

- Polyaromatic hydrocarbons ($\mu\text{g/L}$)

4.2 Monitoring Equipment

4.2.1 *Dissolved Oxygen and Temperature Measuring Equipment*

4.2.1.1 The instrument should be a portable, weatherproof dissolved oxygen-measuring instrument equipped with cable, sensor, comprehensive operation manuals, and use a DC power source. It should be capable of measuring:

- dissolved oxygen level in the range of 0-20 mg/l and 0-200% saturation; and
- temperature of 0-45 °C.

4.2.1.2 It should have a membrane electrode with automatic temperature compensation complete with a cable. Sufficient stocks of spare electrodes and cables should be available for replacement where necessary (e.g. YSI model 59 meter, YSI 5739 probe, YSI 5795A submersible stirrer with reel and cable or an approved similar instrument).

4.2.2 *Turbidity Measurement Instrument*

4.2.2.1 The instrument should be a portable, weatherproof turbidity-measuring instrument complete with comprehensive operation manual. The equipment should use a DC power source. It should have a photoelectric sensor capable of measuring turbidity between 0-1000 NTU and be complete with a cable (e.g. Hach model 2100P or an approved similar instrument).

4.2.3 *Suspended Solids*

4.2.3.1 A water sampler comprises a transparent PVC cylinder, with a capacity of not less than 2 litres, and can be effectively sealed with latex cups at both ends. The sampler should have a positive latching system to keep it open and prevent premature closure until released by a messenger when the sampler is at the selected water depth (e.g. Kahlsico Water Sampler or an approved similar instrument).

4.2.3.2 Water samples for suspended solids measurement should be collected in high density polythene bottles, packed in ice (cooled to 4°C without being frozen), and delivered to the laboratory as soon as possible after collection.

4.2.4 *Salinity*

4.2.4.1 A portable salinometer capable of measuring salinity in the range of 0-40 mg/l should be provided for measuring salinity of the water at each monitoring location.

4.2.5 *Positioning Device*

4.2.5.1 The locations of water monitoring points should be located using a hand-held or boat-fixed digital Global Positioning System (GPS) or other equivalent instrument of similar accuracy. This is to ensure that the water sampling locations are correct during the water quality monitoring work.

4.2.6 *Water Depth Detector*

4.2.6.1 A portable, battery-operated echo sounder should be used for the determination of water depth at each designated monitoring station. This unit can either be handheld or affixed to the bottom of the work boat, if the same vessel is to be used throughout the monitoring programme.

4.2.7 Water Sampling Equipment

- 4.2.7.1 A transparent PVC or glass cylinder, which has a volume of not less than 2 litres and can be sealed at both ends with cups, should be used for collection of water samples at various depths. The water sampler should be equipped with a positive latching system. During water sampling, a messenger is released to trigger the closure of the water sampler at suitable water depth.
- 4.2.7.2 All in-situ monitoring instruments should be checked, calibrated and certified by a laboratory accredited under HOKLAS or any other international accreditation scheme before use, and subsequently re-calibrated at 3 monthly intervals throughout all stages of the water quality monitoring. Responses of sensors and electrodes should be checked with certified standard solutions before each use. Wet bulb calibration for a DO meter should be carried out before measurement at each monitoring location.
- 4.2.7.3 For the on site calibration of field equipment, the BS 127:1993, "Guide to Field and on-site test methods for the analysis of waters" should be observed.
- 4.2.7.4 Sufficient stocks of spare parts should be maintained for replacements when necessary. Backup monitoring equipment should also be made available so that monitoring can proceed uninterrupted even when some equipment is under maintenance, calibration, etc.

4.3 Laboratory Measurement / Analysis

- 4.3.1 Water samples should be analysed in a HOKLAS or other international accredited laboratory. Water samples of about 2 litres should be collected at the monitoring stations for carrying out the laboratory analysis. The analysis should commence within 24 hours after collection of the water samples and should follow the standard methods presented in **Table 4.1** or equivalent methods subject to DEP's approval.

Table 4.1 Analytical Methods for Analysis of Water Samples

Parameters	Standard Method
Suspended solids (SS)	APHA 2540D
Total inorganic nitrogen (TIN)	APHA 4500-N _{org} /NO ₃
Ammonia nitrogen (NH ₃ -N)	APHA 4500-NH ₃
Zinc (Zn)	APHA 3113
Polychlorinated biphenyls (PCBs)	USEPA 8270B (GC/MS) or equivalent methods subject to approval of DEP
Tributyltin (TBT)	Krone et al. (1989) - GC/MS or equivalent methods subject to approval of DEP
Polycyclic aromatic hydrocarbons (PAHs)	USEPA 8270B - GC/MS or equivalent methods subject to approval of DEP

Note:

1. APHA – American Public Health Association. Standard Methods 19th Edition (1995).
2. Krone et al. (1989). A method for analysis of butyltin species and measurement of butyltins in sediment and English Sole livers from Puget Sound. Marine Environmental Research 27(1989), 1-18.

- 4.3.2 There are no assessment criteria for defining allowable concentrations of organic micro-pollutants in the receiving water. USEPA Standards and the European Community Standards were used in the Final EIA as the assessment criteria for PCBs, PAHs and TBT. In order to compare with the assessment criteria, the recommended detection limits for PCBs, PAHs and TBT are 0.00017 µg/L, 0.2 µg/L and 0.002 µg/L respectively.
- 4.3.3 If a site laboratory is set up or a non-HOKLAS and non-international accredited laboratory is hired for carrying out the laboratory analysis, the laboratory equipment, analytical procedures, and quality control should be approved by the DEP. The laboratory analysis should be witnessed by the ER. The EMT Leader should provide the ER with one copy of the relevant