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Discrete Water Quality – Visual Clarity: Annual Integrity Checks

1. Overview:

The Discrete Water Quality Program requires the assessment of the clarity of stream/river water at surface water State of Environment (SoE) and Point Discharge sample sites (excluding discharge/waste effluent and groundwater sites). The primary method for obtaining this information is by Black Disc; a full methodology is available here: [Section 15.6 appendix 9 of the Hydrology Operations manual](#). The secondary method is a clarity tube measurement detailed here: [Section 15.6 appendix 10 of the Hydrology Operations Manual](#).

The National Environmental Monitoring Standards (NEMS) requires at least a 12-month integrity check of the black disc viewer using a reference viewer, by extension this also applies for the program's clarity tubes (vs a reference clarity tube). The purpose of this check is to assess whether the equipment is fit for use.

2. Recording visual clarity assets:

All black disc sets (both viewers and frames/discs) and clarity tubes, including reference ones shall be documented and maintained with the Assets database. These shall have a *calibration* frequency of 12 months – *calibration* refers to the integrity check. Assets shall be updated following the annual integrity check.

3. Recording the annual integrity checks:



The checks shall be documented and stored within [\\ares\Environmental Monitoring Programmes\Discrete WQ Visual Clarity](#). The checks are to be carried out by a staff member of the Environmental Data: Special Projects team.

4. Black Disc annual integrity check:

The annual check is based on a visual inspection. The components detailed in the example below shall be inspected:

BD5	CALIBRATION DATE	7/09/2020
	DISCS:	
	Complete	YES
	Shape	FINE
	Condition	SOME SCRATCHES - COLOUR CONSISTENT - NO CONCERNS
	FRAME:	
	Complete	YES
	Condition	AS NEW
	PASS/FAIL:	PASS
	VIEWER:	
	Carry Case	AS NEW
	Body	1 WINDOW OPENING SUPPORT BROKEN - NO CONCERNS. CRACK IN CASE DUE TO BROKEN SUPPORT, STILL WATERTIGHT - SUPERFICIAL
	Mirror	NO SIGNIFICANT SCRATCHES OR MARKINGS - NO CONCERNS
	Lens	NO SIGNIFICANT SCRATCHES OR MARKINGS - NO CONCERNS
	PASS/FAIL:	PASS

Figure 1: Example black disc annual integrity check

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Further notes:

Discs:

- Complete: if all or any of the discs (200mm/60mm/20mm) are missing the check is failed. Replacements are required prior to further use.
- Shape: If the discs are damaged or distorted so they are no longer round in shape to the staff members satisfaction (in comparison to the reference discs) the check is failed. Replacements are required prior to further use.
- Condition: The discs are made from black plastic so scratches or scuffs should not affect its colour. However significant damage or gauging of the discs may warrant a fail and subsequent replacement.

Frame:

- Complete: if any of the frame is missing or damaged/corroded the check is failed. Repairs/replacements are required prior to further use – *note this is very unlikely due to its robust construction.*
- Condition: The frame is powder-coated and painted in matte black paint however chips are still likely to occur with use. Paint damage to the frame that would not impact taking a reading are not considered a concern however paint damage exposing metal that may impact a reading needs addressing.

Viewer:

- Carry Case: if the case is in anyway damaged it needs repair/replacement – this does not necessitate a fail.
- Body: The body is made of plastic and is liable to cracking if mishandled. Any damage needs to be noted – if any such damage is structural and/or creates leaks during use the equipment should be considered damaged beyond repair. Issues with the carry handle and lanyard should be repairable. The window supports are liable to break off – these are not considered an issue as currently the window is not used.
- Mirror: The mirror should be inspected for damage. If it is damaged or distorted to the extent that it negatively impacts a reading (in comparison to the reference viewer), to the staff members satisfaction, the check is failed.
- Lens: The lens should be inspected for damage. If it is damaged or distorted to the extent that it negatively impacts a reading (in comparison to the reference viewer), to the staff members satisfaction, the check is failed

If there are any issues that are considered a fail the complete black disc set needs to be removed from service, in both asset and physically, until repairs/replacements are completed.

5. Clarity Tube annual integration checks:

The annual check is based on a visual inspection. The components detailed in the example below shall be inspected:

CT9	CALIBRATION DATE	30/05/2022
	Carry Case	AS NEW
	Magnets	AS NEW
	Disc/Target	AS NEW
	Bung/Cap	FINE
	Tube/Body	SOME WEAR -NO CONCERNS
	Lens	MINOR SCUFFS AND WEAR
	DI Reference Comparison	CT REF = <0.94m
		CT15= <0.94m
	DIFFERENCE (%)	0.00
	TURBID Reference Comparison	0.31
		0.3

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	DIFFERENCE (%)	-3.33
	PASS/FAIL:	PASS

Figure 2: Example clarity tube annual integrity check



Further notes:

- Carry Case: if the case is in anyway damaged it needs repair/replacement – this does not necessitate a fail.
- Magnets: Check that the magnets are in good condition – particularly the condition of the pads. Replace regularly as standard practice.
- Disc: Scratches or scuffs can affect a reading. Significant damage to the disc would qualify for a fail. Replace as required.
- Bung: replace if fit is sloppy – these wear due to use. Replace regularly as standard practice.
- Tube body: The body is made of clear plastic and is liable to cracking if mishandled. Regular use will degrade the opacity of the tube and the readability of the measurement gauge (caused by moving the magnet). Any damage needs to be noted – if any such damage is structural and/or creates leaks during use the equipment should be considered damaged beyond repair and fail. If the measurement gauge is unreadable then this should be considered a fail. If the opacity of the tube has degraded beyond the staff member's satisfaction (in comparison to the reference clarity tube) the check should be considered as a fail.
- Lens: if the lens has damage in excess of the staff member's satisfaction (in comparison to the reference clarity tube) the check should be considered as a fail. The protective rim around the lens is liable to fall off – replace if this occurs prior to passing the 'calibration'.
- Reference comparison:
 - (i) De-ionised water: compare the clarity tube to the reference tube – use the magnet/disc combination of the clarity tube being checked for all readings. The end of the tube (recorded as >0.94m) should be visible for both.
 - (ii) Turbidity standard: Mix a turbidity standard and compare the clarity tube vs. the reference tube, ensure the same mix is used on both clarity tubes for the comparison. A +/-20% deviation is considered allowable as values recorded are typically around 0.3m (i.e. a 6mm deviation). It is anticipated that observations as to the clarity tubes condition would support any large deviation/fail

6. When passing a check:

- i. Update the documentation in \\ares\Environmental Monitoring Programmes.
- ii. Update Asset via add new calibration - note any replacements/fixes in the comments section.
- iii. Add the file ([\\ares\Environmental Monitoring Programmes\Discrete WQ Visual Clarity\+++CALIBRATIONS+++](#)) showing the correct # instrument worksheet

Figure 3: Asset screen shot: add calibration

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7. When failing a check:

- i. Update the documentation in \\ares\Environmental Monitoring Programmes.
- ii. Update Asset via add new calibration - note that it failed in the comments section.
- iii. Write the instrument off in Assets if it could not be repaired – inform the DiscreteWQ portfolio holder

8. Repairs and replacements:

Replacements are limited to ancillaries such as replacing discs, magnets, mirrors, bungs and carry cases etc. Many ancillaries should be replaced as needed as good practice in addition to an annual check. Damaged black disc frames can be repaired. Significant damage to the clarity tube and/or viewer requires that the instrument is written off and replaced – repairing is not feasible.

The viewing lens, either the lens on a clarity tube or the viewing lens on the black disc viewer, is the instrument. For example of the viewing lens for BD2 is severely scratched and written off then the discs and frame are also written off. These other components, if in good condition, may be re-used for a new black disc set.