

**6** CLEAN WATER  
AND SANITATION



SUSTAINABILITY REPORT  
TAMKANG UNIVERSITY

2020  
CLEAN WATER &  
SANITATION





# CLEAN WATER AND SANITATION

## Water consumption per person

### Water consumption tracking

The water source of the Tamsui campus, Taipei campus, and Lanyang campus of TKU mainly comes from rivers. The water is treated by reservoirs and public water purification plants and then turned into tap water. The quality of water is guaranteed by the Tap Water Law of Taiwan. The water source (reservoir) is sent to TKU for use through the following procedures:

1. Water intake: pumps the water into the water diversion channel with a water pump at the water source (or reservoir).
2. Water diversion: the process of sending water from the water source to the water purification plant.
3. Water purification: after the water enters the water purification plant, it undergoes purification procedures such as mixing, gelling, sedimentation, filtration, and disinfection to remove impurities and germs in the water.

4. Delivery (distribution) of water: the water is suitable for drinking after the water purification process and disinfection, known as tap water, and the tap water is distributed to the user through a pipeline.

In addition, a small amount of rainwater collected by the TKU's building equipment is also used for irrigating campus plants. The total water consumption in year 2019 is 526,652,556 liters of tap water treated by the water plant in the river; a small part of it is collected by rainwater and used as sprinkler irrigation for plants, about 2,556 liters.

## Water consumption per person

The average yearly per capita water consumption in 2020 is about 21,200 l/y (that is, 58.08 l/day per person), which is better than the average water consumption per capita of colleges and universities in Taiwan of 110 l/d per person.

## Water usage and care

TKU meets the content of the detailed indicators from 6.3.1 to 6.3.5. Here, it is divided into three aspects- water safety, water conservation, and wastewater treatment- and the description is as follows:

1. Water safety: all three campuses use tap water that meets the country's drinking water quality standards as the main source of the campus water; through the inspection management, maintenance and cleaning of water storage towers, pipelines and drinking water equipment, and water quality testing, water safety is ensured. For drinking water, according to the country's continuous drinking water supply fixed equip-

ment use and maintenance management method, the sampling operation of 1/8 of the total number of drinking water machines is implemented every quarter, and the drinking water quality standards must be met so that all faculty and staff can use it free of charge.

2. Water conservation: water conservation (including reuse) and reduction of water waste are the concerns of the university; in terms of water conservation, the Tamsui campus has a green coverage rate of about 58%, and the Lanyang campus has a green coverage rate of more than 80%. New buildings on campus are more in line with the concept of green buildings, emphasizing the water retention function of the base, effectively retaining rainwater and preventing it from becoming runoff. In terms of reducing water waste, it is through planting native plants and drought-tolerant plants to reduce the water used for sprinkler irrigation. In addition, water-saving faucets, flushing toilet seats, and technological non-flushing urinals have been installed to reduce water consumption in baths and toilets.

3. Wastewater treatment: campus domestic sewage is taken over to the public sewage treatment plant through the sewage sewer, and discharged after it meets the discharge standards; the waste liquid generated in the laboratory is collected by temporary storage in the university and is regularly appointed to qualified manufacturers of the Environmental Protection Agency to clear and transport every semester.

## Water treatment

Before 2019, the Tamsui campus set up a gymnasium, a swimming pool, a chemistry hall, an engineering building, and a foreign language building, with a total of 5 buildings. In addition, the Lanyang campus has also set up a sewage treatment plant, which is commissioned by qualified manufacturers to operate and maintain to ensure the normal operation of the sewage plant equipment. The wastewater generated by the campus first enters the sewage plant for chemical treatment and is then discharged into the off-campus sewage pipeline after treatment. The quality of the discharged water is subject to regular sampling inspections by the university and irregular sampling by the local environmental protection agency, which all comply with the discharge water standards.

From 2019, the Tamsui campus followed the Taipei campus and cooperate with the government to complete the public sewage sewer. The wastewater from the Tamsui campus has also been fully integrated into the New Taipei City public sewage pipeline and concentrated to the government-established fresh sea sewage treatment plant. The sewage is treated by the equipment of the treatment plant and will be discharged after the treatment meets the national discharge standard, to achieve the goal of not polluting the water quality of the river; the university also bears the sewage treatment fee.

## **Preventing water system pollution**

To prevent contaminated water from entering the clean tap water system, there are a total of 38 tap water storage towers in the Tamsui Campus, Taipei Campus, and Lanyang Campus. The clean openings of each

water storage tower are locked and controlled, and non-management personnel is strictly prohibited from opening them arbitrarily. Every year, a professional manufacturer is appointed to clean the tower body. After the cleaning is completed, the Taiwan Inspection Technology Co., Ltd. (SGS) will conduct a water quality sample inspection (once every 3 months). The inspection results meet the "Drinking Water Quality Standards" set by the Environmental Protection Agency of Taiwan. In addition, the campus water purification pipeline and sewage pipeline distribution map are established, and the university's professional hydropower technicians schedule an inspection plan. If abnormal water leakage is found, it may be repaired immediately to avoid cross-contamination between water pipelines. The sewage generated in the laboratory can be discharged into the sewage pipe after primary treatment and then taken over to the off-campus sewage treatment plant for final treatment through the sewage sewer.

## **Free drinking water provided**

A total of 253 drinking fountains are installed throughout the 26 buildings and outdoor stadium area of the Tamsui campus, 17 drinking fountains are installed in one building of the Taipei campus, 33 drinking fountains are installed throughout the Lanyang campus, and a total of 303 drinking fountains are provided in the university. The faculty, staff, students and visitors may use these drinking fountains free of charge, and fountains are regularly maintained, filters are replaced, and water quality are checked to ensure the safety of drinking water. In addition to the fair third-party inspection commissioned by the drinking fountain equipment company, the university's environmental safety center also conducts regular sampling in-

spections every year. The dual inspection mechanism ensures drinking water safety. The water quality inspection results are not only announced on the website of the Office of General Affairs but also posted on the drinking fountains using QRcode. Those who are interested in more information may scan the QRcode to view the test report, this mechanism replaces the shortcomings of traditional paper reports that may not be updated in real-time.

## **Water-conscious building standards**

To protect precious water resources, TKU has long adopted conservation methods to avoid water waste, such as installing taps and toilet flushing equipment provided by the campus toilets. In cases of maintenance and replacement, the adopted equipment must meet the National Standards of the Republic of China (CNS) and has water conservation mark on it. The men's toilets fully utilize non-flushing technology urinals. There are 231 urinals in the university, which saves about 5.06 million liters of water per year (calculated based on 6L each time, 10 times a day), which not only saves water but also saves the electricity used for flushing. In addition, the new (renovated) building also follows the water resources indicators of the nine major indicators of the green building standard, and refers to the relevant guidelines for the new (renovated) building to strengthen the protection and utilization of water resources to create a water-saving environment; sprinkler irrigation systems throughout the campus, water-saving spray valves are also used to adjust the time and intensity of spray irrigation according to the weather conditions to reduce the water consumption.

## **Water-conscious planting**

Considering the geographical environment and climatic conditions of TKU, we prioritize the selection of native plants, and under the principle of vegetation diversity, beautiful landscapes and ecological conservation are all included. Tamsui Campus locates in front of the post office of the Student Activity Center, next to the Red 28 bus station on the west side of the Chemistry Building, in front of the Engineering Building, and adjacent to the service center of Section 2 of Shuiyuan Street. Approximately 600 species of drought-tolerant plants are planted to save water and meet the needs of campus greening. The Office of General Affairs also replaces the landscape potted plants that consume more water in the university year by year, utilizing drought-tolerant plants as the guide, not only does this reduce water consumption, this also reduces the frequency of manual care on campus. Around 17,950 drought-tolerant plants are planted around the Shao-Mo Memorial Activity Center, campus roads, and hillsides on the Lanyang campus to save water consumption and meet the needs of campus greening.

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## **Water reuse**

TKU has been established for more than 70 years, and it is limited by the old buildings and water resources reuse related equipment environment. Facing the increasing importance of water resources, TKU gradually

plans the recovery and reuse methods of rainwater or reclaimed water based on the existing feasible technology, combined with the expertise of the teaching faculties on campus. In 2020, with the theme of "TKU Green Feng Shui," TKU received a subsidy of about NT\$150,000 from the Sustainable Circulation Campus Exploration Project of the Ministry of Education and continued to optimize the reuse of water in the campus. Looking forward to the future, learning about water reuse through industry benchmarks (such as TSMC, Industrial Technology Research Institute, etc.), or cooperating with the university's water treatment technology research center to develop campus water recycling and reuse programs, and continue to increase campus water recycling and water reuse. Recycled water may be used for campus sprinkler irrigation, floor cleaning of buildings or toilet flushing, reducing tap water consumption, and reducing campus water and electricity expenditures.

## **Water reuse policy**

As old buildings generally do not have water recovery devices, the water recovery equipment is mainly designed to match new buildings, such as the Lanyang Campus Teaching Building and Hsu Shou-Chlien International Conference Center. Rainwater reservoirs are set up for these new buildings, and the collected rainwater is used as sprinkler irrigation for plants. The three campuses set water-saving goals each year, including setting zero growth in water use or reducing water consumption by 1% as the annual water-saving goal. These goals are regularly reviewed for the effectiveness of water use through environmental sustainability promotion committee meetings at the end of each year. As the sewage pipe is included in the construction of

New Taipei City, the Tamsui campus pays an additional sewage treatment fee every month. Charges are calculated based on the tons of water used (influent) per month. Thus, the plan is to cooperate with the university's water treatment technology research center to develop campus water recycling and reuse programs and continue to increase the rate of campus water reuse. After the water is recycled, it can be used for campus sprinkler irrigation, floor cleaning of buildings, or toilet flushing, which can reduce the amount of tap water and the expenditure on on-campus water and electricity.

## **Water reuse measurement**

In terms of water reuse, as old buildings generally do not have water recovery devices, the water recovery equipment is mainly designed to match new buildings, such as the Lanyang Campus Teaching Building, Hsu Shou-Chlien International Conference Center, etc. Rainwater storage tanks are used to collect rainwater as sprinkler irrigation for planting. According to statistics, the amount of rainwater recovered accounts for 0.16% of the total water consumption of the campus. As the sewage pipe is included in the construction of New Taipei City, the Tamsui campus pays an additional sewage treatment fee every month. Charges are calculated based on the tons of water used (influent) per month. Thus, the plan is to cooperate with the university's water treatment technology research center to develop campus water recycling and reuse programs and continue to increase the rate of campus water reuse. After the water is recycled, it can be used for campus sprinkler irrigation, floor cleaning of buildings, or toilet flushing, which can reduce the amount of tap water and the expenditure on-campus water and electricity; furthermore, environmental

education to practice campus environmental teaching fields will be emphasized.

## Water in community

In terms of community water use, TKU meets the detailed SDG indicators from 6.5.1 to 6.5.5, which are mainly divided into two aspects: water-saving actions on campus and water-saving cooperation outside the campus.

1. Water-saving actions on campus: In addition to the continuous update of water-saving equipment such as the use of water-saving labels on the equipment side, the more important thing is the education and promotion of water conservation on the user side. Experience the changes in the marine environment and human culture from a personal visit to the Maritime Museum on the Tamsui campus. The changes in human culture, to the warm reminder of the A6 posters in front of each urinal or toilet seat, as well as the campus multimedia including the Cyber Channel and TKU Times's insatiable temptation, are here to cultivate faculty and staff to cherish water resources from multiple ways of education in life.

2. Water-saving cooperation outside the campus: out of campus, student associations take advantage of the opportunity of winter and summer vacation service teams to visit the countryside elementary and middle schools to educate future students; through the implementation of the plan, teaching faculties combine the power of the public sector or enterprises to guide the community and people to care for the water resources in the township as part of the university's support for the sustainable use of water resources. In addition, from the past Water Resources Research Center to the

current Information Center for Water Environment, Center for Ocean and Underwater Technology Research, and other institutions, TKU continues to cooperate with government water resources related ministries, such as the Environmental Protection Agency, the Water Resources Agency, or the regional river bureaus. Other units maintain close cooperation to support water management practices with academic research energy and provide opportunities for faculties and students of relevant departments to develop their strengths.

## Water management educational opportunities

TKU provides educational opportunities for local communities to learn about water management. The Department of Water Resources and Environmental Engineering is set up and divided into a Water Resources Engineering Group and an Environmental Engineering Group. These groups are all committed to providing water safety for human society, inspiring students to use engineering and scientific means to achieve the goal of benefiting society. The two sets of characteristics are briefly described as follows:



1. Water Resources Engineering Group: based on hydrology and water science, water conservancy engineering is the main axis, and it is supplemented by the field of information computing technology. The subject coverage includes fluid mechanics, hydrology, open channel hydraulics, flood prevention, coastal engineering, etc., to achieve the goal of sustainable use of water resources for the benefit of water and the elimination of water damage.
2. Environmental Engineering Group: based on water supply, sewage engineering, and water quality treatment engineering, combines with waste treatment, recycling, air quality monitoring, and other scientific areas. The subjects covered include environmental chemistry, solid waste, water supply, and sewage engineering, microbiology and water quality management, etc., to achieve the vision of safe water use, quality, and ecological environment sustainability. Provide courses related to clean water and sanitation, water quality testing, sewage treatment, and waste treatment.

## **Promoting conscious water usage**

TKU promotes water conservation through The Tamkang Times, OA official document system, electronic signage, cyber channel, toilet newsletter, etc. Outside the campus, student clubs promote water conservation in the community and campus with community posters, drama performances, and other opportunities to promote the effective use of water resources, such as the cooperation with Hongsheng Construction Company, Cheng's Ancient House, etc. in 2020 to plan the vision project of "The Company Tianxi Guarding

Project." On May 2nd, the "Company Tianxi Protecting Creek Declaration" was held in the atrium of the freshwater ocean capital community, announcing the official launch of the plan. The Vice President for the Academic Affairs of TKU, the Chairman of Hongsheng Construction, the Section Chief of the River Planning Section of the New Taipei City Government, the Cheng's Ancient House, local people, and the university's USR team, nearly 100 people participated. During the meeting, a teaching faculty from the Department of Architecture explained the relationship between the company's Tianxi and Tamsui, and the participants jointly issued and read the company's Tianxi guardian declaration.

## **Off-campus water conservation support**

Taiwan has abundant rainfall, but due to the short length of rivers, rain waters are not easy to retain. Thus, the precious water resources are retained through the construction of reservoirs. The faculty of the Department of Water Resources and Environmental Engineering of TKU and the National Taiwan University formed a research team, combined with the big data of the Meteorological Bureau's typhoon path, and used AI technology to predict rainfall in the catchment area. Data are given to the Shimen Reservoir Management Center two days in advance to facilitate the decision-making reference of the reservoir's regulatory water release. The faculties of the Department of Water Resources and Environmental Engineering of TKU published the paper on the research and development process with "Self-organizing maps of typhoon tracks allow for flood forecasts up to two days in advance" in the 2020 Nature Communications Volume 11, Article Number:



1983 (2020). This forecast result provides the Shimen Reservoir to adjust the water volume during the typhoon season to meet the water demand of households, agriculture, and industry in Northern Taiwan.

## **Sustainable water extraction on campus**

The Tamsui Campus of TKU piloted a self-employed water truck to carry recycled water from the Tamsui wastewater treatment plant for use as an auxiliary sprinkler irrigation system for planting and planting on campus. Facing the uneven drought and flood in Taiwan caused by global climate change, teaching faculties from the Department of Water Resources and Environmental Engineering of TKU and National Taiwan University jointly developed a sustainable management strategy for groundwater resources. People's livelihood and industrial water demand and the environment, the environmental impact caused by groundwater development was reduced. In addition, the research topics of teaching faculties have also extended to the reuse of recycled water, from early biological treatment, membrane treatment, electro dialysis water regeneration, to the research and development of innovative membranes, and to assist the continuous improvement of Taiwan's wastewater treatment industry recycling technology. For instance, the use of nanofiber filter membranes with composite layer charges, so that low-voltage operation can be used for water treatment and filtration, and the filter membrane materials can be customized. It can effectively remove sodium, calcium, and magnesium plasma from the water, saving 30% to 50% of the wastewater treatment cost.

## **Cooperation on water security**

The Department of Water Resources and Environmental Engineering, and the school-level research center also has a Water Environment Information Research Center. The main objectives of the research work of the faculties of the two units are clean water and sanitation, and they maintain cooperation with the government, private enterprises, or the third sector. For instance, a teaching faculty from the Department of Water Resources and Environmental Engineering serves as an independent director of the Taiwan Water Supply Company and assists the Environmental Protection Agency in promoting the Water Safety Plan (Water Safety Plan); the other teaching faculty assisted private companies to treat industrial wastewater, improve the water quality testing capabilities of water purification plants, and jointly develop clean water technologies; in addition, there are teaching faculties who serve as disaster prevention advisory committees of government departments, and are entrusted by the Water Resources Department of the Ministry of Economic Affairs to provide maintenance and operation consulting for the reservoir flood prevention operation system. Evaluating the capacity of the reservoir to effectively discharge floods to reduce flooding disasters and reduce the loss of life and property caused by typhoon floods.



## 6 CLEAN WATER AND SANITATION



# SDG 6：潔淨水與衛生

人均用水量：58.08 公升/日（遠低於一般大學之 110 公升）

全校提供免費飲水機數量：303 台（飲水機密度，全國第二高）

全校男廁科技免沖水小便斗：231 座（每年節省 506 萬公升用水）



# 人均用水量

## 用水量的測量

本校淡水校園、台北校園及蘭陽校園用水，主要皆來自河流經水庫、公共淨水廠處理後之自來水，用水品質受我國自來水法保障，自水源地（水庫）送至本校使用共經過以下程序：

1. 取水：在水源地（或水庫）以抽水機將原水抽送至導水渠道中。
2. 導水：將原水由水源地送至淨水場的過程。
3. 淨水：原水進入淨水場後經過混和、膠凝、沈澱、過濾、消毒等淨水程序，以去除水中的雜質及病菌。
4. 送（配）水：原水經過淨水程序及消毒後已適合飲用稱為自來水，將自來水以管線配送至使用者端。

另有少量藉由本校建築物設備收集之雨水，亦作為校園植物澆灌使用。使用河川經自來水廠處理之自來水，2019 年總用水量為 526,652,556 公升；少部分經由雨水收集作為植物噴灌使用，約 2,556 公升。

## 人均用水量

教職員總人數：1635

學生人數：23207

學校總用水量  $526652556 / (1635 + 23207) = 21200$ （以公升為單位）

人均用水量為 21200 公升/年（=每人 58.08 公升/日）

## 用水與保養

本校符合 6.3.1 至 6.3.5 各細項指標內容，在此綜整分為用水安全、水源保育及廢水處理三個面向說明如下：

1. 用水安全：三個校園皆使用符合我國飲用水質標準之自來水，作為校園生活用水主要來源；透過蓄水塔、管線及飲水設備的巡檢管理、保養清洗及水質檢測，確保用水安全無虞。飲用水部分，依據我國飲用水連續供水固定設備使用及維護管理辦法，每季實施飲水機台總數 1/8 的抽測作業，必須符合飲用水水質標準，方能讓全校教職員工生安心免費取用。
2. 水源保育：水源涵養（含再利用）和減少水資源浪費也是本校所關注的議題；在水源涵養方面，淡水校園綠覆率約 58%，蘭陽校園綠覆率更高達 8 成以上，校園新建建築更符合綠建築概念，強調基地保水功能，有效留住雨水不讓其成為逕流。減少水資源浪費方面，則是透過種植原生植物及耐旱植物，減少噴灌用水；另以設置節水標章水龍頭、沖便座及科技免沖水小便斗等設備，降低浴廁用水。
3. 廢水處理：校園生活污水透過污水下水道接管至公共污水處理場，經處理後符合排放標準才進行放流；實驗室產生之廢液則藉由校內暫存收集，每學期定期委由環保署合格廠商清運處理。

## 廢水處理

2019 年之前，淡水校園設有體育館、游泳館、化學館、工學大樓及外語大樓，共計 5 座污水處理場。蘭陽校園設置生活污水場 1 座，每年皆委託合格廠商操作、保養及維護，確保污水場設備正常運作。本校所產生之廢污水先是進入污水場進行化學處理，處理後再行排放入校外污水管道；放流水質經學校定期抽檢、地方環保機關不定期抽檢，皆符合放流水標準。

2019 年起，淡水校園比照台北校園，配合政府施作公共污水下水道完工，淡水校園污水亦全面納入新北市公共污水下水道管線，集中至政府設立之淡海污水處理廠處理，經由處理廠的設備將污水處理至符合國家放流標準後再排放，達到不污染河川水質的目標；本校另負擔污水處理費用。

## 防止用水系統污染

為防止受污染水進入乾淨的自來水系統，本校淡水校園、台北校園及蘭陽校園共計有 38 座自來水蓄水塔，每座蓄水塔清潔口皆有上鎖管制，非管理人員無法任意開啟。每年委請專業廠商進行塔體清理，清理完成後由台灣檢驗科技股份有限公司（SGS）進行水質樣品檢驗（每 3 個月一次），檢驗結果皆符合我國環保署訂定之「飲用水水質標準」。另建立校園淨水管道與污水管道分布地圖，由本校專業水電技術人員排定巡檢計畫，遇有發現

異常漏水情事可即時搶修，避免輸水管道之間交叉污染。經實驗室產生之污水亦進行初級處理後，方可排入污水管，經由污水下水道接管至校外污水處理廠進行最終處理。

## 免費飲用水的供給

淡水校園 26 棟樓館及戶外球場區共裝設 253 台飲水機，台北校園 1 棟大樓裝設 17 台飲水機，蘭陽校園全境 33 台飲水機，全校累計共 303 台飲水機，皆提供教職員工生及訪客免費飲用，並定期維護保養、更換濾心及檢驗水質狀況，確保飲用水安全無虞。檢驗除了由飲水機設備公司委託公正第三方檢測外，本校環安中心亦每年定期抽樣檢查，雙重檢測機制確保飲用水安全；水質檢驗結果除公告於總務處網頁之外，也利用 QR code 張貼於飲水機台上，有興趣瞭解者可藉由掃描 QR code 連結到雲端查閱檢測報告書，取代傳統紙本報告書無法即時更新之缺點。

## 維護水資源的建築

為保護珍貴水資源，本校長期以來透過節約方法避免水資源浪費，例如校園廁所提供之水龍頭及馬桶沖水設備，遇有維修汰換時，全面採用符合中華民國國家標準（CNS）及具備省水標章之設備。男廁全面使用免沖水之科技小便斗，全校計有 231 座小便斗，每年可省下約 506 萬公升用水（以每次 6L；一日 10 次估算），不但可節約用水，亦可節省沖廁時的電力耗費。此外，新（改）建大樓亦依循綠建築標準九大指標之水資源指標，參照樓館新（改）建之相關準則，強化水資源的保護與利用，營造節水環境；遍佈校園的噴灌系統，也採用省水式噴閥，視天候狀況調整噴灌時間與強度，降低噴灌所耗費的水資源。

## 維護水資源的植栽

考量本校地理環境與氣候條件，優先選擇本地原生種植物，在植被多樣性的原則下，兼顧景觀優美與生態保育。淡水校園於學生活動中心郵局前方、化學館西側紅 28 公車站旁、工學大樓前方，以及鄰近水源街二段勤務中心旁等角落區域，改種植較為耐旱植物種類約 600 株，以節省用水量並達成校園綠化需求。總務處並逐年汰換校內消耗水分較多之景觀盆栽，盡量選用耐旱植物為導向，不但可以減少用水量，也可減少校內人工實施照顧頻率。

蘭陽校園紹謨紀念活動中心周邊、校園道路及山坡，栽種較為耐旱植物約 17,950 株，以節省用水量並達成校園綠化需求。

# 再利用水

本校創立已逾 70 年，受限於建築物老舊而未設置水資源再利用相關設備環境；面對水資源日益重要之際，擬就現有可行技術，結合校內相關系所師資專長，逐步規劃雨水或中水的回收再利用方式。2020 年以「淡江綠風水」為主題，獲得教育部永續循環校園探索計畫約 15 萬元補助，持續優化校園用水的再利用工作。展望未來透過產業界（如台積電、工研院等）標竿，學習水再利用，或與本校水處理科技研究中心合作，發展校園水回收可再利用方案，持續增加校園水回收與水再利用比率，用於校園噴灌、樓館地面清洗或沖廁使用，降低自來水用量，可減少校園水電經費支出。

## 水再利用政策

由於舊大樓普遍未設置水回收裝置，因此水回收設備以搭配新建築設計為主，例如蘭陽校園教學大樓、守謙國際會議中心等建物，皆設置雨水蓄水池，將收集之雨水作為植栽噴灌使用。三個校園每年設定節水目標，包括設定用水零成長，或以降低 1% 用水量，作為年度節水目標，並於每年年終定期透過環境永續推動委員會會議，檢討用水成效。淡水校園由於污水管納入新北市污水下水道建設，每月須另繳交污水處理費，以每月用（進）水噸數計收，因此未來規劃將與本校水處理科技研究中心合作，發展校園水回收再利用方案，持續增加校園水再利用比率。水回收後可利用於校園噴灌、樓館地面清洗或沖廁使用，既可降低自來水用量，又可減少校園水電經費支出。

## 水再利用率測量

水再利用方面，由於舊大樓普遍未設置水回收裝置，因此水回收設備搭配新建築設計，例如蘭陽校園教學大樓、守謙國際會議中心等，設置雨水蓄水池，將收集之雨水作為植栽噴灌使用，統計雨水回收量佔校園整體用水量，約為 0.16%。由於淡水校園污水管納入新北市污水下水道建設，每月須另繳交污水處理費，係以每月用（進）水噸數計收，因此未來規劃擴大設置中（雨）水回收設備，持續增加校園水回收比率，利用於校園噴灌、樓館地面清洗或沖廁使用，一方面降低自來水用量，可減少校園水電經費支出；另一方面搭配環境教育，實踐校園環境教學場域。



# 社區用水

社區用水方面，本校符合 6.5.1 至 6.5.5 各細項指標，主要分為校園內節水行動和校園外節水合作兩方面：

1. 校園內節水行動：除了設備端持續更新使用節水標章等各項省水設備外，更重要的是使用端關於節約用水的教育及宣導，從親身走訪淡水校園海事博物館領略海洋環境與人類文化的變遷，到每個小便斗或便座前的 A6 海報之溫馨提醒，以及校園內多媒體包含賽博頻道、淡江時報的諄諄善誘，在在都是養成教職員工生珍惜水資源，寓教育於生活的多元途徑。
2. 校園外節水合作：走出校園之外，學生社團利用寒、暑假服務隊下鄉到中小學的機會，紮根於未來學子；教師則透過計畫的執行，結合公部門或企業力量，引導社區民眾愛護鄉里的水資源環境，都是本校支持水資源永續利用的一環。此外，本校從過去的水資源研究中心，到現在的水環境資訊研究中心、海洋及水下科技研究中心等機構，持續和政府水資源相關部會，如環保署、水利署或各地區河川局等單位保持密切合作，以學界研究能量支援水域管理實務，並提供相關科系師生發揮所長之機會。

## 社區性的水管理教育

本校為當地社區提供學習良好水管理的教育機會，設有水資源及環境工程學系，分為水資源工程組及環境工程組，皆以提供人類社會用水安全為職志，啟發學生以工程及科學的手段達成造福社會的目的。兩組特色分別簡述如下：

1. 水資源工程組：以水文及水理為基礎，水利工程為主軸，佐以資訊運算科技範疇，課目涵蓋範圍包含流體力學、水文學、明渠水力、洪水防災、海岸工程等範圍，達成興水之利、除水之害之水資源永續利用為目標。
2. 環境工程組：以給水污水工程及水質處理工程為基礎，結合廢棄物處理循環再利用及空氣品質監測等科學範疇，課目涵蓋範圍包含環境化學、固體廢棄物、給水污水工程、微生物學及水質管理等，達成安全用水、品質及生態環境永續的願景。開設潔淨水與衛生、水質檢測、污水處理、廢棄物處理等相關專業課程。

## 用水觀念宣導

本校透過校內淡江時報、OA 公文系統、電子看板、賽博頻道、廁所文宣等宣傳節約用水；校外則透過學生社團深入社區與校園、社區張貼海報、戲劇表演等機會，促進水資源有效利用，像是於 2020 年與宏盛建設公司、程氏古厝等合作規劃「公司田溪守護計畫」願景工程，並於 5 月 2 日在淡水海洋都心社區中庭舉辦「公司田溪護溪宣言」活動，宣示計畫正式啟動，本校學術副校長、宏盛建設董事長、新北市政府河川計畫科科长、程氏古厝、地方人士，以及本校 USR 團隊，近 100 人參與，會中由建築系教師說明公司田溪與淡水的淵源，並由與會人員共同發表、宣讀公司田溪守護宣言。

## 支援校外水資源保護行動

台灣降雨豐沛，但河川短不易留住水源，因此透過水庫建設保留珍貴水資源。本校水資源及環境工程學系教師與國立台灣大學組成研究團隊，結合氣象局颱風路徑大數據，利用 AI 技術預測集水區降雨量，可提前兩天讓給石門水庫管理中心以利於水庫調節性放水決策參考，本校水資源及環境工程學系教師將這研究開發過程，以〈Self-organizing maps of typhoon tracks allow for flood forecasts up to two days in advance〉發表論文於 2020 年《自然通訊》第 11 卷（Nature Communications volume 11, Article number:1983(2020)）中。此預測結果可提供石門水庫於颱風季節時調節水量之用，以確實滿足台灣北部家庭、農業和工業的用水需求。





## 可永續的取水技術

本校淡水校園試辦自僱運水車，從淡海污水處理場載運回收處理過之再生水，作為輔助校園植栽噴灌使用。而面對全球氣候變遷造成台灣旱澇不均現象，本校水資源及環境工程學系教師與台灣大學共同研擬地下水水資源永續管理策略，兼顧民生及工業用水需求與環境，降低地下水開發所造成之環境衝擊。此外，本校教師研究主題也擴展到回收水的再製利用，從早期的生物處理、薄膜處理、電透析水再生，到研發創新的濾膜，協助我國廢水處理產業回收技術不斷精進。例如使用奈米纖維濾膜，搭配複合層電荷，因此低電壓操作即可進行水處理過濾，還能客製化調整濾膜材料，有效分別去除水中鈉、鈣、鎂等離子，節省廢水處理成本三至五成。

## 與政府機關合作維護用水安全

本校設有水資源及環境工程學系，校級研究中心亦設有水環境資訊研究中心，兩個單位教師研究工作之主要目標為潔淨水與衛生，與政府、民間企業或第三部門皆保持合作。例如：水資源及環境工程學系教師擔任台灣自來水公司獨立董事，協助環保署推動水安全計畫（Water Safety Plan）；另一名教師則協助民間企業處理產業廢水，提升淨水場水質檢測能力，共同研發潔淨水技術；此外亦有教師擔任政府部門之防災諮詢委員，並受政府經濟部水利署委託，提供水庫防洪運轉系統維護與操作諮詢，評估水庫容量有效排洪，以降低洪水造成的溢淹災害，減少因受颱風洪水侵襲而導致之生命財產損失。





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