Continuous Monitoring:

Resources Available

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Revision Author
XX-XX-X.XX

Continuous Monitoring SOP
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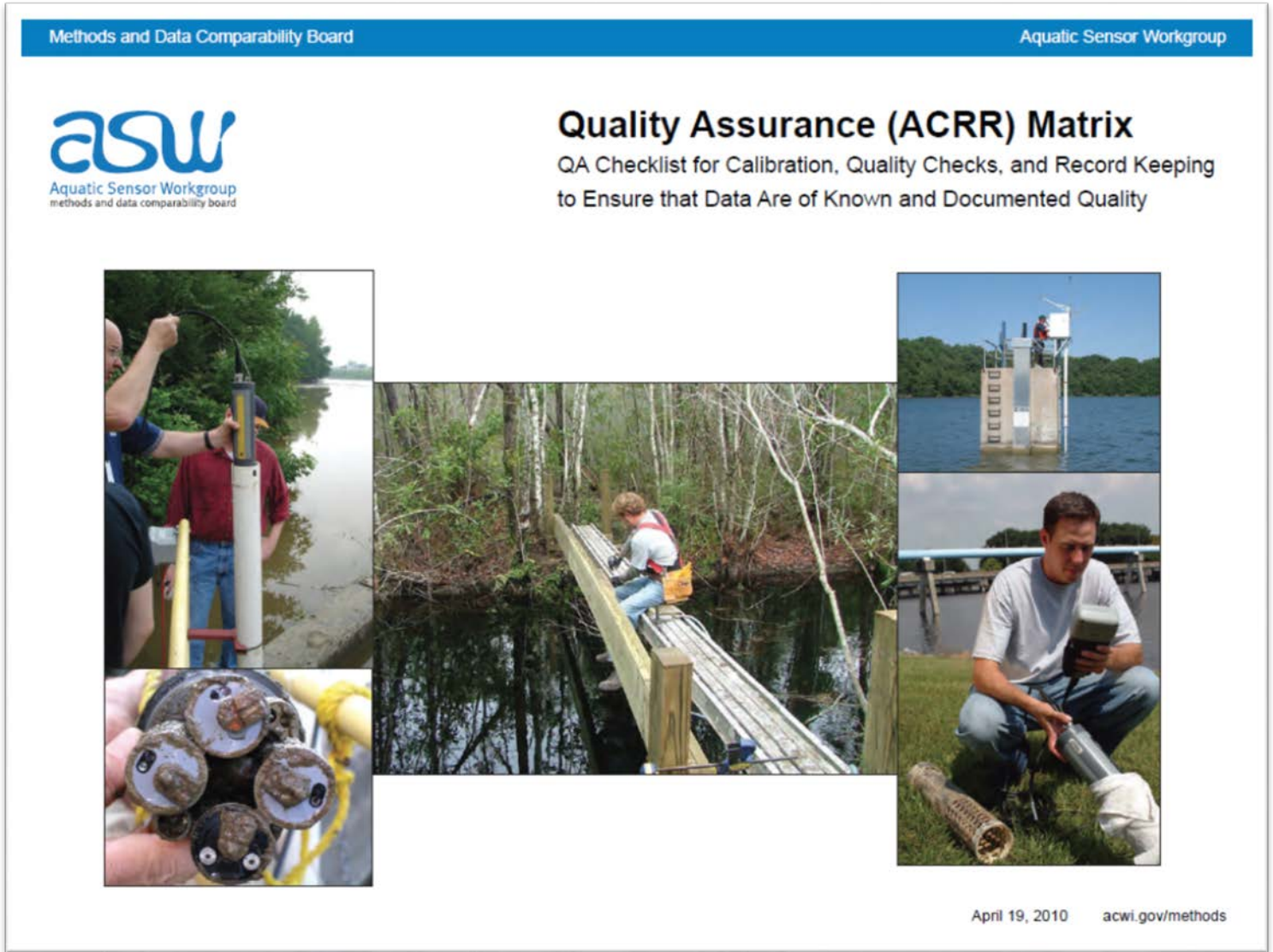
NWQMC Aquatic Sensor workgroup

QA Matrix

- The Sensor QA (ACRR) Matrix is a checklist of actions you can do to Affect, Check, Record, and Report the quality of your Sensors' measurements. A number of data quality aspects are addressed.



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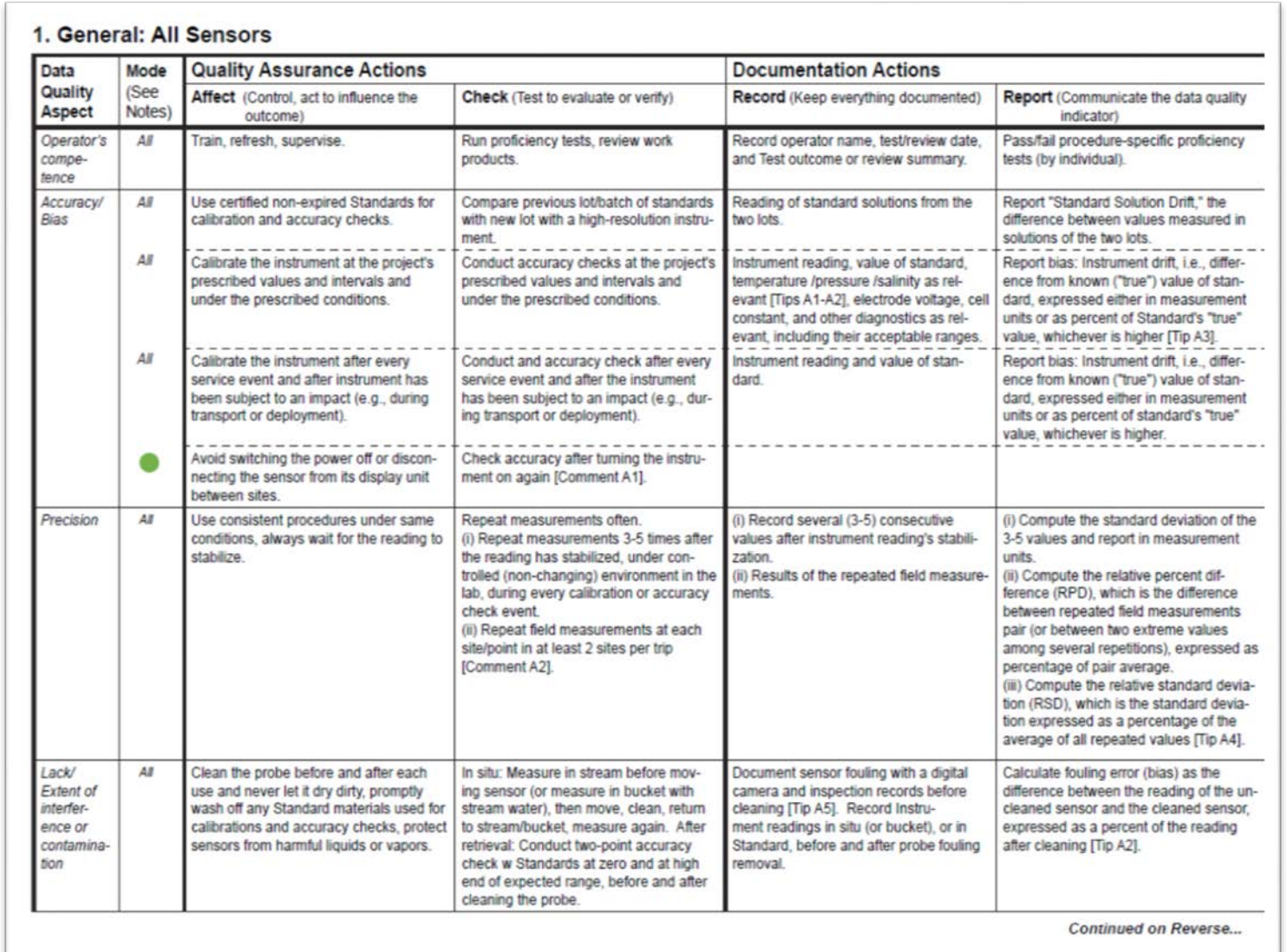

1. General: All Sensors

Data Quality Aspect	Mode (See Notes)	Quality Assurance Actions: Affect (Control, act to influence the outcome)	Quality Assurance Actions: Check (Test to evaluate or verify)	Documentation Actions: Record (Keep everything documented)	Documentation Actions: Report (Communicate the data quality indicator)
Operator's competence	*All*	Train, refresh, supervise.	Run proficiency tests, review work products.	Record operator name, test/review date, and Test outcome or review summary.	Pass/fail procedure-specific proficiency tests (by individual).
Accuracy/ Bias	*All*	Use certified non-expired Standards for calibration and accuracy checks.	Compare previous lot/batch of standards with new lot with a high-resolution instrument.	Reading of standard solutions from the two lots.	Report "Standard Solution Drift," the difference between values measured in solutions of the two lots.
	All	Calibrate the instrument at the project's prescribed values and intervals and under the prescribed conditions.	Conduct accuracy checks at the project's prescribed values and intervals and under the prescribed conditions.	Instrument reading, value of standard, temperature /pressure /salinity as relevant [Tips A1-A2], electrode voltage, cell constant, and other diagnostics as relevant, including their acceptable ranges.	Report bias: Instrument drift, i.e., difference from known ("true") value of standard, expressed either in measurement units or as percent of Standard's "true" value, whichever is higher [Tip A3].
	All	Calibrate the instrument after every service event and after instrument has been subject to an impact (e.g., during transport or deployment).	Conduct and accuracy check after every service event and after the instrument has been subject to an impact (e.g., during transport or deployment).	Instrument reading and value of standard.	Report bias: Instrument drift, i.e., difference from known ("true") value of standard, expressed either in measurement units or as percent of standard's "true" value, whichever is higher.
	●	Avoid switching the power off or disconnecting the sensor from its display unit between sites.	Check accuracy after turning the instrument on again [Comment A1].		
Precision	*All*	Use consistent procedures under same conditions, always wait for the reading to stabilize.	Repeat measurements often. (i) Repeat measurements 3-5 times after the reading has stabilized, under controlled (non-changing) environment in the lab, during every calibration or accuracy check event. (ii) Repeat field measurements at each site/point in at least 2 sites per trip [Comment A2].	(i) Record several (3-5) consecutive values after instrument reading's stabilization. (ii) Results of the repeated field measurements.	(i) Compute the standard deviation of the 3-5 values and report in measurement units. (ii) Compute the relative percent difference (RPD), which is the difference between repeated field measurements pair (or between two extreme values among several repetitions), expressed as percentage of pair average. (iii) Compute the relative standard deviation (RSD), which is the standard deviation expressed as a percentage of the average of all repeated values [Tip A4].
Lack/ Extent of interference or contamination	*All*	Clean the probe before and after each use and never let it dry dirty, promptly wash off any Standard materials used for calibrations and accuracy checks, protect sensors from harmful liquids or vapors.	In situ: Measure in stream before moving sensor (or measure in bucket with stream water), then move, clean, return to stream/bucket, measure again. After retrieval: Conduct two-point accuracy check w Standards at zero and at high end of expected range, before and after cleaning the probe.	Document sensor fouling with a digital camera and inspection records before cleaning [Tip A5]. Record Instrument readings in situ (or bucket), or in Standard, before and after probe fouling removal.	Calculate fouling error (bias) as the difference between the reading of the uncleaned sensor and the cleaned sensor, expressed as a percent of the reading after cleaning [Tip A2].

Continued on Reverse...

Both general and specific QA issues and recommendations are listed

https://www.watersensors.org/pdfs/ASW_QA_Matrix_web.pdf

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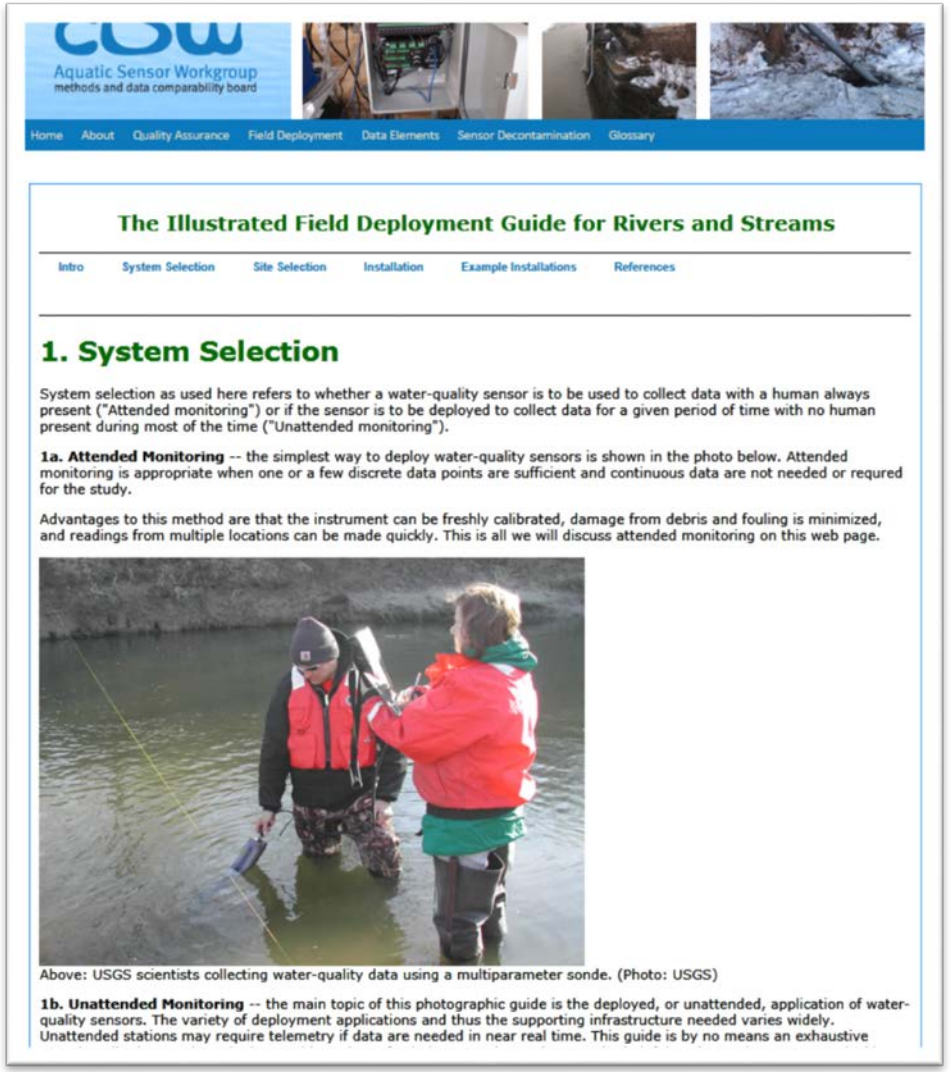
- **Illustrated Field Deployment Guide for Rivers and Streams**
  - is intended to be used as a checklist of considerations to guide both new and experienced users in the deployment of water-quality monitoring systems using sensors.

- https://www.watersensors.org/field_deploy/



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Water Quality Data Elements for Sensors ("Continuous" Monitoring)

Category No.	Category Name (& WQDE Module)	Group No.	Group Name	Subject No.	Subject Name	Field ID	Field name
1	Monitoring Project ("Contact")	1	Project Identifiers	1.1.1	Identity	1.1.1.1	Project ID
1						1.1.1.2	Project Name
1		1		1.1.2	Descriptors	1.1.2.1	Project Duration
1		2	Organization identifiers	1.2.1	Identity	1.2.1.1	Organization ID
1		2				1.2.1.2	Organization Name
1		2		1.2.2	Organization Descriptors	1.2.2.1	Organization Category
1		2				1.2.2.2	Organization Type
						1.2.2.3	**Organization Function in Project**
1		3	Project Contacts	1.3.1	Person	1.3.1.1	Contact Last name
1		3				1.3.1.2	Contact First name
1		3				1.3.1.3	Contact Role
1		3		1.3.2	"Essentials"	1.3.2.1	Address Line 1
1		3				1.3.2.2	Address Line 2
1		3				1.3.2.3	City
1		3				1.3.2.4	State
1		3				1.3.2.5	Zip
1		3				1.3.2.6	Phone at Work
1		3				1.3.2.7	Extension
1		3				1.3.2.8	Fax
1		3				1.3.2.9	Phone-Mobile
1		3				1.3.2.10	Email
1		3				1.3.2.11	URL/Website
2	Result ("Result")	1	Result (how much?)	2.1.1	Value	2.1.1.1	Result Value
2		1		2.1.2	Unit	2.1.2.1	Result Unit
2		1		2.1.3	Result Batch Affiliation	2.1.3.1	Result Batch ID
2		1				2.1.3.2	Result Batch Type

Draft water quality data elements

- includes all the information bits, or metadata, that document the "who, what, when, where, how, and why" associated with your monitoring results. Many descriptors of the results are verbal categories. The file contains an additional spreadsheet with a set of pick-lists, a.k.a. "lookup tables", with lists of verbal “values” that are allowable for a specific data element.
- The Matrix reflects the Sensors QA Workgroup’s consensus on recommendations for a minimal list of actions which will still ensure delivery of data of known and documented quality.

- https://www.watersensors.org/dataelements.html

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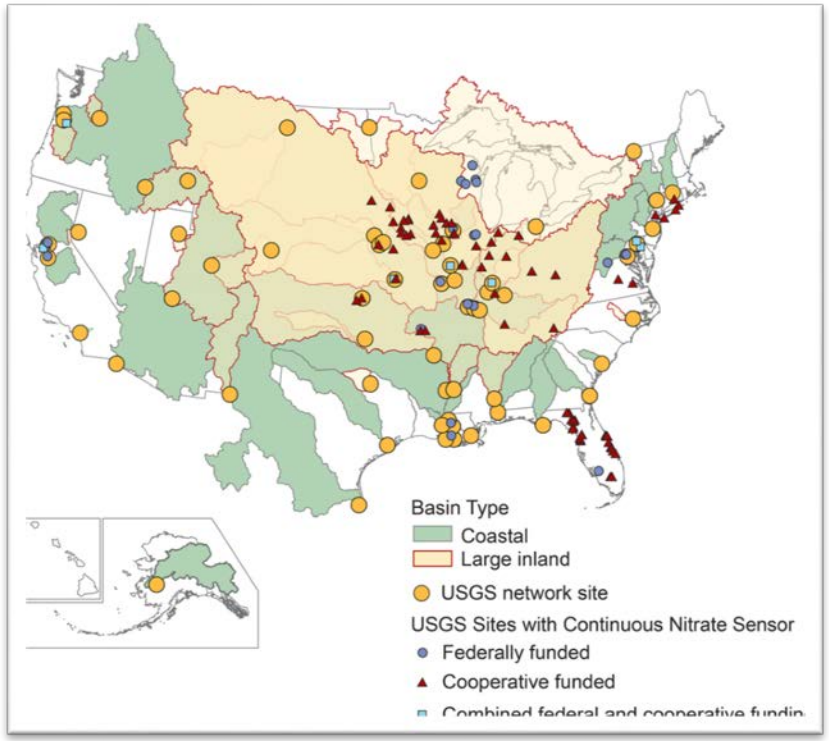
Decontamination of Sensors to Prevent the Spread of Aquatic Invasive Species (USGS, FWC, 6 states)

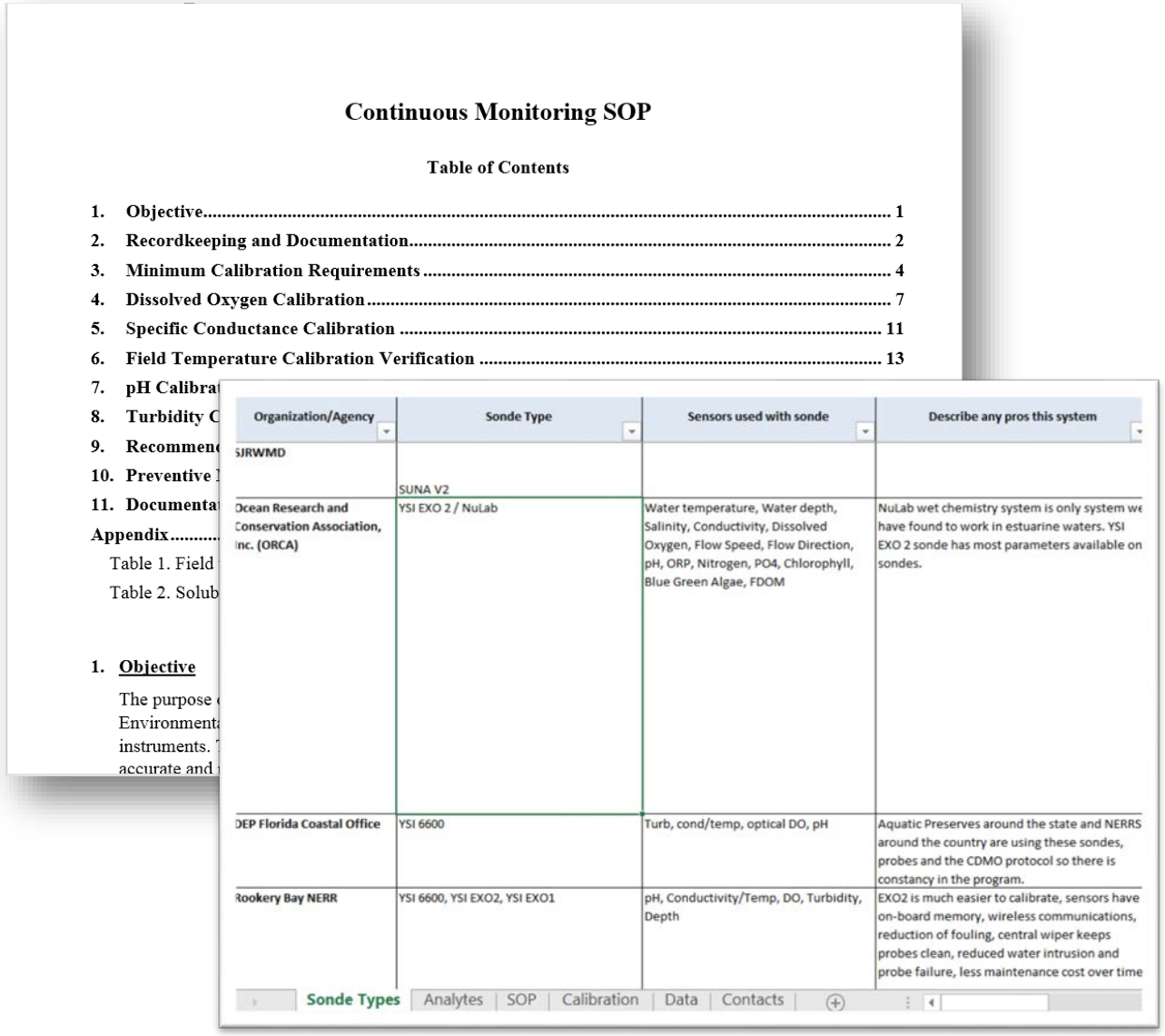
https://www.watersensors.org/ans_decon/index.html

USGS

- Nutrients
  - https://water.usgs.gov/coop/features/real-time.nitrate.summary.pdf
  - https://acwi.gov/monitoring/webinars/national_monitoring_council_webinar_092414b_Pellerin.pdf
  - http://onlinelibrary.wiley.com/doi/10.1111/1752-1688.12386/full
- Guidelines & standard procedures
  - https://pubs.usgs.gov/tm/2006/tm1D3/



DEAR CM Workgroup



Continuous Monitoring SOP

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1. Objective

The purpose
Environmenta
instruments.
accurate and

Organization/Agency	Sonde Type	Sensors used with sonde	Describe any pros this system
SJRWMD	SUNA V2		
Ocean Research and Conservation Association, Inc. (ORCA)	YSI EXO 2 / NuLab	Water temperature, Water depth, Salinity, Conductivity, Dissolved Oxygen, Flow Speed, Flow Direction, pH, ORP, Nitrogen, PO4, Chlorophyll, Blue Green Algae, FDOM	NuLab wet chemistry system is only system we have found to work in estuarine waters. YSI EXO 2 sonde has most parameters available on sondes.
DEP Florida Coastal Office	YSI 6600	Turb, cond/temp, optical DO, pH	Aquatic Preserves around the state and NERRS around the country are using these sondes, probes and the CDMO protocol so there is constancy in the program.
Rookery Bay NERR	YSI 6600, YSI EXO2, YSI EXO1	pH, Conductivity/Temp, DO, Turbidity, Depth	EXO2 is much easier to calibrate, sensors have on-board memory, wireless communications, reduction of fouling, central wiper keeps probes clean, reduced water intrusion and probe failure, less maintenance cost over time

Sonde Types | Analytes | SOP | Calibration | Data | Contacts

- General SOP for future acceptance of field measurements into statewide db
- Spreadsheet of information about CM sensor use in Florida
- Next: Data Management

Coming this fall!