Preventing Water Pollution at SRM University-AP

SRM University–AP has processes to prevent polluted water from entering the water system, including pollution caused by accidents and incidents. They are set out in two written Standard Operating Procedures (SOPs). One covers chemical storage and handling, and the other covers spill prevention and response. Together they cover prevention, containment, response, clean-up, waste disposal and reporting. The campus also treats its wastewater in a chemical-free biological sewage treatment plant, and an external energy, environment and green audit reviews waste handling and pollution control.

1. Preventing Pollution at the Source

The SOP for Chemical Storage and Handling applies to the operation and maintenance of chemical spillage prevention across the university. Its first principle is that people must be protected and exposure limited before any other step is taken. Eye protection is required during handling and during the clean-up of any chemical spill, and the SOP specifies chemical safety goggles and full-face shields, which are kept in the laboratory at the chemical hood. Chemical-resistant gloves, thick neoprene or nitrile, must be worn, and an acid-resistant suit or apron is required because clothing can absorb chemical solutions and hold them against the skin. The SOP states that this equipment is not a substitute for safe working practice.

The SOP recommends a universal spill kit in each laboratory so that a small spill can be dealt with immediately and does not travel. The kit contains goggles, chemical-resistant gloves, absorbent materials (booms, pads and pillows), an acid neutraliser, a base neutraliser, pH test strips or paper, a solvent suppressant, plastic bags for waste, and a plastic scoop and scraper. A laboratory that uses hydrofluoric acid adds a hydrofluoric acid neutralising agent, such as calcium carbonate or a commercial neutraliser, and 2.5 per cent calcium gluconate gel for the skin.

2. Keeping Spills Out of Drains and Water Bodies

The campus drains matter because run-off from common areas and roads is collected and routed to a nearby water body, as recorded in the energy, environment and green audit. A spill that reaches a drain therefore has a direct path to the environment, and both SOPs are written to stop that.

The SOP for Spill Prevention and Response sets out the first actions for any spill, provided the responder is not at personal risk. The release is stopped if it can be done

safely. The spill is then contained with spill kit supplies or with mulch, dirt or sand used as a dam, so that the material cannot flow further. The responder then tries to keep the material from reaching storm water drop inlets by any available means, containing it at the point of discharge if necessary. For oil or other floating material, a floating boom from the spill kit is used to confine the spill. The SOP is explicit that, in no circumstance, may spilled material be hosed down.

The chemical SOP repeats the drain rule for each class of chemical. For organic solvents, acids and bases alike, if there are drains in the area, a boom, sock or other material is placed to prevent the hazardous material from reaching the drain before any other clean-up step begins.

3. Response to Accidents and Incidents

The procedures separate minor spills, which staff can handle with a spill kit, from major spills, which need the emergency services. A spill is treated as major if any of the following applies:

- The person is not comfortable proceeding with the clean-up.
- It involves more than 5 litres of a hazardous material.
- There is a risk of fire or explosion.
- The material creates a respiratory hazard, for example ammonia or concentrated hydrochloric acid.
- The chemicals are unknown or incompatible.
- It involves oxidising acids such as concentrated nitric, perchloric or chromic acid.
- The material is unstable or reacts with air or water.

In a major spill, the responder first extinguishes nearby ignition sources or contains the spill at the source, only if this can be done without risk of injury. Everyone in the laboratory is notified and evacuated, and first aid is given if needed. The emergency authorities are called through the campus phone or the nearest emergency call box, and if the rest of the building is at risk, the nearest alarm pull station is activated to evacuate the building. When responders arrive, they are told the type and quantity of material spilled. In a minor spill, the area is cordoned off, others are alerted, and anyone with chemicals on their clothing removes the affected clothing and flushes the skin with water. The responder collects the spill kit, checks that the right materials are available, and puts on gloves and goggles before approaching. The method then depends on the material:

Material	Response
Organic solvents	Ignition sources are removed, drains are blocked, activated carbon is poured over the spill from the outer edge to the middle, and the liquid is wiped up with absorbent pads working from the outside in.
Acids	Drains are blocked and an acid neutraliser such as sodium bicarbonate or calcium carbonate is poured on from the outside in. After several minutes a representative area is tested with pH paper, and the neutralised material is wiped up.
Bases	Drains are blocked and a base neutraliser such as citric acid or sodium bisulfate is applied in the same way and checked with pH paper before wiping up.
Dry chemicals	Powders of limited hazard are swept up with a scoop and dustpan, while highly corrosive, toxic or reactive materials are treated as a major spill, which may need a hazardous materials team with specialised vacuums.

In every case, the waste is placed in a plastic bag, labelled as hazardous waste, and held temporarily (for solvents, in the fume hood) until a Chemical Waste Disposal Request is submitted. Personal protective equipment is removed, hands are washed, the area is washed with soap and water to remove minor residues, and the spill is reported on an incident report form. The spill SOP adds that the health and safety team should be consulted on the disposal of saturated materials, since chemicals and petroleum products may need special handling, and that environmental specialists should be consulted before any clean-up that goes beyond using a spill kit, so that the clean-up does not cause further harm to the environment.

4. Treating Wastewater on Campus

The campus wastewater is treated in a Bio pipe sewage treatment plant. It is a wholly biological system that works without chemicals or mechanical aeration, produces no excess sludge and no odour, and uses little power. Its compact, modular design allows capacity to be added, and the treated water is suitable for reuse in irrigation, flushing and other non-potable uses. Wastewater from the water-treatment tanks is directed to the sewage treatment plant's final tank or to the garden, including the tank serving the Annapurna Mess.



Figure 1. Biopipe STP (200 KLD) building at the campus



Figure 2. Inside the Biopipe STP, showing the modular biological pipe racks

The energy, environment and green audit, carried out by an external, BEE-certified auditor, includes an environmental audit of the handling and storage of solid, liquid and gaseous wastes, their transport from source to yard, reuse and recycling, and the effectiveness of pollution control for air, water and soil. The audit also recommends that the campus keep a record of the sewage treatment plant's water input, treatment and wastewater, together with a record of the sludge quantity and its use, which gives the university a way to check the performance of the treatment over time.

5. Water Treatment Plants

The Water Treatment Plant (WTP) at SRM University-AP is pivotal in delivering clean water for campus needs. Outfitted with advanced filtration and disinfection systems, it effectively eliminates impurities and pathogens. Operating within stringent regulatory frameworks, the WTP upholds strict water quality standards. With a substantial daily capacity, it safeguards the health of the university community. Moreover, the WTP contributes significantly to sustainability efforts and fosters a conducive learning environment.

SRM University-AP operates seven Water Treatment Plants (WTPs) across its campus to facilitate the treatment and distribution of water to various university facilities. The output from the respective treatment plants is supplied to designated academic blocks, hostels, laboratories and other campus facilities, as Water Treatment Plant–03: Supplies treated water to the Main Kitchen, hostels, X Lab and Old Academic Block. It is also associated with RO Plant–1 (1,500 LPH) and RO Plant–2 (3,000 LPH). Water Treatment Plant–04: Supplies treated water to Academic Block Phase–2, Ganga Hostel and Academic Block Phase–3. Water Treatment Plant–05: Feeds the final water tanks of WTP–03, through which water is distributed to the Main Kitchen, hostels, X Lab, Old Academic Block and RO Plants 1 and 2. This network of seven treatment plants supports the campus-wide supply of treated water for the university's academic, residential and operational requirements.

SI. No.	WTP	Capacity (KLD)
1	WTP-1	250
2	WTP-2	200
3	WTP-3	300
4	WTP-4	300
5	WTP-5	300
6	WTP-6	150
7	WTP-7	450
Total	**7 WTPs**	**1,950 KLD**

Water Treatment Plant - 03

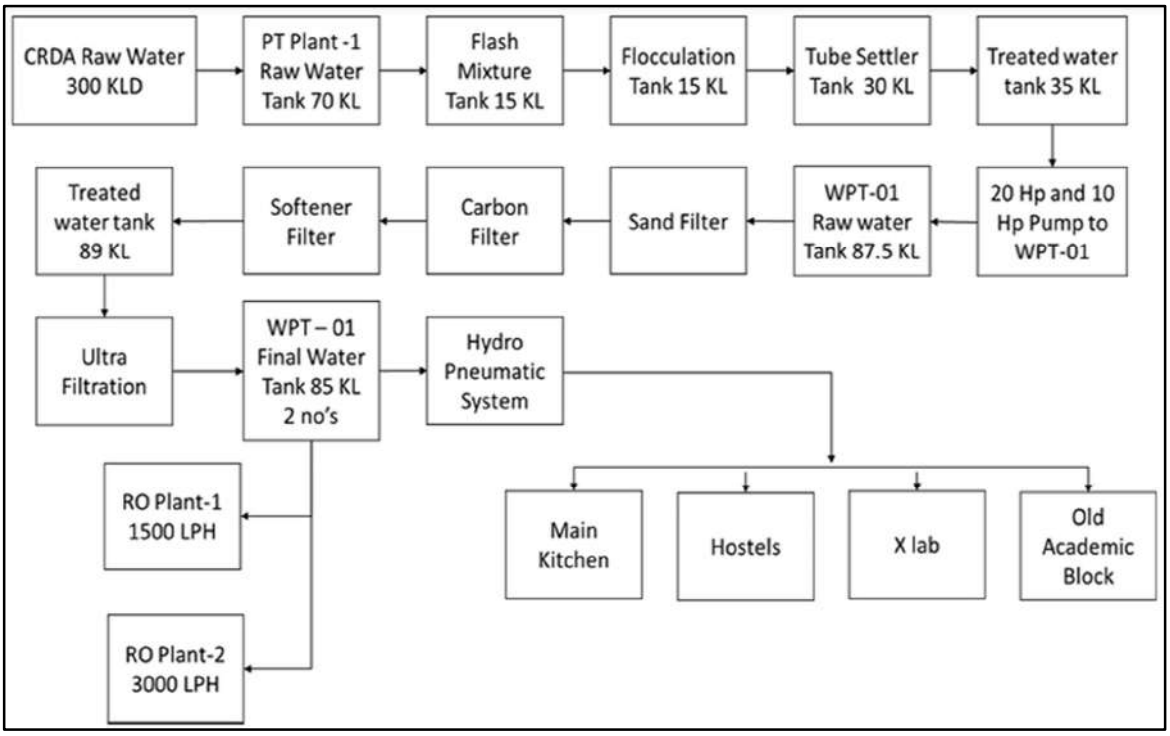


Figure 3. Water Treatment Plant-03 process flow

Water Treatment Plant - 04

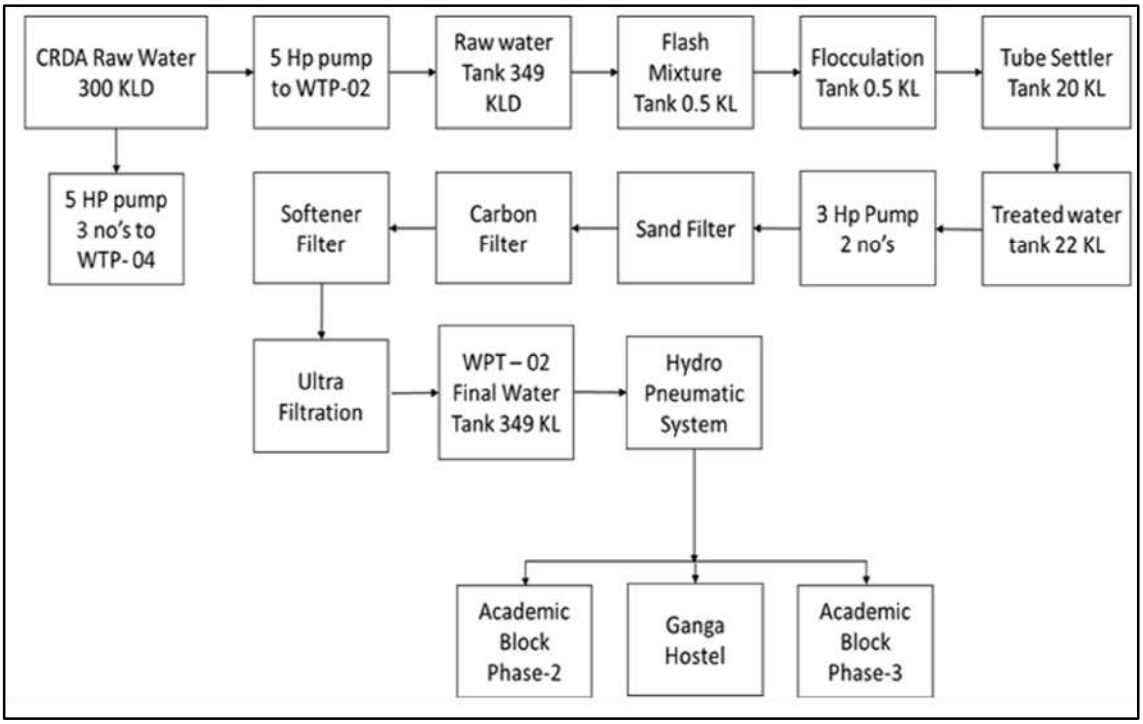


Figure 4. Water Treatment Plant-04 process flow

Water Treatment Plant - 05

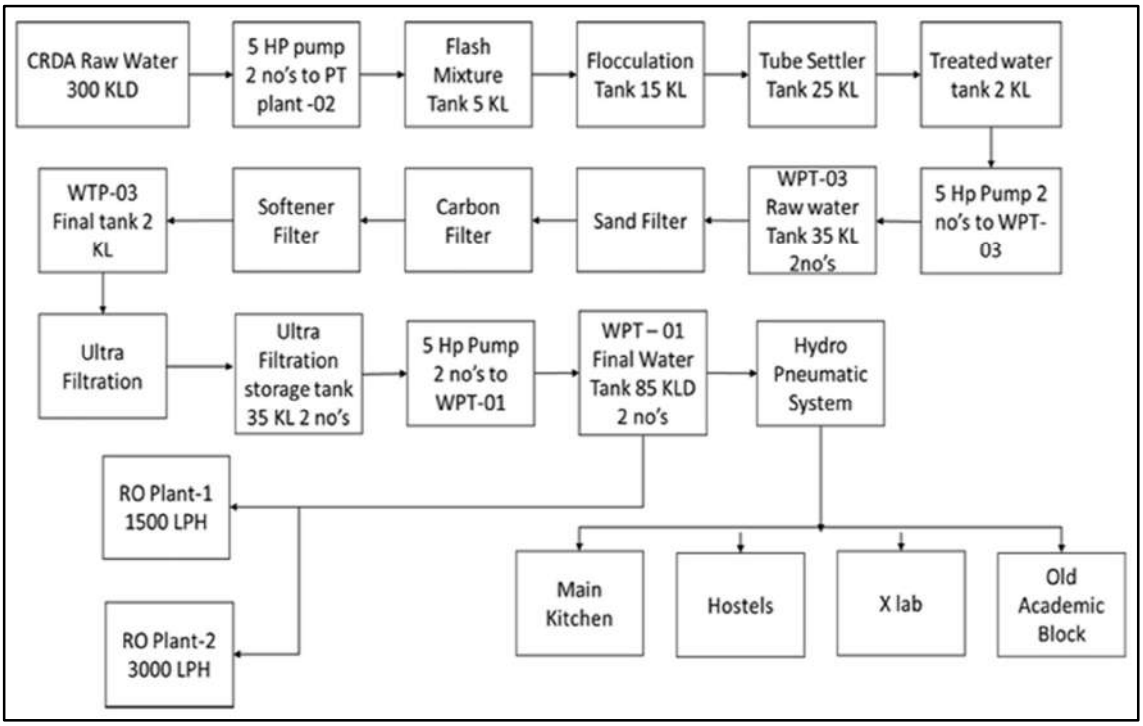


Figure 5. Water Treatment Plant-05 process flow

The plant rooms hold the treated water tanks, each with a board recording the date of the last cleaning and the next one due, and the softener, carbon and sand filters with their multiport valves. The SOP for the WTP is displayed in the plant. It sets out the operation of the sand filter, the activated carbon filter and the softener, and the chlorine dosing of 10 kg of chlorine in 100 litres of water at a dosing pump setting of 80 per cent (8 litres per hour).



Figure 6. Softener, carbon and sand filters with multiport valves at the water treatment plant



Figure 7. Row of softener, carbon and sand filters in the plant room



Figure 8. SOP for the water treatment plant displayed at the plant



Figure 9. UF Membrane-Based System at the Water Treatment Plant

6. Responsibility, Records and Review

Both SOPs assign responsibility at four levels:

Role	Responsibility
Engineer	Proper operation and maintenance of chemical spillage prevention
Manager, Operation and Maintenance	Ensures work is carried out according to the SOP, monitors that planned preventive maintenance is done on schedule, keeps computerised tracking of the activities, and raises material requests for approval
Assistant General Manager, Operation and Maintenance, or General Manager, MEP	Monitors all activities each week and obtains approvals for materials and maintenance
Director, CLM	Manages the SOP and directs its implementation without deviation

The SOPs also require that nothing is operated without the supervision of the engineer or facilities manager, and that any deviation or deficiency is reported. Records are kept in an Operational Readings Register. Any change to a system requires a change to the SOP, and a revision table in each document records the date, the change and the person who requested it, which keeps the procedures current as the campus changes.