Water Stewardship

Strategies	2030 Goals	2023 Targets	2022 Achievements
Manage Water Resource Risks Enforce climate change mitigation policies; implement water conservation and water shortage adaptation measures	Reduce unit water consumption by 30% (L/12-inch equivalent wafer mask layer) (Base year: 2010)	Reduce unit water consumption by 2.7% (L/12-inch equivalent wafer mask layer) (Base year: 2010)	Reduced unit water consumption by 2.6% (Base year: 2010) — Note 1 Target: 16%
Develop Diverse Water Sources Develop water reclamation technologies; continue to practice water conservation and use reclaimed water during manufacturing	>60% replacement of water resources with reclaimed water Note 2	5% replacement of water resources with reclaimed water Continue to collaborate with the government to complete the second water reclamation plant located in Anping, Tainan	TSMC Tainan Science Park Reclaimed Water Plant started supplying water on September 19, 2022 ✓ Target: TSMC Tainan Science Park Reclaimed Water Plant start of operations
Develop Preventive Measures Improve the efficiency of water pollution control and removal of water pollutants	Water pollution composite indicator reduction rate of >60% Note 3	Water pollution composite indicator reduction rate of 56%	Water pollution composite indicator reduction rate of 54.3% ↑ Target: 45%

Note 1: In 2022, TSMC newly built Fab 18 Phases 6, 7 & 8. While not yet in operation (volume production level), the new facilities still consume water at a fixed rate, as such the Company failed to reach the 2022 target for unit water consumption. Excluding the new facilities, the unit water consumption was 15.6% in 2022. In the future, facilities below a certain economic scale will be excluded from the calculation of unit water consumption

Note 2: (1) The source of reclaimed water include municipal drainage and industrial discharge (2) Replacement rate of reclaimed water = consumption volume of reclaimed water/(consumption volume of reclaimed water + tap water). Figures from TSMC fabs in Taiwan

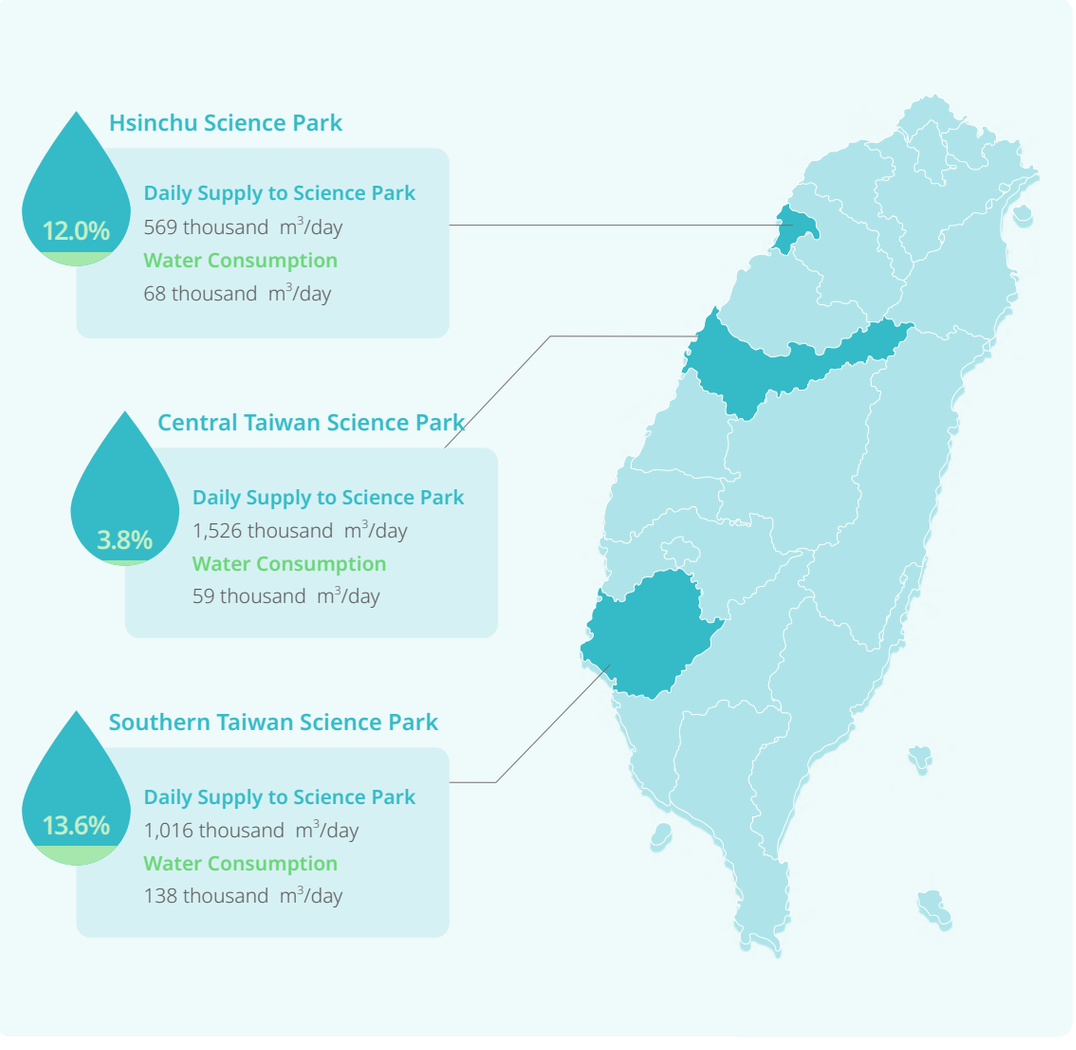
Note 3: In 2022, TSMC was able to reduce the water pollution composite indicator by 54.3%, exceeding the 2022 target of 45% and long-term 2030 goal of 50%. As such, the 2030 goal was changed from 50% to over 60%. Figures from TSMC fabs in Taiwan

↑ Exceeded ✓ Achieved — Missed Target

In 2022, Taiwan experienced zero typhoons while weather fronts carrying moisture failed to cover reservoirs in Taiwan, resulting in little rainfall in Southern Taiwan. Based on the drought monitoring signals issued by the Water Resources Agency, TSMC adopted response measures in compliance with the TSMC Internal Control Procedures for Low Water Supply Crisis Management to take stock of areas where more water could be conserved and to strengthen the water use efficiency of recycling systems. In 2022, the Company conserved 3.35 million m^3 of water and recycled a cumulative total of 215 million m^3 of water throughout the year.

While working to increase water reclamation efficiency, TSMC also cares about getting the most use out of every drop of water. As such, TSMC is actively developing water reclamation technologies. On September 19, 2022, the TSMC Tainan Science Park Reclaimed Water Plant—Taiwan's first privately-operated water reclamation plant—became operational and started recycling industrial wastewater produced in the Southern Taiwan Science Park into reclaimed water for advanced semiconductor processes, a first for the global semiconductor industry. TSMC also continues to work with the government and is planning to complete the Tainan Anping Reclaimed Water Plant in 2023, which is estimated to reclaim 35,000 m^3 of water per day for TSMC facilities in the Southern Taiwan Science Park (STSP). TSMC's goal is to increase the supply of reclaimed water to gradually reduce city water consumption each year. The Company is also exploring the concept of being water positive in the hope of restoring water resources in the future and upholding sustainable water practices.

TSMC Water Consumption in Three Science Parks



Resource: Water Resources Agency, Ministry of Economic Affairs

Drought Contingency Measures

Water Signal from the Water Resource Agency (WRA)	Government Response Measures	TSMC Response Measures
Blue Normal water levels	Stable supply and demand	• Monitor WRA reservoirs supply for TSMC fabs • Host drills regularly
Green Fairly severe	Farmers encouraged to suspend farming	• Drought Emergency Response Team in operation • Check water resources and water truck capacity • Spontaneously save water by 5%
Yellow First stage	• Reduce water pressure at specific times • Suspended irrigation water in certain areas	• Reduce water consumption by 7% • Water truck drills
Orange Second stage	Reduce water supply to industrial users by 5-20%	• Activate water trucks • Reduce water consumption by 7-20%
Red Third stage	Water rationing by district	• Activate water trucks • Reduce water consumption by 7-20%

Manage Water Resource Risks

Every year, TSMC evaluates the water risk levels of all TSMC facilities using the Water Risk Atlas from the World Resources Institute (WRI). Results from 2022 were identical to those of 2021: WaferTech was rated as low risk; TSMC facilities in Taiwan and VisEra were rated as medium-to-low risk; and TSMC (China) and TSMC (Nanjing) were rated as high and medium-to-high risk, respectively, due to regional water quality differences. In 2022, TSMC added Fab 18B into the water risk evaluation. While building Fab 18B, TSMC preemptively elevated foundations, installed floodgates, and applied existing recycling systems and wastewater treatment measures to the facility. By the time Fab 18B became operational, it already possessed outstanding flood protection and process water recycling rate, which enabled it to maximize water resources and mitigate environmental impact.

Effective Water Management with AWS

In 2022, Fab 12A, Fab 12B, and Fab 5 at Hsinchu Science Park and Advanced Backend Fab 3 at Lungtan Science Park obtained Alliance for Water Stewardship (AWS) Platinum certification. All advanced TSMC fabs in Taiwan's three science parks have obtained AWS Platinum certification (the highest level available) for three consecutive years, a first for the global semiconductor industry.

Sustainable water stewardship at TSMC complies with AWS standards. In 2022, the Company introduced water reclaimed from industrial wastewater to facilities at the STSP for the first time. The reclaimed water was gradually supplied to Fab 6, Fab 14, and Fab 18 to reduce city water consumption and achieve the preliminary target toward sustainable water balance. TSMC's efforts toward good water quality include a new tetramethylammonium hydroxide (TMAH) treatment system in Fab 3 to effectively reduce effluent concentration by 90%; 70% copper concentration reduction from effluents discharged by Advanced Backend Fab 3 to improve local creek water quality. After improving the cooling equipment of the reaction tank and reducing the batch reaction time, in June 2022, the hyfrofluoric (HF) acid waste regeneration system in Fab 15B achieved zero treatment outsourcing of the HF acid waste liquid. The hydrofluoric acid waste regeneration system processed a cumulative total of 4,193 metric tons of HF acid waste and produced 1,025 metric tons of cryolite in 2022. In addition, ecological restoration and soil and water conservation in areas surrounding TSMC facilities are AWS implementation priorities. TSMC compiled the TSMC Firefly Habitat Management Process to bring back fireflies and launched afforestation initiatives. In 2022, over 1,900 adult fireflies appeared across TSMC's three major factories. The Company also planted 108,000 trees and 320,000 shrubs, expanding afforested areas to 10.1 hectares to create a healthier water environment.

TSMC WRI Risk Identification

Overall WRI Risk Index

- **Frequency**
  - Water risk
  - Decreasing underground water levels
  - Interannual variation
  - Seasonal variation
  - Drought
  - Flood risks
  - Tsunami risks
- **Quality Control**
  - Coastal erosion
  - Untreated water bodies
- **Regulation and Reputation**
  - Drinking water quality
  - Sanitary conditions
  - Sustainable investment index

TSMC Assessment

- Flood Risk
- Water Risk
- Water Quality Risk

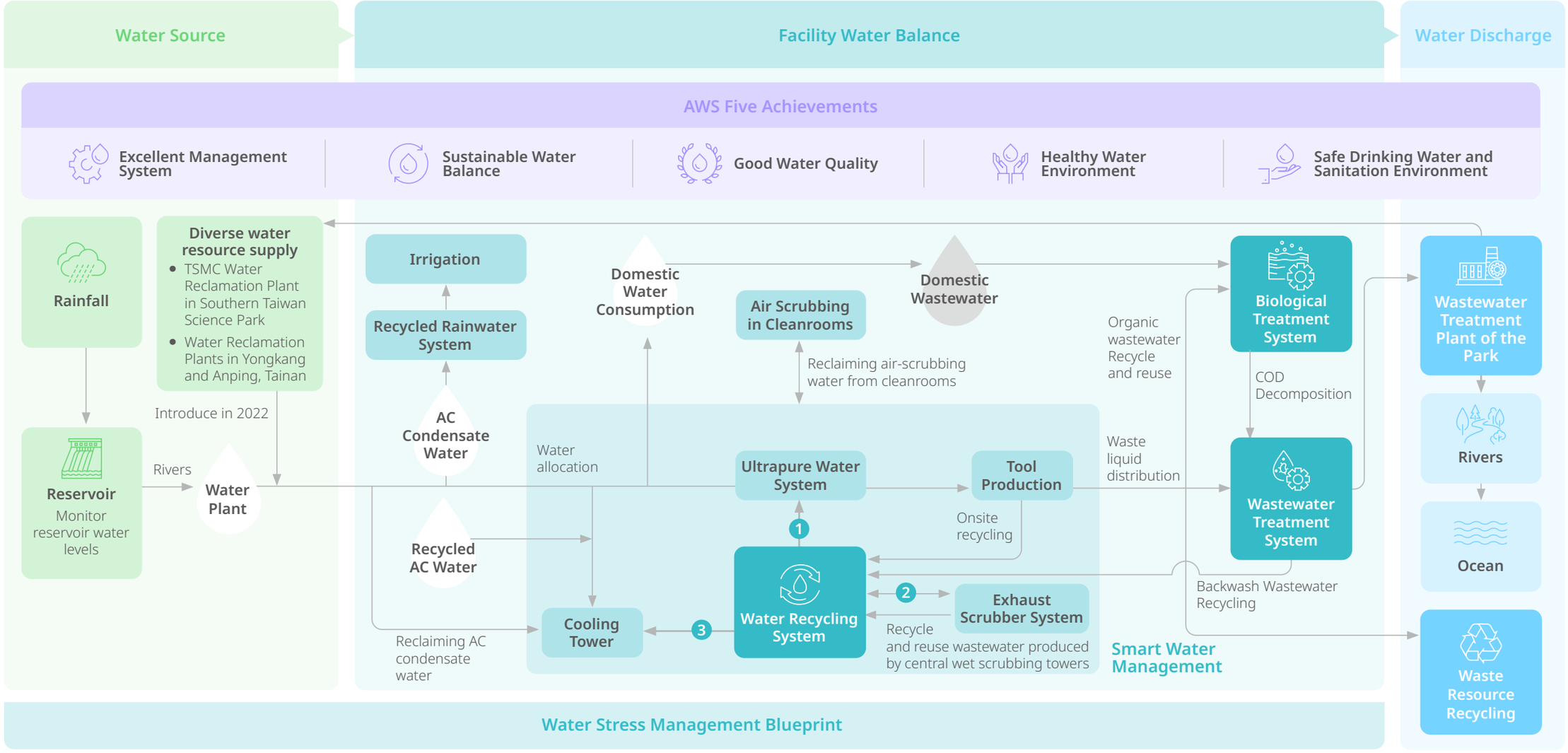
TSMC Assessment Results

Low Risk	1 Facility
Mid-to-low Risk	16 Facility
Mid-to-high Risk	1 Facility
High Risk	1 Facility

TSMC Response Measures

- **Facility Design**
  - Elevate facility
  - Install flood gates
- **Water Management**
  - Establish emergency response procedures
  - Develop diverse water sources
  - Recycle and reuse water
  - Set water pollution composite indicator

Water Balance and Supply Chain Environmental Relationship

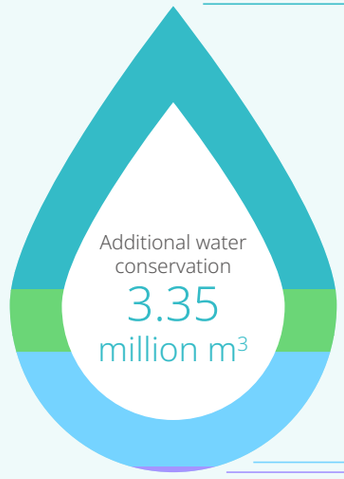


1 Replace city water with refined recycling water
2 Reclaiming exhaust scrubbing water
3 Smart water pumping model to regulate peak water consumption

Strengthen In-house Water Reclamation and Water Use Efficiency

TSMC has created an internal Water Map platform to effectively manage and gain insights into water used in TSMC facilities. The Company also continues to track reservoir water levels and install in-house water quality and water level monitoring points to monitor water usage, recycled water, wastewater, and domestic water consumption in processes according to the water balance chart. This forms the basis for integrating water consumption and recycle and reuse mechanisms to calculate recycling/discharge rates and allocate water to units that use water. In 2022, TSMC continued to implement four major water saving measures: reducing facility system water consumption, increasing the wastewater recycling of facilities, improving the water production rate of the system, and decreasing water discharge loss from the system. The Company conserved 3.35 million m^3 of water and yielded a wafer unit water consumption of 137.3 liter per 12-inch equivalent wafer mask layer, a 2.6% reduction from the 140.9 liter per 12-inch equivalent wafer mask layer in 2010, the base year. Nevertheless, TSMC failed to reach the 2022 target because new facilities built in 2022 were still in risk production stages. Though the new facilities have not yet reached economic scale, there was still a fixed amount of water consumption, which led to a lower water saving rate. Wastewater discharge was 93.0 liter per 12-inch equivalent wafer mask layer, an 18% increase from last year. The increase was also caused by the water consumption for risk production in new facilities. Before the new facilities reach economic scale in production, TSMC will continue to optimize operating parameters for water recycling systems, increase water use efficiency, and reduce wastewater discharge.

Water Saving Measures and Achievements in 2022



Improve Water Production Rate of the System

1,935,000 m^3 (57.7%)
Improved usage efficiency of recycled water

123,000 m^3 (3.7%)
Increased the water production rate of RO recycling systems

Increase Wastewater Recycling by Facilities

203,000 m^3 (6.1%)
Reclaimed from central wet scrubber

107,000 m^3 (3.2%)
Recycled acidic wastewater

121,000 m^3 (3.6%)
Reclaimed organic wastewater

24,000 m^3 (0.7%)
Reclaimed acidic wastewater

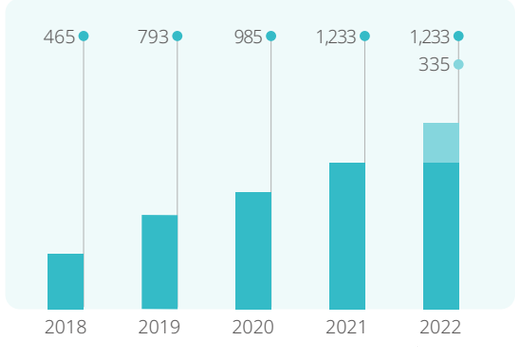
Decrease Water Discharge Loss from the System

832,000 m^3 (24.9%)
Recycled from MAU Drain

Reduce Facility System Water Consumption

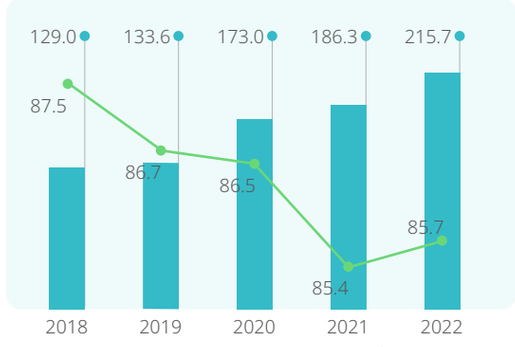
2,000 m^3 (0.1%)
Recycled TMAH-containing water

Annual Water Conservation



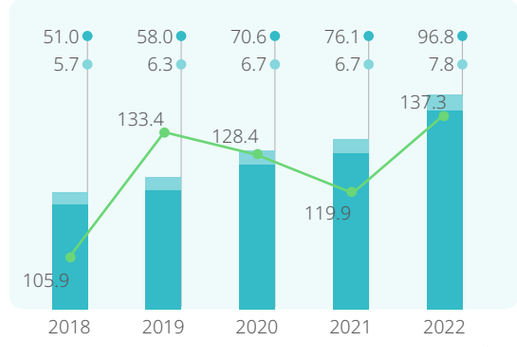
Annual cumulative water conserved (10,000 m^3)
Additional water conserved in 2022 (10,000 m^3)

Water Recycling and Usage Efficiency



Total amount of water recycling (million m^3)
Average process water recycling rate (%)

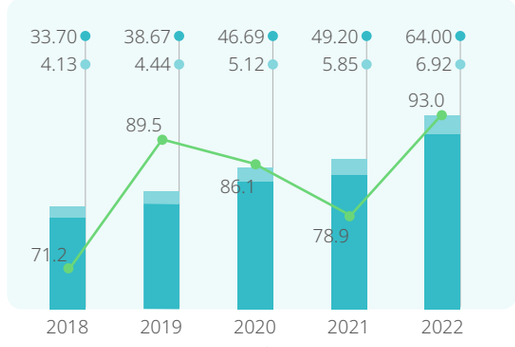
City Water Consumption and Water Consumption per Wafer-layer



Total city water consumption of Taiwan fabs (million m^3)
City water consumption of subsidiary (million m^3)
Water consumption per wafer-layer (Liter/12-inch equivalent wafer mask layer)

Note: Figures from TSMC fabs in Taiwan, WaferTech, TSMC (China), TSMC (Nanjing) and VisEra

Wastewater Discharge per Unit



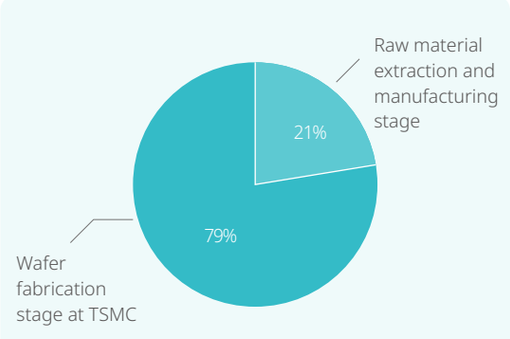
TSMC wastewater (million m^3)
Subsidiary wastewater (million m^3)
Wafer mask unit wastewater (Liter/12-inch equivalent wafer mask layer)

Note: Figures from TSMC facilities in Taiwan, WaferTech, TSMC(China), TSMC(Nanjing) and VisEra

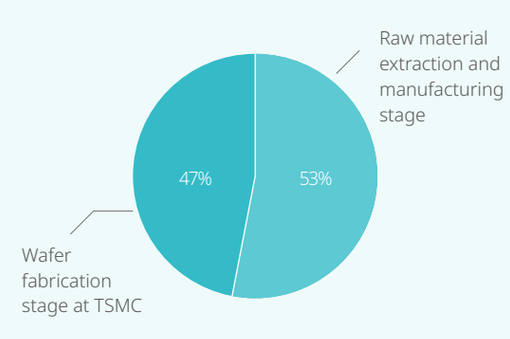
Product Water Footprint

TSMC is committed to reducing product water footprint in various stages, including raw material manufacturing and transportation, product manufacturing, testing, and packaging, etc. The water footprint of products is assessed every three years. In 2022, the Company obtained third-party ISO 14046 certification. According to the Company's 2021 product water footprint survey, TSMC facilities consume 79% of water (mainly from direct water consumption by facilities) and raw material suppliers consume the remaining 21% of water (mainly chemical, silicon wafer, and bulk gas suppliers). In terms of water quality indicators, TSMC and raw material suppliers account for 47% and 53%, respectively. Water pollutants are mainly suspended solids, metals, and chemical oxygen demand (COD). In addition to actively reducing water consumption from production processes and discharge of water pollutants, TSMC also helps suppliers to set water conservation targets with the Sustainability Management Self-Assessment Questionnaire. All suppliers are required to adhere to the TSMC Supplier Code of Conduct to manage water use and discharge, while identifying opportunities for water saving and implementing measures. For more details, please refer to Sustainable Supply Chain in this report.

TSMC Product Water Footprint Distribution – Water Consumption Indicator



TSMC Product Water Footprint Distribution – Water Quality Indicator



Develop Diverse Water Sources

The year 2022 marked the start of water reclamation at TSMC. To get the most out of every drop of water, TSMC is actively conserving water from production processes while also developing water reclamation technologies. To ensure water quality complies with advanced process specifications and their demands for cleanliness, TSMC works with the government, industry, and academia to develop low-energy consumption biological treatment, low-energy consumption sludge treatment, high-efficiency urea removal process, and other innovative technologies. The Company also establishes multi-layered, real-time, and automatic monitoring systems to ensure the quality of reclaimed water supplies. In September 2022, the TSMC Tainan Science Park Reclaimed Water Plant entered into operation as a center for processing, monitoring, and supplying TSMC facilities in the STSP. As of December 2022, the Reclaimed Water Plant has supplied 380,000 m^3 of water reclaimed from industrial wastewater. To develop diverse water resources, the Water Reclamation Plant in Anping, Tainan, will be completed and enter into operation in 2023. In 2026, the water supply capacity of the Tainan Science Park Reclaimed Water Plant will reach up to 36,000 m^3 per day, reducing city water consumption and contributing positively to the surrounding environment. TSMC is also designing innovative systems to reclaim concentrated wastewater and make waste sludge reusable through waste heat, thereby reducing the discharge of high-concentration wastewater.

In 2022, TSMC completed the TSMC Tainan Science Park Reclaimed Water Plant and also launched the Hsinchu Science Park Reclaimed Water Plant project to expand the use of reclaimed water. The Hsinchu Science Park Reclaimed Water Plant is expected to supply 10,000 m^3 of water per day in 2025. With the Hsinchu Science Park Reclaimed Water Plant and reclaimed water provided by the city government, new fabs in the Hsinchu Science Park will use 100% reclaimed water, strengthening TSMC's operational resiliency and fulfilling the commitment to achieve sustainable water cycle management.

Reclaimed Water Supply Schedule

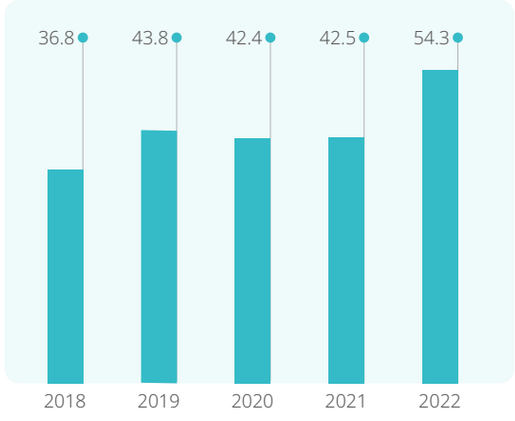
- 2015: Launched the water reclamation R&D project
- 2016: Built a pilot water reclamation plant and conduct wastewater testing
- 2020: Built the TSMC Tainan Science Park Reclaimed Water Plant
- 2022:
  - February: Launched the Hsinchu Science Park Reclaimed Water Plant project
  - July: Conducted system testing at the TSMC Tainan Science Park Reclaimed Water Plant
  - September: Completed the TSMC Tainan Science Park Reclaimed Water Plant with a supply of 380,000 m^3 of water by the end of December
- 2023: Complete the water reclamation plant in Anping, Tainan, with an estimated supply of 10,000 m^3 of water
- 2025: Estimated supply of 10,000 m^3 of water per day from the Hsinchu Science Park Water Reclamation Plant
- 2026: Estimated supply of 36,000 m^3 of water per day from the TSMC Tainan Science Park Reclaimed Water Plant
- 2030: Achieve >60% replacement rate of water with reclaimed water in Taiwan Fabs

Develop Preventive Measures

TSMC continues to advance the performance of water pollution control and treatment processes. As advanced processes have evolved and increased the use of organic chemicals, TSMC has introduced a membrane bioreactor system to strengthen water pollutant removal. In 2022, average COD and TMAH concentration levels were reduced to 151.5 ppm and 3.75 ppm, respectively. Fab 15B introduced rotating packed bed technology in 2022 to further reduce COD levels. Lab test results showed that 70% of COD levels in water can be reduced. TSMC plans to officially roll out this technology in 2023. Due to the increased use of cobalt sulfate, cobalt sulfate treatment systems have also been expanded, which have helped to achieve a 54.3% water pollution composite indicator reduction rate, far exceeding the 2022 target of 45% and 2030 goal of 50%. As such, the reduction rate goal for 2030 has been raised to over 60% to achieve environmental sustainability.

Water Pollution Composite Indicator Reduction Rates

Unit: %

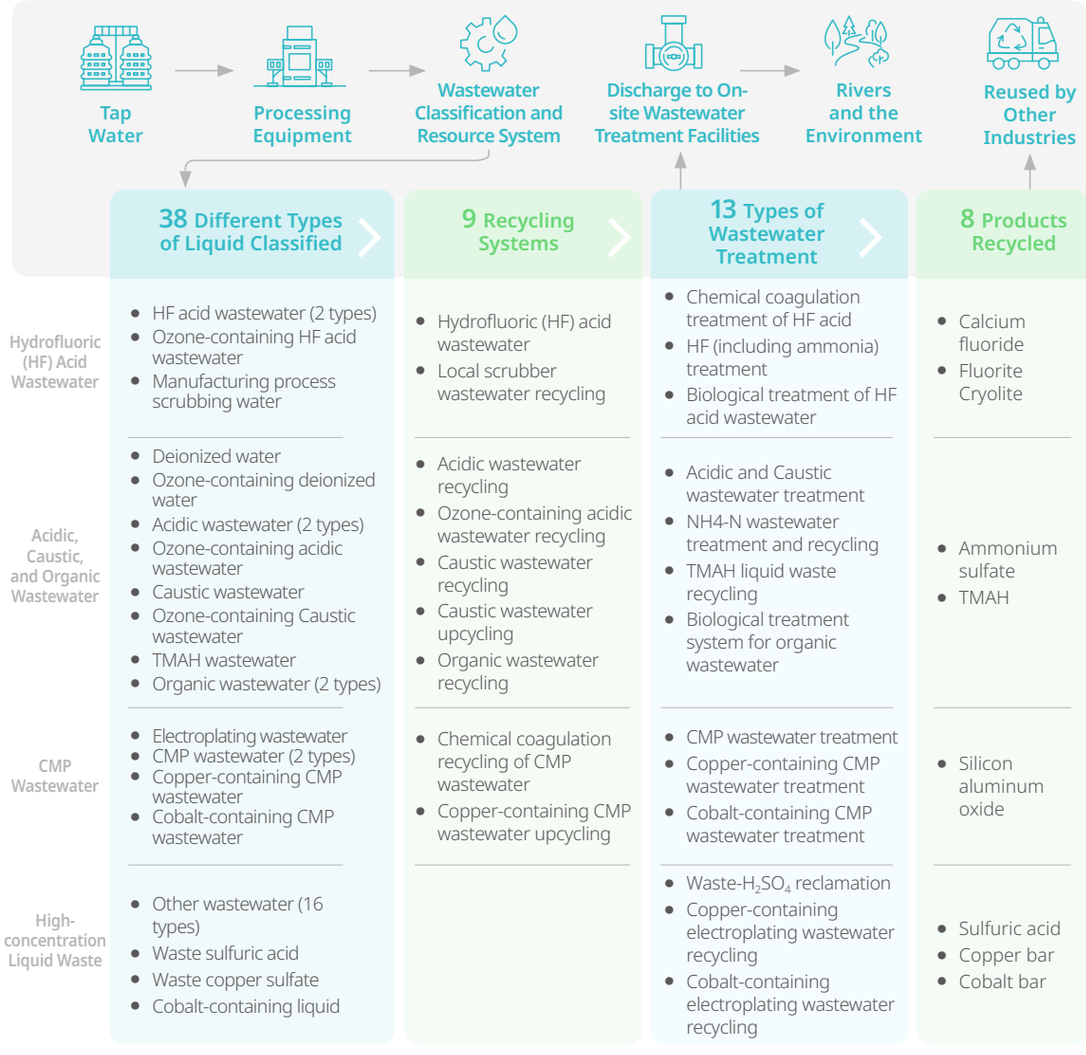


Note: Figures from TSMC fabs in Taiwan

Wastewater Classification and Resource System

To classify and treat wastewater, TSMC has developed 38 separation systems based on the composition and concentration of wastewater for treatment, recycling, and reuse. In the third quarter of 2022, Fab 15B successfully eliminated HF acid waste outsourcing by optimizing the hydrofluoric acid waste regeneration system, further perfecting the renewable technologies of local circular economy industries. TSMC also performed sludge tests, a byproduct of the chemical mechanical polishing process, at the Zero Waste Manufacturing Center, turning sludge into aluminum silicon oxide through dehydration, grinding, and surface modification. The aluminum silicon oxide can then be used as plastic fillers for factory use.

Wastewater Classification and Resource System

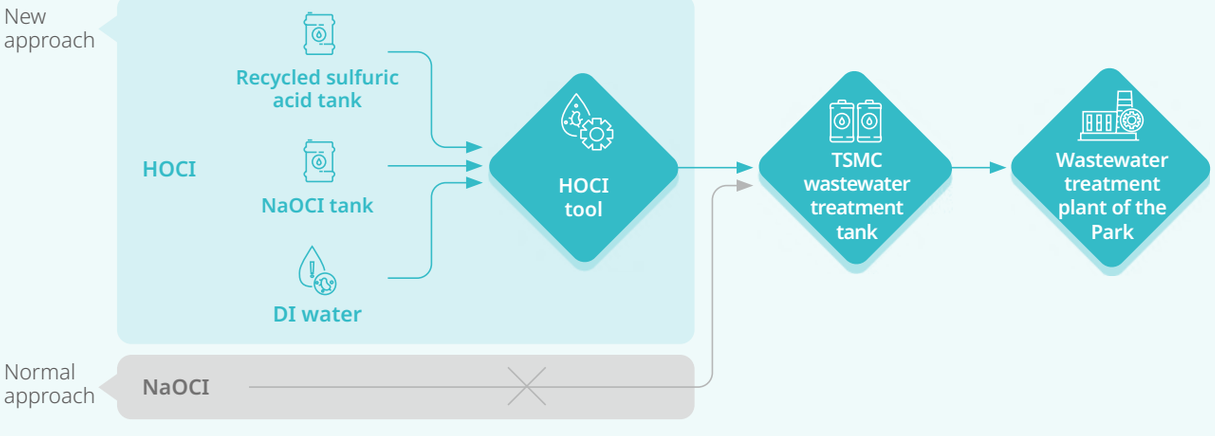


Case Study

Innovative HOCI Conversion System Reduces Chemical Consumption and Carbon Emissions

As semiconductor technologies continue to evolve, the consumption of sodium hypochlorite (NaOCl) increases to treat pollutants in wastewater. To practice green manufacturing, reduce environmental impacts, and improve the water quality of effluents, TSMC launched the NaOCl reduction project in 2022. Between pH 5.5 and 6.5, NaOCl turns into hypochlorous acid (HOCl), a strong oxidizing agent approximately 80 times stronger than NaOCl. TSMC capitalized on HOCl's strong oxidizing properties by adding recycled sulfuric acid to NaOCl with deionized water (DI water). After optimizing the mixing ratio, it became possible to convert NaOCl to HOCl stably, reducing NaOCl consumption without compromising disinfection and ammonia nitrogen removal. In 2022, the HOCl conversion system was introduced to Fab 15B for pilot run. It is estimated that annual NaOCl consumption and carbon emissions can be reduced by 80 metric tons and 10 metric tons, respectively. The Company will continue to roll out the system in other facilities as it is friendlier for the environment and can increase the reuse value of waste liquids, promoting environmental sustainability through green innovation.

HOCl Conversion System



TSMC innovates HOCl Conversion System to reduce chemical consumption