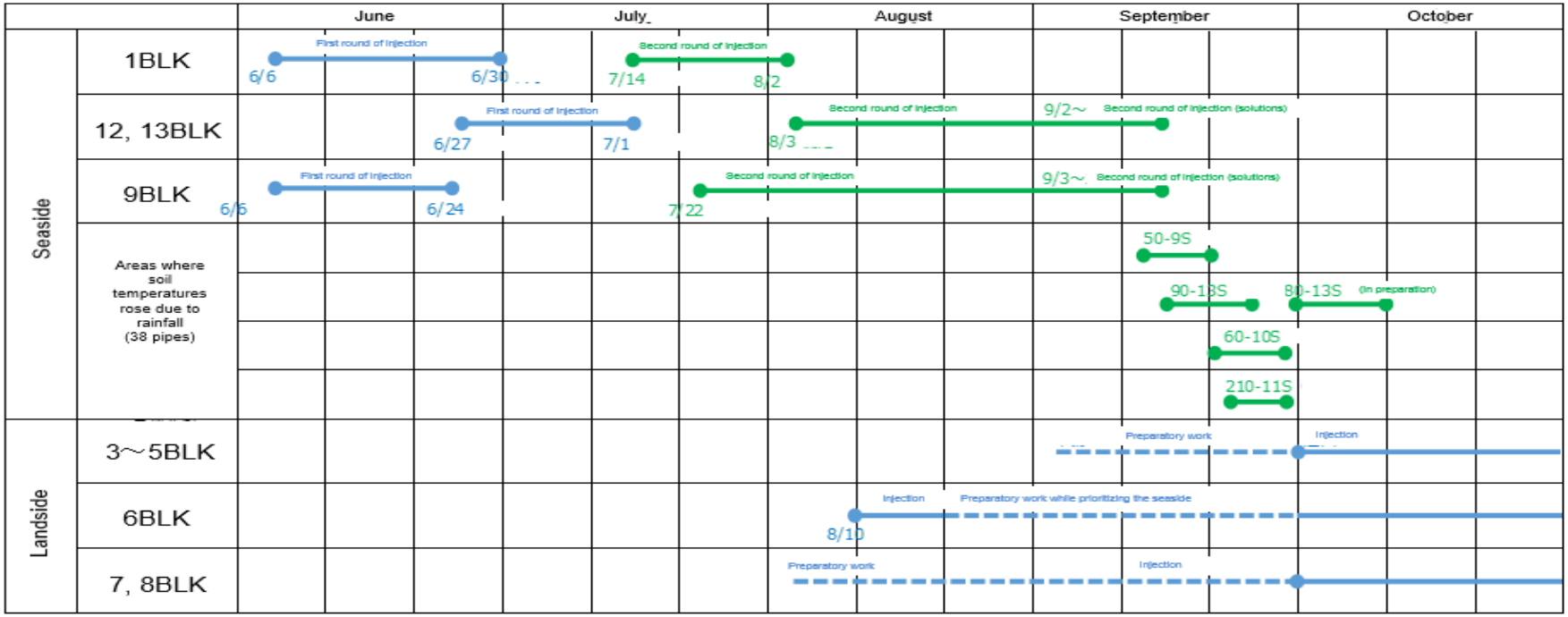


50-9S



Progress in work using supplementary methods and future plans





*Above mentioned prioritized areas will be completed by the end of October 2016.
*Supplementary methods will be applied to the areas where non-freezing portions may remain based on the soil temperatures.

Application of supplementary methods to assist freezing on the landside（6BLK）

【60-6S】（Four out of nine solution-type chemicals injected as of September 26)
Application of supplementary methods is in progress.
Monitoring of the soil temperatures continues.