

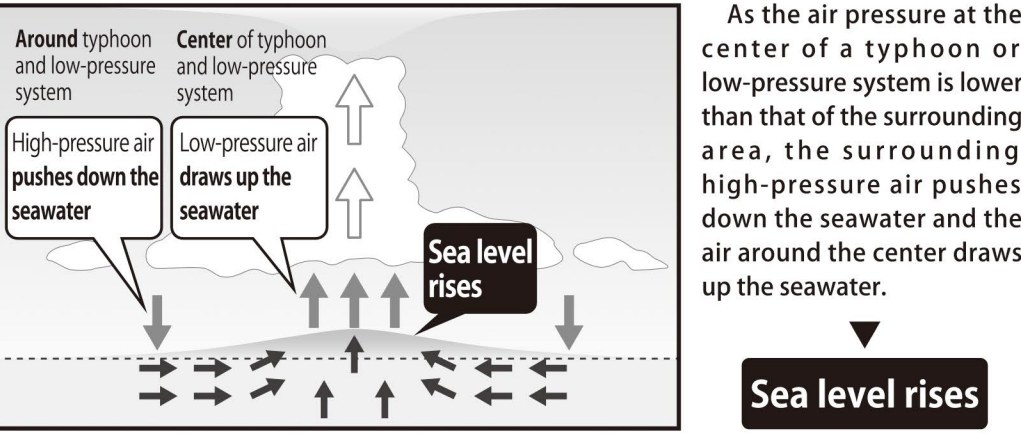
About storm surges

Mechanism of storm surge generation

When a typhoon or a developed low-pressure system passes, sea levels (tide levels) may rise significantly, which is called a "storm surge." Storm surges are mainly caused by ① "inverse barometer effect" due to the decrease in atmospheric pressure; and ② "wind drift effect" due to the wind.

Moreover, when high tide coincides with a storm surge, the storm surge water level rises further, making it more likely for a large-scale disaster to occur.

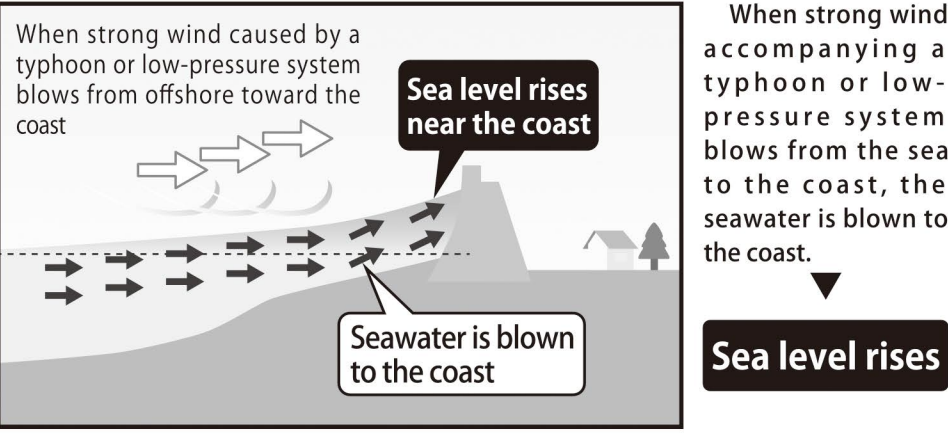
① "Inverse barometer effect" due to the decrease in atmospheric pressure



Air pressure decreases by 1 hPa.
Tide level rises by about 1 cm

For example...
When a typhoon with a central pressure of 910 hPa arrives where it was 1,000 hPa until then,
1,000 hPa - 910 hPa = 90
the sea level rises by about 90 cm near the center of the typhoon.
(Even in the surrounding area, the sea level rises according to the air pressure.)

② "Wind drift effect" due to the wind.



The rise in tide level due to the wind drift effect is proportional to the square of wind speed.

For example...
If the wind speed doubles,
the rise in sea level quadruples.

• Sea with shoals
• Bay opens in the windward direction

The landform works to encourage the rise in sea level, especially at high tide.

Influence of ebb and flow of the tide

When the "high tide" time zone coincides with the approach of a typhoon or low-pressure system, the sea level rises further. Moreover, during a "spring tide" when the tide level is high, the sea level rises even more.

High tide and low tide

The phenomenon where sea levels rise and fall caused by the attractive force of the moon and sun, and the centrifugal force of the earth rotating around the sun, is called sea tide. Twice a day, the sea level gradually rises (high tide) and falls (low tide).

Spring tide and neap tide

When the moon and sun are aligned with the earth in one straight line, the difference in tide level between high and low tide in one day is largest. This period is called "spring tide" (a few days around the new moon and full moon). Conversely, the period when the difference in tide level is smallest is called "neap tide" (a few days around half moon).

What is a water level dissemination coast?

Based on Article 13-3 of the Flood Prevention Act, coasts are designated by prefectural governors as being at risk of causing considerable damage due to storm surges. In Tokyo, the area from the Kyu-Edogawa River (bordering Chiba Prefecture) to the Tamagawa River (bordering Kanagawa Prefecture) is designated as a water level dissemination coast.

What is a storm surge special warning water level?

The storm surge special warning water level of Minato City is A.P. + 3.6 m (Tatsumi Floodgate, Koto City) —

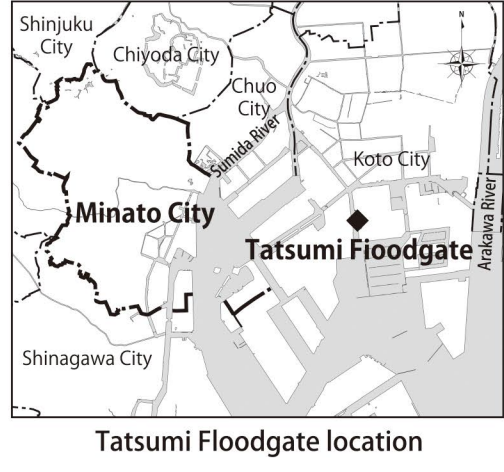
The storm surge special warning water level is the standard water level for informing residents of the danger of flooding of the coast and rivers due to a storm surge caused by the maximum level of a typhoon that can be expected and is set by all wards of Tokyo.

Tide level rises due to storm surge.

Tide level at the Tatsumi Floodgate (Koto City), which is the reference site, reaches the storm surge special warning water level (A.P. + 3.6 m in the case of Minato City).

"Storm Surge Flooding Information" (equivalent to warning level 5 equivalency) is announced.

Storm surge flood risk water level is the water level that takes into account the time necessary for evacuation and information transmission (lead time).

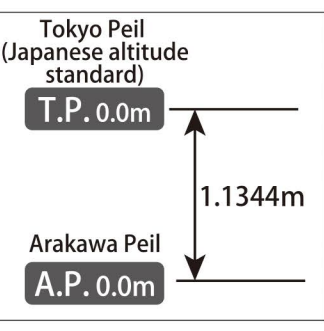


A.P. (Abbreviation for Arakawa Peil)

A.P. stands for Arakawa Peil, and when altitude (T.P.) is 0 m, it is A.P. + 1,134.4 m. This is a method of displaying the height based on the zero level set by the lowest tide level of the Reigaijima water gauge installed in the Sumida River adjacent to then 2-chome Shinkawa, Chuo City, in October 1873.

Lead time

The minimum required lead time, from reaching the storm surge special warning water level to information transmission and evacuation, is as follows:
- 10 minutes for preparation for announcement and information transmission
- 20 minutes for evacuation (preparation and movement)
- 30 minutes in total



Major storm surge damage in the past

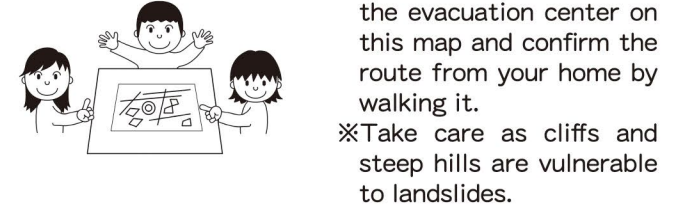
Date (M/D/Y)	Main cause	Main damaged areas	Highest tide level by 12 m	Maximum deviation (m)	Damage situation
October 1, 1917	Typhoon in 1917	Tokyo Bay	3.0	2.1	When the typhoon approached Tokyo Bay, the spring tide coincided with high tide time, and as a result, the sea level rose immediately, causing enormous damage in the Tokyo Bay coastal area. A total of 1,324 people were killed or went missing, and 55,733 houses were destroyed or severely damaged.
September 21, 1934	Muroto Typhoon	Osaka Bay	3.1	2.9	20% of Osaka City, 30% of Sakai City, and 40% of Amagasaki City were flooded. The tide level increase in Osaka Bay was rapid. In less than 30 minutes, the flood depth reached more than 2 m according to the record on the street of Chikko, Osaka Bay. A total of 3,036 people were killed or went missing, and 80,046 houses were destroyed or severely damaged.
September 27, 1959	Isewan Typhoon	Ise Bay	3.9	3.4	Considerable damage centered around Nagoya City, the most inner part of Ise Bay. The sea level of the entire bay rose by 2 m and the total length of the embankment breach reached almost 33 km at 220 sites centered on low-lying areas in the inner part of the bay. A total of 5,098 people were killed or went missing, and 151,973 houses were destroyed or severely damaged.
September 16, 1961	Second Muroto Typhoon	Osaka Bay	3.0	2.5	In Osaka City, a 31-km² area was inundated, and flooding also occurred in Hyogo Prefecture, Wakayama Prefecture, and the eastern part of Shikoku. A total of 200 people were killed or went missing, and 54,246 houses were destroyed or severely damaged.
August 30, 2004	Typhoon 16	Seto Inland Sea	2.5	1.3	In Takamatsu City, Kagawa Prefecture, the tide level exceeded the embankment by about 70 cm, and 15,561 households were inundated, covering 960 ha.
September 4, 2018	Typhoon 21	Osaka Bay	3.3	2.8	In Osaka City and Kobe City, figures exceeding all-time-high tide levels were observed. The runway of Kansai International Airport was inundated, and shipping containers were toppled at Kobe Port.

Maximum deviation : The maximum difference between the tide level without a storm surge (estimated astronomical tide level) and the actual tide level.

Things to keep in mind before, during, and after a disaster

Prepare before Always be prepared in case of an emergency

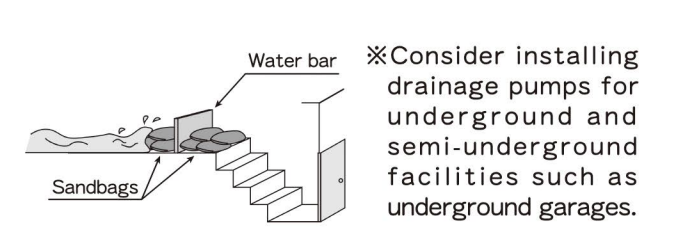
Confirm the location of the designated evacuation center and a safe route to that location.



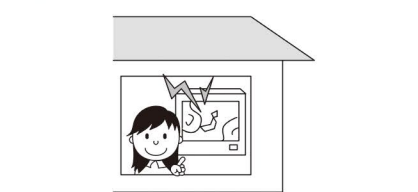
Prepare an emergency bag with basic necessities.

- flashlights
- portable radio
- batteries
- drinking water
- emergency provisions
- first aid kits
- towels
- clothes, underwear
- rope
- valuables, cash, etc.

Prepare sandbags and water bars in basements and half-basements.



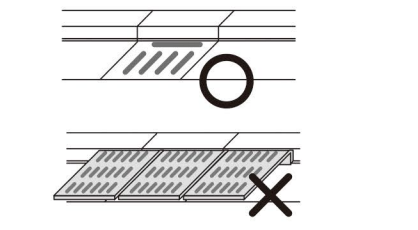
Always check the weather forecast on TV, radio, PC, etc.



Please cooperate by keeping areas around street drains clean.



Don't put anything on top on drainage ditches or street drains.



What you can do at home to prevent flooding

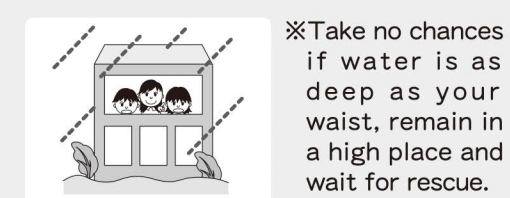
A simple method of preventing flooding is to use something in your home as a water barrier. Of course, this method will only work when the water is still shallow. Continue to pay attention to water levels and do not miss the chance to evacuate at the appropriate time.

- Make a simple water barrier out of plastic trash bags.
- Make a water bar.
- Use planters and a plastic ground sheet (tarpaulin).
- Use simple absorbent sandbags.

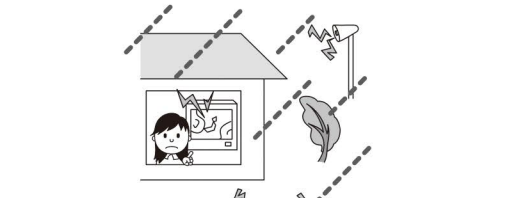
Be careful when evacuating

Evacuation method

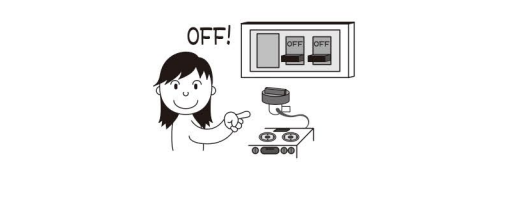
Evacuate to a nearby tall building or evacuation center.
(Please contact Minato City Hall when you evacuate to an evacuation center.)



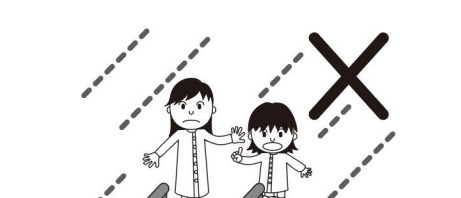
Always gather the latest weather information from TV, radio, or PC.
Pay attention to evacuation orders from City Hall or the police department.



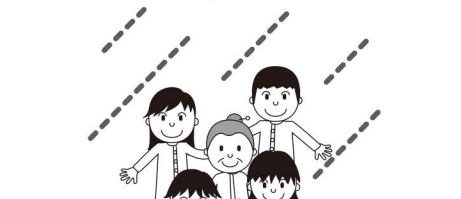
Turn off gas at the supply valve and turn off electricity at the circuit breakers.



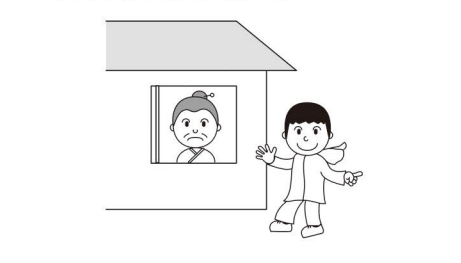
Stay away from rivers and/or bridges.



Do not evacuate alone; contact friends and neighbors and evacuate together.



We ask for your cooperation in helping to evacuate the elderly, children, and the sick.

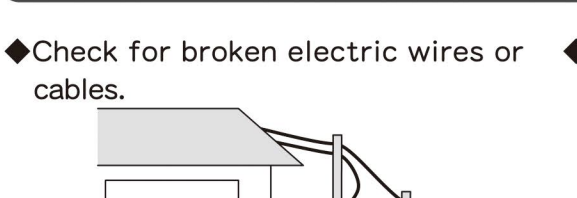


After After flooding has receded

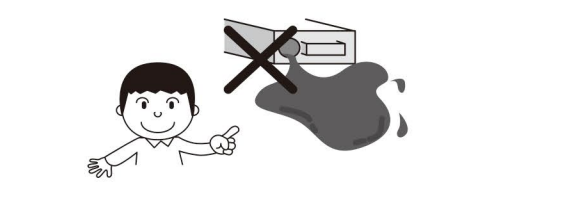
Disinfect to prevent infectious diseases.



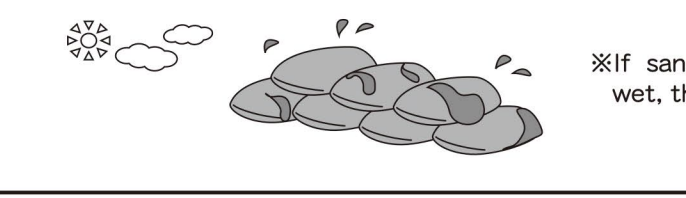
Check for broken electric wires or cables.



Check for leakage of hazardous materials such as kerosene.



Dry out used sandbags and return or store them.



Information on disaster prevention and timing of evacuation

Criteria for issuing evacuation information and actions to be taken by residents

Evacuation information issued by Minato City, criteria for issuance, and actions to be taken by city residents are shown in the following table. Please take appropriate action according to this information.

Warning level	Actions to be taken by residents	Evacuation information (Issued by Minato City)
Warning level 5	◆ A disaster has already occurred or is imminent. So take immediate life-saving action. (Move to a relatively safe place, such as an indoor upper-floor evacuation. (vertical evacuation))	Emergency Safety Measures
Warning level 4	◆ There is a high risk of disaster. Evacuate everyone from areas that are dangerous. (Evacuation to outdoors or securing indoor safety.) Securing indoor safety means actions taken at one's own discretion after confirming that one's personal safety is secured indoors.	Evacuation Instruction
Warning level 3	◆ There is a risk of a disaster. For those who need time for evacuation of the elderly, etc. Prepare for evacuation or conduct early evacuation. Others	Evacuation of the Elderly, Etc.
Warning level 2	◆ As weather conditions are becoming worse, Check evacuation actions such as evacuation sites and the timing of evacuation using hazard maps, etc.	—
Warning level 1	◆ As there is a possibility that weather conditions will worsen in the future, Improve preparedness for disasters by looking at weather forecasts, etc.	—

Criteria for issuing evacuation information
If the following events occur or information is announced, evacuation information will be issued.
Immediately before a disaster occurs or may have already occurred
◆ When abnormality at a flood gate, land lock, etc. is confirmed.
◆ When the tide level exceeds a dangerous level (T.P. + 2.4 m) and flooding is estimated to have occurred.
◆ In the case where Storm Surge Flooding Information is announced at a beach where storm surge may cause considerable damage.
Confirm the occurrence of a disaster
◆ In the case of collapse of a coastal embankment, etc.
◆ When abnormal overtopping wave or overflow occurs.
◆ In the case of storm surge flooding at a beach where a storm surge may cause considerable damage.
◆ When a Storm Surge Warning or Storm Surge Emergency Warning is announced.
◆ When a typhoon with heavy rainfall that requires the issuance of an Evacuation Instruction (Warning Level 4) is expected to approach or pass from night to dawn. (An Evacuation Instruction is issued in the evening)
◆ When it is mentioned in the announcement of a Storm Surge Advisory that there is a high possibility of a Storm Surge or Storm Surge Warning.
◆ When a Storm Surge Advisory is issued and { that the area is expected to be in the typhoon storm zone. typhoon information indicates { that a typhoon is approaching.
◆ When a typhoon with heavy rainfall that requires the issuance of an Evacuation of the Elderly, Etc. (Warning Level 3) is expected to approach or pass from night to dawn. (An Evacuation of the Elderly, Etc. is issued in the evening)
◆ When it is known from prefectural meteorological information or a press conference by the Japan Meteorological Agency that an "Ise Bay typhoon" -class typhoon is approaching and there is a possibility of Special Warning issuance 24 hours in advance of landing.

Disaster prevention meteorological information on Storm Surge

Types	Contents	Warning level	Announcing organization
Storm Surge Flooding Information	Announced when the coast designated as a water level dissemination coast has reached the storm surge special warning water level.	Warning level 5 (equivalency)	Tokyo Metropolitan Government
Storm Surge Emergency Warning	If a storm surge caused by a strong typhoon that occurs once every few decades or similar-level extratropical cyclone is predicted.	Warning level 4 (equivalency)	
Storm Surge Warning	If it is predicted that there is a risk of serious disasters caused by abnormal rise of sea levels due to a typhoon or low-pressure system, etc.	Warning level 3 (equivalency)	
Storm Surge Advisory	If it is predicted that there is a risk of disaster caused by abnormal rise of sea levels due to a typhoon or low-pressure system, etc.	Warning level 2	Japan Meteorological Agency
Typhoon Information	Information on typhoon conditions, such as center location of the typhoon, air pressure, maximum wind speed, predicted course, and storm surge.		

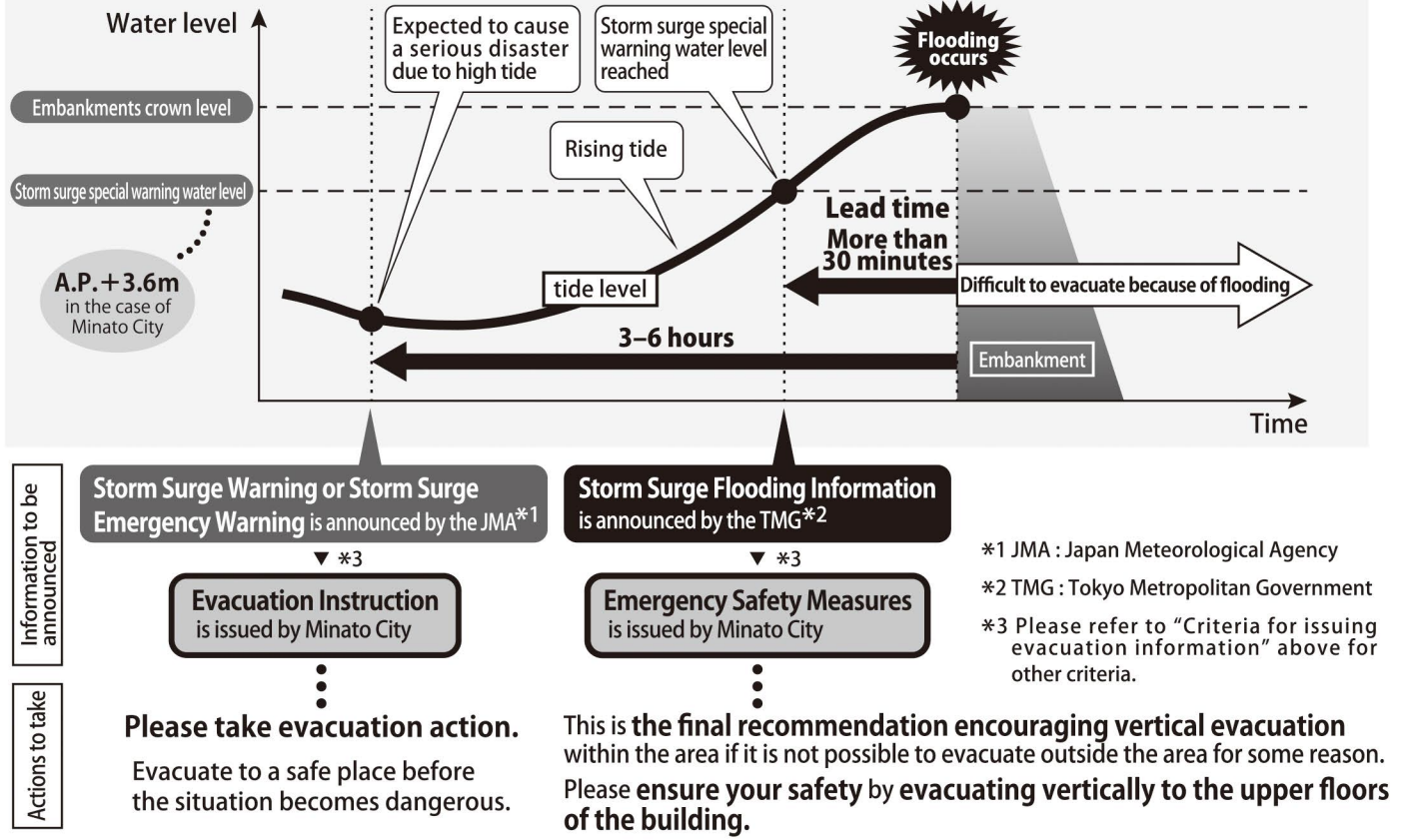
Relation between tide level, information to be announced, and actions to be taken

The relation between tide level, information to be announced, and actions to be taken is shown in the figure on the right.

When a Storm Surge Warning or Storm Surge Emergency Warning is announced, an Evacuation Instruction is issued by Minato City, so please evacuate to a safe place.

After that, when the tide level rises and Storm Surge Flooding Information is announced, Emergency Safety Measures are issued by Minato City. Please ensure your safety by evacuating to the upper floors of the building (vertical evacuation).

Moreover, when a typhoon that may cause storm surge disasters is approaching, it is assumed that a wind storm will start before tide levels rise, and in such a situation it is expected to be difficult to evacuate to remote facilities. Therefore, it is necessary to act on evacuation when an evacuation Instruction is issued based on Storm Surge Warning or Storm Surge Emergency Warning.



About communication of information

Register with Minato City's Disaster Information E-mail Service!

Minato City sends information on disasters including storm surges by e-mail to mobile phones, smartphones, tablets, and personal computers. The registration method is easy, and you can register, deregister, and make changes at any time.

How to Register

- Send a blank e-mail to the following: t-minato@sg-p.jp
(If your cell phone supports two-dimensional codes, scan the two-dimensional code on the right to access the site.)
 - You will receive an e-mail from the Minato City Disaster Information E-mail Service. You will see the URL of the registration form in the e-mail; please access the registration screen.
 - Review the terms of use and press "Agree."
 - Select the delivery category, enter the information to be registered, and press "Confirmation Screen."
 - Confirm the information entered and register it.
- * Select either Japanese or English. You can select the language on each page.

Information for Delivery

- Earthquakes
- Amount of rainfall
- Tsunami
- Disaster prevention /weather
- Water levels
- Advisories and warnings
- Civil protection
- Other emergency information

How can I check the contents of the disaster prevention wireless system?

Disaster information is broadcast from speakers installed outdoors, but if you could not catch it or missed it, you can also check it by the following methods.

Telephone call to check the contents of a broadcast: 03-5401-0742	Minato City's disaster information e-mail service	Minato City's official website
Minato City Official X (formerly Twitter)	Minato City's official Facebook	J:COM channel (11ch)

Disaster prevention related agencies, etc.

Please contact the following facilities in case of flood or typhoon damage.

Content of request	Name of facility	Location	Contact information
Certificate of damage	Management Subsection, General Administration Section, Each Minato City Regional City Office	Each Regional City Office (see below)	Each Regional City Office (see below ②)
Trash collection	Minato Recycling and Waste Management Office	3-9-59 Konan	3450-8025
Consultation on disinfection after flooding recedes	Life Hygiene Counseling Subsection, Life Hygiene Section, Minato Public Health Center	1-4-10 Mita	6400-0043
Health consultation	Health and Welfare Subsection, Residents Support Section, Each Minato City Regional City Office	Each Regional City Office (see below)	Each Regional City Office (see below ②)
Relief money after small-scale disaster	Collaboration Project Subsection, Collaboration Project Section, Each Minato City Regional City Office	Each Regional City Office (see below)	Each Regional City Office (see below ②)
Emergency support funds for small and medium businesses	Industry Promotion Section, Minato City	Fudanotsuji Square (5-36-4 Shiba)	6435-4620
Loans for living assistance and welfare	Livelihood Support Section, Minato Council of Social Welfare	Azabu Regional City Office (see below)	6230-0282
National tax	Shiba tax office	5-8-1 Shiba	3455-0551
Prefectural tax	Azabu tax office	3-3-5 Nishi-azabu	3403-0591
City Ward tax	Minato Metropolitan Taxation Office, Taxation Section, Minato City	3-5-6 Azabudai	5549-3800
Consultation regarding National Health Insurance fees	National Health Insurance and Pension Section, Minato City	2F Minato City Hall	3578-2593
		3F Minato City Hall	3578-2643 ~ 2645

Contact information for related facilities

Information needed	Name of facility	Location	Contact information
Disaster prevention in general	Disaster Prevention Section, Disaster Prevention and Crisis Management Department, Minato City	SF Minato City Hall	3578-2541
Flood preparation, sandbags	Public Works Subsection, Community Development Section, Each Minato City Regional City Office	Each Regional City Office (see below ②)	Each Regional City Office (see below ②)
Fire Station, paramedics	Shiba Fire Station, Shiba Volunteer Fire Company	2-13-7 Higashi-Shimbashi	3431-0119
	Azabu Fire Station, Azabu Volunteer Fire Company	3-4-42 Moto-azabu	3470-0119
	Alakasa Fire Station, Alakasa Volunteer Fire Company	2-16-9 Minami-ayama	3478-0119
	Takanawa Fire Station, Takanawa Volunteer Fire Company	2-4-12 Shibaaura	3446-0119
	Atago Police Station	6-18-12 Shimbashi	3437-0110
	Azabu Police Station	4-7-1 Roppongi	3479-0110
	Akasaka Police Station	4-18-19 Akasaka	3475-0110
	Takanawa Police Station	3-15-20 Takanawa	3440-0110
	Mita Police Station	4-2-12 Shibaaura	3454-0110
	Tokyo Wangan Police Station	2-7-1 Aomi, Koto City	3570-0110
Tokyo Metropolitan streets/roads	Bureau of Construction, Tokyo Metropolitan Government, 1st Construction Office, Minato Area	1-2-13 Mita	3452-1464 (Nights and holidays)
Routes 1 and 15	Tokyo National Highway Office, Shinagawa Branch	1-1-3 Yashio, Shinagawa City	3799-6315
Route 246	Tokyo National Highway Office, Yoyogi Branch	4-30-8 Yoyogi, Shibuya City	3374-9451
Sewers	Bureau of Sewerage, Tokyo Metropolitan Government, Chubu Sewerage Office, Minato Branch (excluding Daiba area)	2-20-14 Mita	3798-5243
	Bureau of Sewerage, Tokyo Metropolitan Government, Tobu 1st Sewerage Office, Koto Branch (only for Daiba area)	7-1-14 Toyo, Koto City	3645-9273

Each Regional City Office

Name of regional city office	Location	Management Subsection, General Administration Section ①	Health and Welfare Subsection, Residents Support Section ②	Collaboration Project Subsection, Collaboration Project Section ③	Public Works Subsection, Community Development Section ④
Shiba Regional City Office	1-5-25 Shibakoen	3578-3191	3578-3161	3578-3123	3578-2032
Azabu Regional City Office	5-16-45 Roppongi	5114-8811	5114-8822	5114-8802	5114-8803
Akasaka Regional City Office	4-18-13 Akasaka	5413-7014	5413-7276	5413-7015	5413-7015
Takanawa Regional City Office	1-16-25 Takanawa	5421-7124	5421-7085	5421-7621	5422-7941
Shiba-ura-Konan Regional City Office	1-16-1 Shiba-ura	6400-0011	6400-0022	6400-0031	6400-0032