INDIAN WATER QUALITY ASSOCIATION

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TECHNICAL NOTE

Standard Operating Procedure

Sampling of water

for physical and chemical analysis

Planning, collection, field measurement, transport, registration, storage and information management

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Purpose and central principle

A laboratory can measure only the material delivered to it. If a sample is taken at the wrong location or time, changes during transport, or is assigned the wrong preservation and method, a precise instrument result may still describe the wrong water. The sampling programme is therefore part of the measurement system: it must define the decision, represent the relevant water body or process, preserve the target analyte and document every transfer until the result is released. This note covers physical and chemical parameters in groundwater, treatment plants, drinking-water distribution and sewage treatment plants. Microbiological sampling and analysis are outside its scope. [1, 2, 3, 4, 5, 6, 7]

Indian requirements and the approved analytical method control work in India. ISO standards provide the sampling framework; US EPA procedures and 40 CFR Part 136 are useful comparators for method-specific preservation and holding times, particularly for wastewater. A US table is not automatically an Indian statutory requirement. A site-specific SOP must adopt the applicable Indian standard, permit condition and laboratory method, then resolve any difference in bottle, filtration, preservative or holding time before sampling. [1, 2, 3, 4, 5, 6, 7, 8]

1 Why sampling quality matters

Representativeness: a single tap, plant outlet or groundwater bore does not automatically represent an entire service zone, aquifer or process period. Where concentration changes over time, a grab sample answers “what was present now”; a time- or flow-weighted composite can answer a different question about average loading. A composite must never be substituted for a grab where a permit, method or unstable parameter calls for an instantaneous measurement. [1, 4, 5]

Chemical integrity: oxidation, volatilisation, adsorption to the bottle, precipitation, hydrolysis and biological or chemical conversion can change the concentration between collection and analysis. Cooling slows some changes but does not stabilise every analyte. Dissolved metals require prompt, method-compliant filtration before acidification; total recoverable metals use an unfiltered aliquot. A single “general chemistry” bottle cannot reliably serve every analysis. [2, 3, 6, 7]

Operational and public value: paired raw/treated samples show treatment removal; simultaneous inflow/outflow and flow data support STP load balances. Well-designed samples can locate a distribution problem, identify an abnormal industrial input and provide defensible evidence for corrective action. Poorly chosen samples can falsely reassure, trigger unnecessary treatment or misdirect investment. [1, 4, 5]

2 Applicable standards and how to use them

Reference	Sampling relevance	Implementation note
IS 3025 Part 1:1987	Indian water and wastewater sampling framework for physical and chemical tests.	Confirm current BIS amendments and laboratory method-specific instructions. [8]
IS 17614 Part 1:2021; Part 3:2021	Indian series on programme design and preservation/handling.	Use current BIS edition and check how it relates to IS 3025 Part 1. [9, 10]
ISO 5667-1:2023; ISO 5667-3:2024	Programme design, sampling technique, preservation, handling, transport and storage.	Later drafts do not supersede published editions until formally issued. [1, 2]
ISO 5667-14:2014; ISO/IEC 17025:2017	Field quality control and laboratory competence, including sampling when within scope.	Audit staff competency, records, uncertainty and nonconforming work. [7, 11]
US EPA 40 CFR 136.3 Table II	Containers, preservation and maximum holding times for US Clean Water Act methods.	Use as a clearly labelled comparator, not as an automatic Indian legal limit. [3]

A published holding time is the maximum allowed under its stated method and conditions, not a target for delaying analysis. Time normally runs from collection; a 24-hour composite can require

special handling and a defined start/end convention under the applicable method. The shortest relevant period governs route planning. [2, 3]

3 Preparing the sampling plan

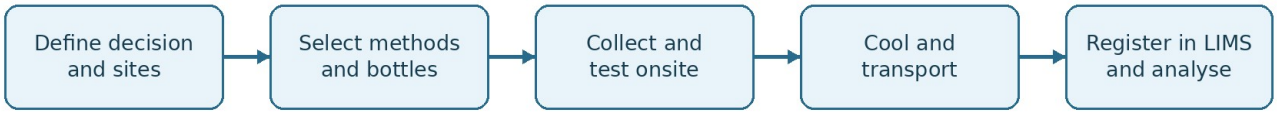

Figure 1 Sampling decisions and custody from plan to result

3.1 Define the decision before locations

State whether the programme is for compliance, surveillance, trend, process control, complaint investigation, source attribution or emergency response. Write the decision threshold; target physical and chemical parameters; reporting limit; expected range; required precision; and who receives and acts on results. Define the matrix and sampling unit: individual well, raw-water inlet, unit process, finished-water main, customer tap or STP inlet/outlet. [1, 4, 5, 6, 7]

3.2 Build a site and time map

Record site identifiers, GPS coordinates, access and safety conditions, hydraulic layout, upstream/downstream connections, chemical dosing points, storage tanks, return flows, industrial junctions and discharge locations. A drinking-water plan should cover source, outlet, reservoirs, distal and vulnerable distribution points and complaint clusters. A wastewater plan should consider inlet after preliminary mixing, intermediate units, recycle streams and final discharge, with synchronized flow. In wells, document construction, screened interval, purging method and stabilization. [1, 4, 5, 6, 12]

Set times to capture variability: peak and low demand, before and after supply restart, diurnal sewage peaks, wet and dry weather, seasonal raw-water changes and suspected process upsets. For paired removal calculations, account for hydraulic retention time; simultaneous inlet/outlet grabs may represent different water parcels. Choose grab, integrated or composite sampling explicitly for each analyte. Reactive gases, residual disinfectants, pH and volatile chemicals are usually unsuitable for a general composite. [1, 5]

3.3 Predefine quality controls and logistics

Use Annex A to approve the site and collection plan. For each sample, assign parameter, method, bottle material and size, pre-cleaning, filtration, preservative, cooling, light protection, maximum time to preparation and analysis, instrument, field blank/duplicate frequency, and laboratory destination. Establish a routing sheet that proves the last collection can arrive before the earliest deadline. Use field blanks where handling or the environment may contaminate samples; equipment blanks after cleaning; transport blanks for volatile organics when prescribed; and paired field duplicates at risk-based frequencies. Specify calibration standards, acceptance limits, corrective steps and sample rejection criteria. [2, 3, 7, 11]

Sampling-plan item	Record before the first visit
Decision and coverage	Purpose, compliance point, matrix, season, number of sites, trigger thresholds
Each location	Unique code, GPS, plumbing/flow schematic, exact tap or outlet port, access permission
Each analyte	Approved test method, dissolved/total fraction, bottle, volume, preservative, holding time
Timing and mode	Grab/composite, frequency, shift, event trigger, flow measurement, travel deadline
Quality control	Blanks, duplicates, calibration checks, preservation verification, acceptance criteria

Pre-dispatch bottle requisition: the field lead should receive one site-specific kit list showing each analyte, approved method, matrix, required quantity, bottle material, number of bottles, precleaning/certification lot, filter size, preservative and quantity, fill/headspace instruction, temperature band, earliest filtration/preparation/analysis deadline, field QC bottle, and contact number for a shortage or breakage. The laboratory should check the kit and sign it before sealing the cooler. This prevents a correct sample being placed in the wrong bottle because the correct one was never sent. [2, 3, 7]

4 Field preparation and collection sequence

Before departure, compare the itinerary against bottle kits prepared by the laboratory. Check bottle cleanliness, correct preloaded preservative, expiry, sample labels, tamper seals, chilled compartments, battery backup and spare containers. Calibrate or verify pH, conductivity, dissolved oxygen, turbidity and chlorine instruments against traceable standards and record instrument identity, standards, time, reading and acceptance. Keep reagents segregated from unpreserved samples and use PPE appropriate to the site. [2, 3, 7, 11]

Complete Annex B at each site: confirm the sample point and flow condition, photograph or describe unusual conditions, and document exact collection time. For a tap, distinguish a first-draw sample from a flushed sample; do not silently flush if first-draw chemistry is the purpose. Avoid hoses, stagnant dead ends or treatment attachments unless they are part of the question. For an STP, identify whether a grab or flow-proportional composite meets the decision and prevent solids settling in a composite sampler; keep sampler bottles protected and chilled as required. For a monitoring well, use a suitable low-flow technique and document water-level drawdown and stabilization where prescribed. [1, 4, 5, 6, 12]

Collect field measurements immediately, then fill each dedicated bottle according to its method. For volatile organics, use the method-specified vial and avoid headspace; do not pour from a bucket that aerates the sample. Where dissolved fractions are required, filter promptly with a validated, analyte-compatible filter and label the aliquot “dissolved”; do not filter total metals, TSS, total phosphorus or other whole-water parameters unless the method explicitly calls for it. Add only the correct preservative to the appropriate aliquot, verify pH when required without contaminating the bottle, cap securely, and record the preservative, person and time. [2, 3, 7]

5 Sample bottles and sampling equipment

5.1 Bottle selection and preparation

The laboratory should issue a pre-labelled bottle kit for each site. The bottle must be compatible with both the analyte and preservative: high-density polyethylene or another validated plastic is common for inorganic ions and many metals; glass is needed for oil and grease and many organics; volatile-organic vials require a suitable septum cap and no headspace. Low-level

organics may require certified pre-cleaned amber glass and field blanks. Boron and silica can require plastic, PTFE or quartz to avoid contamination from glass. The approved method, not a generic preference for glass or plastic, decides the material. [2, 3]

Specify the bottle volume needed for the method, repeat analysis and QA. The laboratory must prepare/clean containers to its validated SOP, check caps and liners for compatibility and leaks, and distinguish sterile packaging (unnecessary for this physical/chemical note) from chemically clean containers. Bottles containing preloaded acid or alkaline preservative must carry an unmistakable label and secure secondary containment. For acid-sensitive parameters such as alkalinity, nitrate/nitrite and BOD, issue separate unacidified bottles. Prepare dedicated total-metal and dissolved-metal bottles with distinct labels. Do not rinse a pre-preserved bottle or a certified VOC vial; rinse only when the applicable method requires it. [2, 3, 7]

Bottle or container	Typical physical or chemical use	Critical handling
Clean plastic (HDPE/PP as validated)	Major ions, nutrients, TDS/TSS and many metals	Select method-compatible plastic; use separate acidified and unacidified sets.
Acid-washed plastic	Trace total/dissolved metals when method permits	Keep dust-free; filter dissolved fraction first, then acidify per method.
Clear or amber glass	Oil/grease, TOC and many semivolatile organics	Check cap liner and cleaning; amber glass/light exclusion for sensitive organics.
Glass VOA vial with PTFE-lined septum	Volatile organic compounds and solvents	Fill gently to eliminate headspace; use method-specific dechlorination/preservative.
Glass DO bottle with ground stopper	Winkler dissolved oxygen	Fill without bubbles and fix at site; probe readings need immediate analysis.

Bottle or container	Typical physical or chemical use	Critical handling
Dedicated compositing bottle	Wastewater time- or flow-proportional composite	Compatible with analytes; clean sampler tubing, preserve temperature and log subsamples.

5.1.1 Minimum sample quantity and bottle material

The quantities below are practical planning minima for one routine determination, not universal requirements of ISO or BIS. The laboratory must issue its method-specific volume, plus additional volume for duplicate analysis, field QC, high turbidity, dilution or low reporting limits. A 100 mL analytical aliquot is not the same as the required collected volume. Collect separate bottles whenever preservatives, filtration, headspace or container materials differ. Where a cited US EPA method names a volume, it is shown explicitly; other entries are cautious kit-planning values that require laboratory confirmation. [2, 3, 16, 17, 18, 19, 20, 21]

Analyte or group	Bottle material and minimum collected quantity	Reason or source
Major ions, hardness, alkalinity, chloride, sulfate, fluoride	Clean HDPE or PP; plan ≥250 mL unacidified.	Operational kit minimum; method may permit glass or require a different volume. [2, 3]
Heavy metals total, e.g. Pb, As, Cd, Cr, Fe, Mn	Trace-metal-clean HDPE/PP; plan ≥250 mL unfiltered; acidify HNO_3 as method directs.	EPA 200.8 uses a 100 mL analytical aliquot for some matrices; collect extra for QC/digestion. [16]
Heavy metals dissolved	Separate trace-metal-clean HDPE/PP; plan ≥250 mL; field filter then preserve.	USGS documents a 250 mL dissolved trace-element bottle; never infer dissolved

Analyte or group	Bottle material and minimum collected quantity	Reason or source
		from an unfiltered sample. [17]
Mercury; hexavalent chromium	Dedicated method-approved bottle; plan ≥250 mL each.	Preservation differs from routine metals; confirm method and low-level blanks. [3]
Pesticides / herbicides / semivolatile organics	Certified clean amber glass with PTFE-lined cap; usually ≥1 L per method bottle; some methods require two 1 L bottles.	EPA 525.2 uses 1 L amber glass; volume and dechlorination vary by pesticide method. [18]
TOC (total organic carbon)	Organic-clean glass vial/bottle with PTFE-compatible closure; EPA 415.3 permits 40 mL–1 L; plan ≥100 mL unless lab issues validated 40 mL vial.	Do not substitute DOC: DOC needs filtered aliquot. [19]
DOC / UV254	Organic-clean glass; plan ≥250 mL, often 1 L for paired filtration/UV work.	EPA 415.3 recommends 1 L for combined DOC/UVA set; no acid for UVA aliquot. [19]
Volatile organic compounds (VOCs)	Glass 40 mL vial with PTFE-lined septum, no headspace; plan ≥2 vials of 40 mL (more for QC).	Confirm compound-specific preservative and method. [3, 20]

Analyte or group	Bottle material and minimum collected quantity	Reason or source
Oil and grease / petroleum extractables	Precleaned wide-mouth glass with PTFE-lined cap; approximately 1 L.	EPA Method 1664B collects approximately 1 L directly into glass. [21]
COD	Clean glass or approved plastic; plan ≥250 mL, separate acidified aliquot.	Operational minimum; lab may use less or need more for duplicates. [3]
BOD, TSS, TDS	Clean method-approved plastic or glass; plan ≥1 L combined only if lab allows sharing, otherwise separate ≥500 mL aliquots.	Do not acidify BOD/TSS/TDS; suspended solids require representative mixing. [3]
Ammonia; nitrate; nitrite; phosphate	Clean plastic; plan ≥250 mL per incompatible preservation group; orthophosphate filtered aliquot separately.	Ammonia acidification differs from nitrate/nitrite; phosphate fraction differs. [3]
Sulfide or cyanide	Dedicated compatible plastic/glass; plan ≥250–500 mL per analyte.	Special preservatives and interference checks; laboratory issues exact bottle. [3]
Residual chlorine, pH, DO, temperature	No routine transport bottle for field decision; small test aliquot/flow cell as method specifies.	Measure immediately; a transported bottle cannot preserve original state. [3]

5.1.2 Consequences of the wrong bottle

An unsuitable material can alter a result in either direction. Metals can leach from glass, coloured pigments, caps or dust, causing a false high, or adsorb to container walls and precipitates, causing

a false low. Plastic can sorb hydrophobic pesticides and release plasticisers or other organic carbon, biasing organic tests. Clear glass can allow photolysis of light-sensitive pesticides; an incompatible cap liner can contribute organics. A partially filled VOC bottle loses volatile compounds into headspace, causing a false low. A shared acidified bottle changes alkalinity, nutrient species and BOD, and wrong filtration changes “dissolved” into “total” or vice versa. These errors may create a false compliance result or a false exceedance, and cannot reliably be corrected in the laboratory. [2, 16, 18, 19, 21]

Wrong choice	Likely bias or loss	Required response
Ordinary unclean bottle for trace metals	Contamination or adsorption; false high or low	Do not report unqualified; recollect in trace-metal-clean bottle.
Plastic for pesticide or oil/grease where glass specified	Sorption of organics; extraction method incompatibility	Recollect in certified glass with correct cap.
Clear bottle for photolabile pesticide	Light degradation; false low	Recollect amber/light-protected sample.
Headspace or permeable cap for VOC	Volatilisation; false low	Reject/recollect full method-approved septum vial.
Acidified shared bottle for BOD or alkalinity	Changes the constituent being measured	Keep dedicated unacidified aliquot and recollect if needed.

5.1.3 Cleaning, certification and custody of bottles

The laboratory, not the field sampler, should normally clean and issue bottles. First discard chipped, stained or chemically incompatible containers and caps. Wash reusable bottles with validated non-phosphate laboratory detergent; thoroughly rinse with tap water followed by reagent-grade water. For trace metals, follow the analytical method’s acid-wash and high-purity-water rinse, using trace-metal-grade acid, compatible labware and a clean drying/storage area. EPA Method 200.8 describes detergent washing followed by acid treatment and reagent-water

rinse for reusable trace-element labware; it is an example, not permission to apply acid indiscriminately. Organic bottles require a separately validated low-organic cleaning process, which may include solvent rinse or controlled heating if compatible with the bottle/cap and method. Do not solvent-rinse plastic or PTFE liners without a method-approved procedure. [16, 22, 23]

After cleaning, cap immediately, seal or bag individually, label cleaning lot and date, and document blank testing where low detection limits require it. Keep trace-metal-clean, organic-clean and general-chemistry bottles separate. Inspect purchased certified bottles against the supplier certificate and preserve their seals. At the site, do not rinse pre-preserved bottles, certified organic bottles or VOC vials; other bottles are rinsed with sample only if the relevant method and kit instructions require it. Reuse is not acceptable for a bottle whose prior content cannot be excluded by validated cleaning and blank checks. [2, 16, 18, 22, 23]

5.2 Choosing a sampling device

A bottle held directly in a clean stream is suitable only when the point is safe, accessible and representative. At a WTP or STP sampling tap, a clean inert transfer tube or purpose-built port can collect a grab without splashing. A telescopic pole or discrete-depth sampler allows collection from an open process tank or channel where a pipe sampling port is unavailable. Avoid a dirty bucket or transfer vessel, which may contaminate metals and organics or change pH and DO. Keep each sampler and tubing material compatible with the analyte and use a documented between-site cleaning sequence with an equipment blank when contamination is plausible. [1, 4, 5, 6, 7]

Groundwater monitoring may call for a low-flow pump and flow-through cell to minimise aeration and drawdown while pH, conductivity, DO, temperature and redox-related indicators stabilise. Specify pump material, intake position, tubing length, purge record and stabilization criteria. For wastewater, an automatic time- or flow-proportional sampler can represent changes over a shift or day; it should have a programmable controller, timestamped aliquot log, appropriate tubing and strainers, refrigerated collection compartment, power backup and a flow signal when flow weighting is specified. Verify representativeness for settleable solids and clean the intake between

events. A composite device is inappropriate for analytes whose chemistry changes rapidly or for a compliance grab requirement. [1, 3, 5, 6, 12]

Sampler	Suitable application	Main limitation or verification
Direct grab at tap or clean port	Distribution, treatment-unit or effluent grab	Define flush/first draw, pressure, exact point and contact materials.
Low-flow groundwater pump with flow cell	Monitoring well chemical profile	Log drawdown, stabilization, tubing and pump materials.
Automatic refrigerated composite sampler	Time- or flow-weighted wastewater loads	Check aliquot timing/volume, refrigeration, tubing cleaning and permit applicability.

5.3 Step by step physical and chemical sampling from a tap

Select the tap procedure from the decision being tested. First-draw lead/copper investigation, consumer exposure, a flushed distribution-main sample and an operational outlet sample represent different waters. Record stagnation and flushing instead of applying one universal purge duration. Never flush before a required first-draw sample. Use Annex A for point selection, Annex B at the sampling point and Annex C when the laboratory receives the bottles. [4, 24, 25]

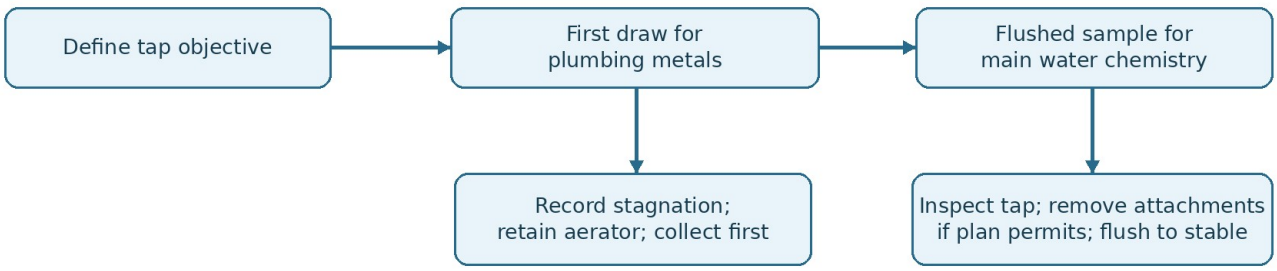

Figure 2 Tap sampling branches determined by the analyte and objective

1. Identify the precise cold-water tap and its relation to the main, service line, storage tank and any point-of-use treatment. Compare its code with Annex A. Ask about last use, intermittent supply,

repair, hose, aerator, filter and low pressure. Record these observations in Annex B before opening the tap; photograph the point if permitted.

2. Check the kit against the analyte list: unpreserved bottles, acid-preserved metals bottles, amber organic bottles and VOC vials are distinct. Check caps, preservatives, expiry and labels. Keep bottles capped on a clean tray until filling, change gloves, and do not set caps or sample mouths on a surface.

3A. For a prescribed first-draw lead/copper sample, document the required stagnation interval and volume under the applicable programme. Do not flush, remove the aerator, pre-rinse or otherwise alter the tap unless that protocol explicitly directs it. Open the cold tap and collect the first prescribed volume directly into its designated bottle; document any departure.

3B. For a flushed distribution or source-water sample, use an appropriate cold tap before household filters/RO/softeners where the objective is the supply itself. Remove attachments only if permitted and note removal. Flush at moderate flow until the intended supply arrives and temperature/conductivity are reasonably stable under the plan; record minutes, approximate flow and total volume, pressure or interruptions. If flushing is impossible, label the sample as unflushed and qualify its interpretation.

4. Reduce flow to a smooth stream. Record temperature, pH, conductivity, turbidity, DO and chlorine residual as applicable using a calibrated instrument, preferably in a flow-through cell or fresh dedicated aliquot. Measure chlorine immediately; record whether residual is free or total. Never return measured water to a sample bottle.

5. Hold each container beneath the stream without contact between spout and bottle lip. For required dissolved analytes filter at the site using method-compatible clean tubing/filter, then preserve as directed; collect total metals without filtration. Do not rinse bottles containing preservative or dechlorinating reagent. For volatile substances, fill slowly with minimal turbulence and no headspace; verify there are no visible bubbles.

6. Apply the laboratory's analyte-specific fill line (see section 5.3.1), cap immediately and gently mix only where the preservation method requires it. Check preservation using a separate aliquot or approved procedure. Label every bottle with site, unique bottle ID, collection time, fraction,

preservative and sampler; record any unusual odour, discoloration or solids without opening a sealed bottle again.

7. Scan the bottle IDs, complete the field record and custody handoff, then place upright in a padded, light-protected cooler as required. Link exact tap status and field readings to the same sample event. Record changes of custody and arrival checks in Annex C; escalate any missing bottle, failed stabilization, abnormal pressure or exceeded deadline.

Tap precautions: do not flame or chemically disinfect a tap during physical/chemical collection unless the particular method expressly requires it. Such treatment may change metals, organics or chlorine. Do not draw from a hot-water tap for a cold-water supply assessment. A sample after a domestic RO unit or rooftop tank answers a different question and must be labelled accordingly. Follow the governing method for sequence where disinfectant residual, VOCs and organics share a point. [4, 24, 25, 26]

5.3.1 Fill level and protection from air exchange

No universal air gap is appropriate. Laboratory method instructions and any preloaded preservative take priority. CO_2 loss may increase pH and alter alkalinity, dissolved inorganic carbon and carbonate equilibrium; air contact also changes DO, redox-sensitive species and volatile analytes. Measure pH, DO and chlorine in the field rather than relying on transport. [2, 26, 27]

1. For a routine unpreserved chemistry bottle, fill to its laboratory-marked shoulder or fill line, normally leaving a small space so the cap closes securely and the sample can be mixed where needed. Do not claim that filling to the brim preserves pH or DO.

2. For VOC vials and any method specifically requiring no headspace, fill by the approved technique to a convex meniscus, cap without trapping a bubble and invert to inspect. Replace and recollect any vial with a visible persistent bubble; do not top it up later.

3. For dissolved gases or gas-sensitive speciation, use the validated gas-tight vessel, submerged tubing or overflow method and no headspace where specified. Record the collection configuration; an ordinary capped bottle is not equivalent.

4. For preservative-filled, amber organic, oil-and-grease or other special containers, obey the supplied fill mark and method; leave only the headspace specifically specified for preservative addition or mixing. Do not overfill and spill preservative or leave a large air space by default.

Precautions: Never rinse a pre-preserved bottle. Avoid splash, shaking, decanting and delays. There is no defensible fixed rule such as “fill every bottle to 90%”: specify fill level per analyte in Annex A and note actual deviations in Annex B.

5.4 Underground service reservoir outlet

This procedure samples water leaving an underground service reservoir (UGR), not the tank interior. Select a dedicated, labelled port on the active outlet header after mixing and before any downstream chemical dosing or blending, unless the plan explicitly targets the final blended supply. Record tank identification, outlet valve, water level, pumping/flow status, inlet and outlet configuration, last cleaning and time since refilling. [1, 4, 7]

1. Obtain the hydraulic drawing and operator permission; verify the port is on the outlet rather than drain, recirculation, stagnant bypass or inlet. Confirm the tank is supplying the selected zone.

2. Inspect the port for leaks, dirt, hose connections and hazardous access. Place a clean drain/collection tray; never enter a confined reservoir to take an outlet sample. Remove a hose if safe and allowed.

3. Open the port slowly and flush its dead-leg volume until water temperature/conductivity are stable and the outlet is flowing normally. Record estimated port flush and actual tank operation; a fixed time alone does not prove representativeness.

4. Measure immediate parameters with a flow cell or clean aliquot; reduce flow and collect directly into dedicated bottles according to section 5.3.1 and the parameter matrix. Take a paired inlet sample only when the plan requires a tank effect comparison.

5. Cap, label and cool; record tank level, pump or valve status, residual chlorine, sampling time and any change of supply during the event in Annex B.

Precautions: Do not dip an unclean bucket into a covered tank. A bottom scour/drain can overstate settled solids, while a long idle port can represent the dead leg rather than reservoir outflow. Record any chlorination downstream of the port.

5.5 Overhead or elevated service reservoir outlet

Choose an accessible outlet-header sampling port downstream of the storage volume and upstream of any additional dosing or blending, with a clear reference to the population served. Distinguish the actual outlet from the overflow, scour and filling pipe. [1, 4, 7]

1. Confirm reservoir code, compartment, current fill/discharge cycle, water level, inlet and outlet valves and whether multiple compartments or outlets mix before the selected port.

2. Use a ground-level or safe-platform outlet port whenever available; isolate the sampling position from vehicle traffic and falling hazards. Do not climb to a tank roof merely to reach an open hatch.

3. Clean the outside of the port without introducing chemicals into the sample path, purge its dead leg and watch temperature/conductivity and free chlorine as appropriate for stable flowing outlet water.

4. Collect analyte-specific bottles from a gentle stream, take field readings immediately and document start and end times, flow condition and any pump change.

5. Close the port and confirm there is no leak; seal, scan and pack bottles and record exceptional circumstances in Annex B.

Precautions: A roof hatch or dip sample describes the stored water at that location, not necessarily outlet water. Avoid hosepipes, stagnant standpipes, overflow pipes and sampling immediately after an abnormal operational switch unless the event itself is the objective.

5.6 Tubewell with installed pump

Select a raw-water sampling port as close to the wellhead as practicable, before aeration, chlorination, blending, treatment, pressure storage or household plumbing. If sampling treated delivery instead, identify it as a different sample point. The purge method depends on pump duty and well construction. [6, 12, 28]

1. Identify bore/well code, depth and screen if known, pump type, operating history, sample-port location, treatment connections, prior shutdown and recent maintenance. Record whether the well is already in continuous service.

2. Inspect and safely open a tap/valve before treatment. Divert purge water away from the wellhead so it cannot return to the casing or create an electrical hazard.

3. For a continuously operating supply well, confirm stable flow and field parameters and flush the port's dead leg. For an idle well, pump at an appropriate rate and monitor time, discharge/volume and temperature, pH, conductivity, DO and turbidity until the approved stabilization criterion is met; do not impose a universal number of casing volumes without regard to well hydraulics.

4. Keep a gentle steady flow. Collect directly or through validated low-aeration tubing/flow cell; fill gas-sensitive and VOC containers without splash/headspace, filter dissolved fractions onsite and preserve the proper bottles.

5. Record pumping rate/volume, last operating time, stability readings, abnormal turbidity, pump cycling and a possible drawdown issue; complete Annex B and custody.

Precautions: Avoid pressure tanks, flexible garden hoses, leaky fittings and sampling after chlorination when raw aquifer chemistry is sought. Never force the pump to run dry. Stop, document and seek a revised plan if the well fails to stabilize or the pump cycles unpredictably.

5.7 Dug well

The plan must say whether the target is water withdrawn for use or the standing water in the open dug well. A dug well can stratify and receive recent surface inflow; these two objectives require different, clearly named sample points. [1, 6, 28]

1. Confirm the well ID, protection/apron, cover, water level, lining, pumping arrangement, recent rainfall, visible inflow and nearby contamination sources. Keep personnel outside an unguarded rim.

2. For pumped supply, use a suitable pre-treatment outlet, operate the pump to replace stagnant discharge-line water, then monitor field parameters and collect from steady flow using the tubewell sequence.

3. When a standing-well sample is explicitly required, use a decontaminated depth-specific sampler at the planned depth below the surface, clear of walls, bottom sediment and floating material unless those are the target. Record depth and device; never infer that this is a whole-well average.

4. Transfer carefully into the proper containers with minimal aeration, carry out field measurements immediately and filter/preserve according to the analytes.

5. Record water level, sample depth, well condition, pumping status and any rain/surface inflow; flag the sample if safety or accessibility prevented the specified depth.

Precautions: Do not lower an unclean household bucket, rope or bare bottle into the well. Do not disturb sediment or drop preservative into the well. Open-well standing water is especially sensitive to rain and handling; report the exact method.

5.8 Hand pump

Sample from the spout of the identified hand pump after establishing whether the purpose is consumer first-use exposure or representative aquifer/pumped supply. The number of strokes alone is not a universal purge criterion. [6, 28]

1. Record pump code, local use, last known operation, casing and platform condition, standing water, leaks and any attached hose or filter. Inspect and clear the discharge area safely.

2. If first-use exposure is the question, collect before pumping/purging under the planned protocol and label it explicitly as first use.

3. For aquifer/pumped supply, operate at a consistent practical rhythm to expel standing water in the pump and riser; monitor conductivity and temperature and, where appropriate, pH/turbidity until reasonably stable. Record strokes, duration, estimated volume and any interruption.

4. Collect from the free-flowing spout without letting it touch the bottle; use a clean compatible transfer if direct capture would splash. Measure field parameters immediately, then fill, filter and preserve specific bottles.

5. Note pumping difficulty, loss of prime, sandy discharge or marked parameter instability and flag interpretive limits in Annex B.

Precautions: Do not touch the spout with a bottle or place the cap on the pump platform. A public pump may be contaminated at the spout; retain that condition if studying consumer exposure, and do not pretend that a surface wipe makes the aquifer sample sterile.

5.9 Point selection and exceptions across all locations

Each physical sampling point needs a permanent site code and a drawing or photograph that identifies the exact port. Pair the point with a question: raw source, treatment outlet, reservoir outlet, distribution water or point-of-use exposure. If a point is inaccessible, damaged or after unplanned treatment, stop and record an approved alternate rather than substituting a nearby convenient tap. [1, 4, 7]

1. Confirm site ID, asset/compartment and hydraulic position against the plan and Annex A; log GPS, local landmark and access authorization.

2. Check current operation: source online, tank filling or emptying, pumps on/off, valve position, dosing, blending, intermittent supply, recent repair and potential backflow.

3. Select first-draw or flushed collection, flow-through or direct sampling, purge/stabilization rule and analyte-specific filling from the approved method; prepare the required field QC.

4. At the point, document any deviation, capture the associated reading and bottle ID in Annex B, and request supervisor approval before a substitute location is used.

5. At the laboratory, reconcile the collection event and every bottle with Annex C before accepting analytical work.

Precautions: Use closed, accessible outlet ports for reservoir outflow. Site coding must distinguish the same asset's inlet, outlet, scour and post-dosing points. Never infer a reservoir outlet value from a household tap without noting intervening storage and pipes.

6 Parameter-specific collection and preservation matrix

The examples below follow the current US 40 CFR 136.3 Table II for wastewater unless marked as a practical field measurement. They illustrate why separate bottles and deadlines are needed. Exact Indian laboratory instructions may differ; confirm the current approved method, permit and matrix before issue of the bottle kit. P = plastic; G = glass; FP = fluoropolymer. "Cool ≤6 °C" does not mean freeze. [2, 3]

Parameter or group	At the site / sample fraction	Illustrative US EPA preservation and maximum time
Temperature; pH	Measure in situ or immediately in a flowing cell; record calibration and time.	15 minutes for each; no preservative. [3]
Free/total residual chlorine; DO	Measure residual chlorine promptly with validated DPD method; DO with calibrated probe in situ or fixed Winkler bottle.	Total residual chlorine 15 min; DO probe 15 min; Winkler fixed on site and dark, 8 h. [3]
EC, TDS, turbidity, colour	EC can be measured in field; lab TDS needs separate whole-water bottle for gravimetry; keep turbidity promptly measured where feasible.	Conductivity ≤6 °C, 28 d; TDS ≤6 °C, 7 d; turbidity and colour ≤6 °C, 48 h. [3]
Alkalinity, chloride, sulfate, fluoride	Dedicated unacidified bottles; avoid aeration for alkalinity and analyse promptly where practical.	Alkalinity cool ≤6 °C, 14 d; chloride 28 d; sulfate cool ≤6 °C, 28 d; fluoride plastic, 28 d. [3]
Ammonia; nitrate; nitrite	Different aliquots: do not acidify unpreserved nitrate/nitrite sample just to share an ammonia bottle.	Ammonia cool ≤6 °C and H_2SO_4 pH<2, 28 d; nitrate/nitrite separately cool ≤6 °C, 48 h. [3]
Orthophosphate; total phosphorus	Filter dissolved orthophosphate promptly; leave total phosphorus unfiltered.	Orthophosphate filter within 15 min, cool ≤6 °C, analyse ≤48 h; total P cool ≤6 °C + H_2SO_4 pH<2, 28 d. [3]

Parameter or group	At the site / sample fraction	Illustrative US EPA preservation and maximum time
Total and dissolved metals	Total: unfiltered; dissolved: filter promptly before acidification; Hg, Cr(VI), boron have distinct instructions.	Most metals HNO_3 pH<2, 6 mo; Cr(VI) cool ≤6 °C and pH 9.3–9.7, 28 d; Hg method-specific. [3]
COD; BOD; TOC	Separate aliquots; BOD cannot share an acidified COD bottle.	COD cool ≤6 °C + H_2SO_4 pH<2, 28 d; BOD cool ≤6 °C, 48 h; TOC cool ≤6 °C + approved acid pH<2, 28 d. [3]
Oil and grease; VOCs	Oil/grease direct to glass; VOCs dedicated sealed glass vials without headspace.	Oil/grease cool ≤6 °C + specified acid pH<2, 28 d; VOC preservation and time are compound/method-specific. [3]
Sulfide; cyanide	Special bottles and reagents; avoid aeration and oxidant interference; trained samplers only.	Sulfide cool ≤6 °C, zinc acetate + NaOH pH>9, 7 d; cyanide cool ≤6 °C + NaOH pH>10 and oxidant treatment as specified, 14 d. [3]

A shorter time may apply under an Indian method, a drinking-water EPA method, an analyte-specific method or an unstable site matrix. Do not use “28 days” for all nitrogen forms: US EPA Table II gives nitrate and nitrite 48 hours when analysed separately. Do not infer actual gravimetric TDS from EC without a validated conversion factor and a clear label that the result is estimated. [2, 3]

7 Why certain measurements belong at the site

Temperature changes immediately after collection. pH shifts as CO_2 exchanges with air and reactions continue. Dissolved oxygen changes by respiration, aeration and temperature; a sample carried in a partly filled bottle does not preserve its original DO. Residual chlorine reacts with pipe deposits and organics and decays during travel. Ammonia speciation depends on pH and temperature. Oxidation state, especially Fe(II), Mn(II) and Cr(VI), may change unless a defined fraction and preservative are applied. Rapid filtration preserves an intended dissolved fraction and avoids later particle dissolution or adsorption. For these reasons, a van must carry trained staff and calibrated instruments; refrigeration cannot recover the original field value after a delay. [2, 3, 12, 13]

A van may also support validated onsite titration or colorimetry for chlorine and selected analytes where the method permits. The van is not automatically an accredited mobile laboratory: result traceability, calibration, environmental control, reagent quality, proficiency and accreditation scope must be established for any reportable field test. Identify in reports whether a value was measured in situ, at a van workstation, or after laboratory receipt. [11]

8 Transport and a dedicated sampling van

The objective is to deliver each bottle under its method-specific physical conditions before its holding time expires, with its seal and identity intact. A dedicated van is justified for high-volume municipal networks with many routes, heat exposure, tight deadlines and onsite tests. It can provide a secure, temperature-logged refrigerated compartment, separate racks for acids and solvents, upright shock-protected bottle holders, clean benches for field instruments, independent power or backup, GPS and route tracking, barcode scanning, spill containment and a direct connection to LIMS. A van also makes long multi-site routes auditable. [2, 3, 7]

A dedicated van is a programme design recommendation, not an ISO, BIS or EPA requirement to exclude all other transport. A properly validated insulated carrier or other vehicle can meet the same conditions for short routes. A van does not extend any holding time or compensate for delayed field pH, DO or chlorine measurement. Specify a target transport temperature based on the strictest relevant method (often near 4 °C operationally for analytes that require cooling), log air and representative sample temperatures, and avoid direct contact of bottles with frozen packs

or unintended freezing. Separate preserved from unpreserved bottles, secondary-contain chemicals, and protect light-sensitive or volatile samples. [2, 3]

At collection and each handoff record collector, date/time, site code, bottle IDs, number of containers, preservation, cooler/compartment ID, temperature, tamper seal, driver, laboratory receiver and exceptions. Pack bottles to prevent breakage and agitation. The van manifest should warn of the earliest analysis deadline, traffic delays, compressor failure, power loss and missed visits, with a diversion/escalation plan. Do not leave loaded samples unattended in a parked vehicle. [2, 3, 7, 14]

8.1 Dedicated sample van specification

For a municipal programme with many locations, the dedicated van should have a sealed, dustproof sample compartment; active, adjustable cooling set to approximately 4 °C for aliquots that require refrigeration; calibrated continuous temperature logging and alarms; an independent battery/inverter or backup supply; insulated, upright bottle racks with cushioning and restraint to prevent jerks, vibration, tipping and breakage; and separate secondary containment for acids, solvents and unpreserved samples. Temperatures should be verified at the sample container or in a representative load, not inferred solely from the thermostat. Cooling must start immediately after collection where prescribed, must not freeze bottles, and does not extend any method holding time. [2, 3, 15]

The van should carry the complete approved onsite testing kit for the planned physical and chemical parameters: calibrated multiparameter meter (pH, temperature, conductivity and, where appropriate, oxidation-reduction potential), dissolved oxygen meter and flow cell, portable turbidity meter, DPD free/total chlorine colorimeter, portable flow meter or access to flow records, and any validated onsite colorimetric or titrimetric kit needed on that route. Add calibration standards, QA checks, fresh reagents, clean tubing, filtration apparatus for dissolved analytes, deionized water, PPE, spill kit, barcode scanner or tablet, GPS, camera, chain-of-custody forms and power/lighting. A portable balance or full lab-grade spectrophotometer should be fitted only if the method, stable bench and accreditation scope support their use. [2, 3, 11]

Route acceptance must check door seals, dust ingress, compressor performance, empty/full load temperature mapping, temperature probe calibration, bottle-restraint performance, cleaning log

and backup endurance. Assign each bottle to a rack position in the manifest. Even a well-equipped van cannot replace an immediate pH, chlorine or DO measurement at the actual sampling point. [2, 3]

8.2 Chain of custody from collection to laboratory receipt

Chain of custody (CoC) is the documented history of who controlled each sample, when and where it was transferred, and in what condition it was received. It links the bottle label, sampling logbook or field sheet, analysis request, tamper-evident seal, transport record and laboratory receipt. Its purpose is to establish identity and integrity from collection through analysis and reporting. A seal indicates possible interference if broken; it does not replace a signed transfer record or prove that the sample was correctly collected.

At the sampling point, the sampler assigns a unique bottle ID and records the site and exact port, collection date and time (including composite start and end times), sample type, requested analyses, preservative and field measurements in Annex B. The label and analysis request must carry matching IDs. Cap the bottle, inspect for leakage, apply a tamper-evident seal where specified by the programme, and place it upright in the appropriate cooler. Keep the field log and custody record legible and protected from condensate.

At each change of control, the person relinquishing and the person receiving jointly reconcile bottle IDs and counts, then record their names or authenticated electronic identities, signatures, date and time, cooler or seal ID, and observed condition in Annex C. If a courier cannot sign at collection, use a documented tracking number, sealed package and dispatch and delivery records linked to the CoC. The transporter records custody, route and required temperature history; unattended samples remain in a locked, access-controlled container with the responsible custodian identified.

On arrival, laboratory reception checks the seal, bottle count and IDs against Annex B and Annex C, then records receipt time, cooler or sample temperature by the approved method, container condition, requested tests and any discrepancy. Register accepted bottles in the LIMS with an accession number and preserve the link to the original sample ID. Record subsequent internal transfers to storage, preparation and analysts. A missing signature, broken seal, unexplained gap, incorrect bottle or temperature excursion must be recorded and assessed under Section 9

before testing or reporting; do not silently repair the record. For regulatory or disputed samples, retain the original signed form and audit trail under the laboratory's retention policy. [14, 29]

Figure 3 Chain of custody and sample integrity flow sheet

Custody check: sample label ↔ field record ↔ analysis request ↔ handoff log ↔ laboratory accession. Investigate any mismatch before accepting results.

9 Laboratory registration and acceptance

Reception staff use Annex C to match the physical bottles with the field sheet and chain-of-custody record, photograph or describe damage, check unique identifiers and collection times, verify requested methods and volume, record arrival time and temperature, inspect headspace where relevant, and check preservation within the approved procedure. Assign a laboratory accession ID linked to—but distinct from—the field sample ID. Compute holding-time deadlines

from collection; route urgent pH/DO/chlorine or orthophosphate samples for immediate handling; never backdate receipt or silently substitute a new bottle. [3, 11, 14]

Where a bottle is broken, unlabeled, warm contrary to method, outside holding time, insufficient, acidified for the wrong analyte, or inconsistent with custody records, quarantine it and open a nonconformity. A qualified reviewer decides whether to reject, recollect, analyse with an explicit qualification if allowed, or notify the client/authority. The final report identifies deviations and their likely effect. Barcode scans should preserve both the original field record and every subsequent change. [2, 3, 11, 14]

An arrival decision tree should make four outcomes explicit: accept without qualification; accept after a documented, method-permitted correction; analyse with a visible data-quality qualification after authorised review; or reject and recollect. Refrigeration loss, visible dust contamination, broken seals, absent collection time, wrong bottle, wrong preservative and exceeded holding time should each have a defined escalation route. Neither a clean instrument blank nor a later preservative addition automatically repairs an altered field sample. [2, 3, 11]

10 Storage and internal movement

Store under the method's temperature, light, containment and security requirements. Provide separate refrigerated space or segregated secondary containment for incompatible acids and solvents; do not store standards above open samples. Monitor temperature continuously or at documented intervals with calibrated sensors and alert limits; keep an auditable excursion record. Record transfer from intake refrigerator to preparation bench, analyst, instrument queue and archive or disposal. A sample may be received within time yet exceed its preparation deadline while waiting in the laboratory. [2, 3, 11]

Document the distinction between collection time, filtration time, preservation time, preparation/extraction time and analysis time. Periodic refrigerator checks, equipment maintenance, reagent logs, access controls, retention periods and safe disposal complete the storage procedure. The primary record must remain available if a result is challenged. [2, 3, 11]

11 LIMS as the control system

A laboratory information management system (LIMS) links the sampling plan to field collection, transport, registration, analysis, technical review, release and corrective action. Use Annexes A–C as the paper schema during implementation. The minimum useful design holds a unique location and sample ID, GPS and matrix, planned and actual times, assigned analytes and methods, bottle and preservative requirements, calibration records, custody transfers, storage temperatures, holding-time clock, raw instrument files, blanks and duplicates, analyst review, approved report, changes and an immutable audit trail. Role-based access, backup and tested restoration are necessary. [11, 14]

A mobile offline-capable application can issue route and bottle checklists, scan barcodes, capture time/GPS and field results, photograph exceptions and sync when connectivity returns. The system should flag missing field values, improbable results, failed QC, duplicate IDs, breached temperatures and overdue analysis; block automatic release until an authorised reviewer resolves them. A dashboard can show trends by intake, treatment unit, pressure zone or outfall and route exceedances to a named engineer with response and retest deadlines. LIMS improves control only if sites, methods and people are correctly configured; it does not make an unrepresentative sample representative. [7, 11, 14]

11.1 Suggested mobile app and LIMS architecture

Provide a utility-owned, offline-capable sampling app for field staff and a laboratory-owned LIMS for controlled registration and testing. The app should implement the three annex forms as structured records, with unique IDs generated by the LIMS or a collision-resistant offline namespace. An interface service validates and synchronizes records over an authenticated API. This is a proposed system design, not a prescribed product or a substitute for laboratory validation. [7, 11]

Workflow: approved plan and site master → scheduled visit and kit → barcode scan and field measurements → sealed bottle and custody handoff → transport temperature log → laboratory accession and acceptance → analysis and review → diagnostic interpretation and action. Every record must link plan version, site, visit, sample, bottle, parameter request, field result, chain-of-custody event and laboratory accession ID.

Role boundaries: programme officer approves sites and plan versions; laboratory manager approves methods, bottle matrix and acceptance rules; sampler records a visit; transporter records custody and cooler conditions; reception officer accepts/quarantines individual bottles; analyst enters results; reviewer authorizes release and diagnostic observations. The interface must preserve prior versions and reasons for edits rather than silently overwriting recorded observations.

11.2 Minimum data model and validation rules

Entities: Site and Asset (type, exact sampling port, hydraulic relationship, GPS, accessibility); Sampling Plan (purpose, analytes, frequency, method, QC, purge rule); Visit (operator, date, route, operating state); Sample Event (collection basis, time, stabilization, GPS); Bottle (barcode, material, size, fraction, preservative, fill rule); Measurement (parameter, units, instrument, calibration, timestamp); Custody Event (from/to, time, seal, cooler, temperature); Receipt Decision (accepted, qualified, quarantined or rejected, reason); Test Result (method, analyst, units, uncertainty/flag); Action (observation, responsible person, closure).

Validation: block missing site/port and duplicate bottle IDs; prompt for whether a sample is first draw or flushed; require method-specific bottle/fill/preservation details; flag missing field chlorine/pH/DO where requested; calculate holding-time risk from actual collection time; compare arrival temperature with the applicable method; require deviation and supervisor approval for a replacement site; prevent a sampler from altering an accepted laboratory result.

Offline operation: cache only assigned routes and required site metadata; generate time-stamped local events with device ID and monotonic sequence; warn when GPS/time are uncertain; encrypt local records and uploads; sync with idempotent event IDs and conflict review on reconnection. Print or save a signed custody receipt at handoff. Allow manual paper Annexes A–C during outages, then enter them with original event time, entry time and data-entry attribution.

Implementation: start with site master, bottle matrix, barcode scanning and field/receipt forms; pilot representative tap, UGR, overhead tank and well routes; confirm labels and custody against paper records; then add instrument import, temperature telemetry, route alerts and management dashboards. Use open documented APIs, role-based access, audit trail, backups

and retention periods fixed by the organisation's policy. Do not automatically convert field photographs or GPS into compliance conclusions.

12 Worked sampling route for a water utility

For a district complaint about brown water and low chlorine, the plan compares raw source and WTP outlet, storage reservoir, the upstream distribution main, the complainant's first draw and flushed tap, and a nearby unaffected tap. Record supply start/stop and flushing status. Measure temperature, pH, EC, turbidity and free/total chlorine immediately; collect separate chemical bottles for iron and manganese (total and dissolved), alkalinity, chloride, sulfate, TDS and any site-specific contaminants. The dissolved-metal aliquot is filtered and preserved according to the method; the total-metal aliquot is not filtered. Capture paired time and pressure data, schedule vehicle delivery against the shortest lab deadline, and compare results with recent baselines and flow direction. This design can distinguish plant breakthrough, main corrosion or deposit release, and premise-plumbing effects more reliably than one anonymous tap sample. [1, 2, 3, 4, 7]

For an STP, pair representative influent and final-effluent samples with flow and hydraulic travel time; include key intermediate points where removal falters. Use a suitable flow-proportional composite for stable load indicators when the compliance requirement allows, but measure pH, temperature, DO and residual chlorine at defined times on site. Dispatch separate bottles for BOD, COD, ammonia, nitrate/nitrite, phosphate, TSS and metals according to their individual preservation schedules. [3, 5]

13 Implementation checklist

Before sampling	At site and during travel	At laboratory
Approved plan, locations, methods and trigger criteria	Confirm identity, time, condition, flow and exact point	Match custody, labels, bottles and analytes
Bottle kit and preservatives checked	Calibrated field readings and timely filtration	Record arrival temperature and preservation

Before sampling	At site and during travel	At laboratory
Route meets shortest holding time	Seal and segregate aliquots; scan every handoff	Calculate preparation/analysis deadlines
Staff competency and QC schedule	Log chilled van conditions and exceptions	Quarantine deviations; review QC before release

Recommended governance: the water utility should approve an annual risk-based programme; the laboratory should own the method-specific bottle and holding-time matrix; field teams should own representative collection and custody; and a designated reviewer should join laboratory findings to operational action. Update the plan after network changes, new contaminants, treatment changes, repeated excursions or a failed audit. [1, 2, 7, 11]

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Annex A Sampling plan and point approval form

Complete before fieldwork. Use one line per point in the site schedule and attach extra sheets for additional points. Write N/A where a field does not apply.

A1 Programme approval			
Plan ID		**Version**	
Organisation / zone		**Plan type**	☐ Routine ☐ Complaint ☐ Incident
Purpose / decision		**Applicable standard / permit**	
Start and end dates		**Review date**	
Prepared by / date		**Approved by / date**	

A2 Point schedule Repeat for every approved point				
Site ID	**Asset type / code**	**Exact port or tap**	**GPS / map ID**	**Purpose and supply zone**

A3 Point specific instructions Copy for each point			
Selected site ID		**Hydraulic position**	☐ Before dosing ☐ After dosing ☐ Before storage ☐ Outlet
Normal operating state		**Collection basis**	☐ First draw ☐ Flushed ☐ Pumped ☐ Standing well
Frequency / time window		**Permitted alternate site**	
Flush or purge rule		**Stability measurements**	
Access / safety contact		**Recent repairs or risk**	

A4 Analytical and transport instructions			
Analytes and methods		**Reporting limits**	
Field tests / instrument IDs		**QC type / frequency**	
Bottle kit reference		**Bottle material / volume**	
Filtration and preservative		**Fill or headspace rule**	
Cooling and light control		**Earliest holding deadline**	
Transport / lab contact		**Deviation approver**	

A5 Dispatch sign off			
Map / photo revision		**Approval signature**	
Team / route		**Bottle kit issue date**	

Annex B Sample drawing and field data sheet

One form per visit. Record actual times and readings. Write N/M for not measured and explain any deviation before leaving the point.

B1 Site identity			
Plan / version		**Visit ID**	
Site / exact port		**Date and GPS**	
Address / landmark		**Sampler / contact**	
Arrival time		**Collection start / end**	

B2 Conditions before sampling			
Collection basis	☐ First draw ☐ Flushed ☐ Outlet ☐ Pumped ☐ Standing well	**Supply / flow state**	
Tank level / cycle		**Pump since / valve state**	
Dosing / blending		**Recent repairs / rain**	
Tap or spout condition		**Stagnation / last use**	
Pressure / leaks		**Water level / drawdown**	

B3 Flushing or well purging			
Purge start / end		**Duration / volume**	
Strokes if hand pump		**Flow / interruptions**	
Why stopped purging		**Unusual turbidity / odour**	

B4 Stabilization readings Record sequentially					
Time	Temp °C	pH	EC µS/cm	DO mg/L	Turbidity NTU

B5 Final field measurements			
Temperature °C		pH	
EC µS/cm		TDS and method / factor	
Turbidity NTU		DO mg/L	
Free chlorine mg/L		Total chlorine mg/L	
ORP if needed		Instrument / check ID	

B6 Bottle record One line per bottle				
Barcode	Analytes / fraction	Preservative / lot	Fill / headspace	Time / cooler

B7 Quality control and custody			
QC bottle IDs		Filter / equipment IDs	
Photo / attachment IDs		Deviations / approval	
Sampler signature / time		Handoff name / time	

Annex C Sample deposit registration and custody form

Use at every custody transfer and laboratory receipt. Repeat bottle and custody rows as needed; keep the signed original with the LIMS entry.

C1 Deposit summary			
Visit / plan ID		Site / point ID	
Collection time		Receiving lab / tests	
Transporter / vehicle		Dispatch / arrival	
Cooler / seal ID		Arrival temperature °C	
Logger / ice status		Damage / discrepancy	

C2 Chain of custody Repeat at every handoff					
From / sign	To / sign	Date and time	Bottle no.	Cooler / seal	Condition

C3 Bottle accession and check One line per bottle				
Barcode	Accession ID	Analyte / fraction	Fill / preserve	Deadline / status

C4 Receipt decision and action			
Filtration time if any		**Preservative / pH check**	
Collection to receipt		**Required storage**	
Receipt outcome	☐ Accept ☐ Correct and accept ☐ Qualify ☐ Quarantine ☐ Reject	**Nonconformity reason**	
Correction / resample		**Field team notified / time**	
Storage location / time		**LIMS record / audit ID**	
Reception officer / time		**Reviewer / authorisation**	

Annex D Acronyms and abbreviations

Terms used in this technical note and its tables are listed below. Chemical formulas and routine units are omitted.

Term	Meaning
BIS	Bureau of Indian Standards
BOD	Biochemical oxygen demand
CFR	Code of Federal Regulations (United States)
COD	Chemical oxygen demand
DOC	Dissolved organic carbon
DO	Dissolved oxygen
DPD	N,N-diethyl-p-phenylenediamine (chlorine test reagent)
EC	Electrical conductivity
EPA	Environmental Protection Agency (United States)
GPS	Global Positioning System
HDPE	High-density polyethylene
ID	Identifier
IEC	International Electrotechnical Commission
IS	Indian Standard
ISO	International Organization for Standardization
LIMS	Laboratory information management system
PPE	Personal protective equipment
PP	Polypropylene
PTFE	Polytetrafluoroethylene
QA	Quality assurance
QC	Quality control
RO	Reverse osmosis
SOP	Standard operating procedure
STP	Sewage treatment plant
TDS	Total dissolved solids
TOC	Total organic carbon
TSS	Total suspended solids
US	United States
USGS	United States Geological Survey
UV	Ultraviolet
UVA	Ultraviolet absorbance
VOC	Volatile organic compound
VOA	Volatile organic analysis
WTP	Water treatment plant
API	Application programming interface
UGR	Underground service reservoir