



Data Quality Standards for Springs, Seeps and Tinajas Monitoring Protocol

Chihuahuan and Sonoran Desert Networks

Natural Resource Report NPS/SOPN/NRR—2018/1806



ON THE COVER

NPS biologist measuring wetted width of a springbrook. NPS Photo

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Chihuahuan and Sonoran Desert Networks

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Abstract

The purpose of this report is to document the data quality standards used by the Chihuahuan Desert Network (CHDN) and Sonoran Desert Network (SODN) for activities related to the collection, processing, storage, analysis, and publication of monitoring data as described in the Springs, Seeps and Tinajas Monitoring Protocol: Chihuahuan and Sonoran Desert Networks (McIntyre et al. 2018). The policies and procedures documented or referenced in this quality-assurance plan complement the quality-assurance plans for other monitoring activities conducted by the Chihuahuan Desert and Sonoran Desert networks and supplement the data management plans for the networks (Richie 2009 and Angell 2005, respectively). This report also serves as a guide for all Chihuahuan Desert Network and Sonoran Desert Network personnel who are involved in protocol/program activities and as a resource for identifying memoranda, publications, and other literature that describe associated techniques and requirements in more detail.

Version 1.00

Revision History Log

Previous version#	Revision date	Author	Changes made	Reason for change	New version #
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Introduction

The National Park Service (NPS) Inventory and Monitoring (I&M) Program was established by an act of Congress in 1999 to provide more than 270 national park system units a core suite of baseline minimum scientific information (inventories) and to identify and implement long-term monitoring of high-priority measurements of resource condition in those units (Fancy et al. 2009). The overarching purpose of natural resource monitoring in parks is to develop scientifically sound information on the current status and long-term trends in the composition, structure, and function of park ecosystems, and determine how well current management practices are sustaining those ecosystems.

The purpose of this Data Quality Standards (DQS) report is to document the standards, policies, and procedures used by the Chihuahuan Desert Network (CHDN) and Sonoran Desert Network (SODN) for activities related to the collection, processing, storage, analysis, and publication of monitoring data as described in the Springs, Seeps and Tinajas Monitoring Protocol: Chihuahuan and Sonoran Desert Networks (McIntyre et al. 2018). The policies and procedures documented or referenced in this quality-assurance plan complement the quality-assurance plans for other monitoring activities conducted by the Chihuahuan Desert and Sonoran Desert networks and supplement the quality management plan for the networks (Richie 2009 and Angell 2005). The DQS also serves as a guide for all Chihuahuan Desert Network and Sonoran Desert Network personnel who are involved in protocol/program activities and as a resource for identifying memoranda, publications, and other literature that describe associated techniques and requirements in more detail.

Protocol Overview

The Chihuahuan Desert and Sonoran Desert networks Springs, Seeps and Tinajas Monitoring Protocol (McIntyre et al. 2018) describes the background, goals and objectives, sampling design, field methods, data management, reporting and analysis, personnel requirements, and operational requirements for monitoring springs in Amistad National Recreation Area (NRA), Big Bend National Park (NP), Carlsbad Caverns NP, Chiricahua National Monument (NM), Coronado National Memorial (NMem), Fort Bowie National Historic Site (NHS), Fort Davis NHS, Gila

Cliff Dwellings NM, Guadalupe Mountains NP, Montezuma Castle NM, Organ Pipe Cactus NM, Saguaro NP, Tonto NM, and White Sands (NM). The overarching goal of the spring monitoring program is to detect broad-scale change in aquatic and riparian ecological condition by observing selected drivers, stressors, and processes.

The Chihuahuan Desert and Sonoran Desert networks selected sentinel springs (similar to targeted sites) to monitor. At each of those sentinel sites, the objectives of the protocol are to:

- determine status and long-term trend in the persistence of springs (temperature measured every 1 or 2 hours),
- determine status of spring discharge and wetted extent,
- determine status in core water quality parameters (temperature, pH, conductivity, and dissolved oxygen),
- determine status in select major ions and alkalinity
- determine presence (status) of select obligate/facultative wetland plants and invasive nonnative plants, and
- determine status of anthropogenic and natural disturbances.

Data and information are shared with parks, NPS staff, and the public through a variety of reports and products. At the end of each field season, network staff send a short field and data summary that summarize observations and highlight observations of interest or concern to each park. Annually, the Sonoran Desert Network summarizes springs data in Climate and Water Resources Reports that also incorporate data from climate, groundwater, and streams monitoring. Every five years, each network produces park-specific status and trend reports. Additional products will be derived from the published reports, including, but not limited to, two-page briefs and social media posts.

Protocol Activities and Modules

Data are collected or derived as a part of the Springs, Seeps and Tinajas Monitoring Protocol (McIntyre et al. 2018) in four modules (water quantity, water quality, site condition, site characterization). Within each module, a variety of activities occur (Table 1).

Table 1. Protocol activity matrix for Chihuahuan and Sonoran Desert networks Springs, Seeps and Tinajas Monitoring Protocol (McIntyre et al. 2018, NPS 2018).

Category	Activity Number	Activity	Description
Site Recon, Establishment, and Maintenance	1	Site recon and establishment	Sites visited before establishment to determine if water present and if repeatable measurement locations present (See Section 3.2 of protocol narrative).
Field Observations	2	Site characterization	Qualitative descriptions of site and its vegetation, preparation of a site diagram, identification of spring type (from pick-list) and abiotic characteristics (SOP #3, NPS 2018). Part of site characterization module of protocol.
	3	Invasive non-native wildlife observations	Documentation of the presence of invasive non-native wildlife (SOP #5, NPS 2018). Part of site condition module of protocol.
	4	Invasive non-native plant observations and obligate/facultative wetland plants	Documentation of the presence and density of invasive plants and presence of a suite of wetland/obligate wetland plants (SOP #5, NPS 2018). Part of site condition module of protocol.
	5	Condition and disturbance	Categorical rating of anthropogenic and natural disturbances (SOP #5, NPS 2018). Part of site condition module of protocol.
	6	Discharge	Five timed, volumetric measurements of discharge (flow) (SOP #7, NPS 2018). Part of water quantity module of protocol.
	7	Wetted extent	Five length, width, and depth measurements of pools or for brooks, 10, 15, or 20 width measurements at cross-sections, with water and detritus depth and substrate measured at five cross-sections (SOP #7, NPS 2018). Part of water quantity module of protocol.
Sensor Data	8	Core water quality parameters	Measurement of pH, temperature, dissolved oxygen (DO), conductivity, and calculated estimate total dissolved solids using a multiparameter meter at one or more locations per spring (SOP #6, NPS 2018). Part of water quality module of protocol.
	9	Continuous temperature measurements	Measurement of temperature every one or two hours with sensor (SOP #7, NPS 2018). Part of water quantity module of protocol.
	10	Photo point data	Photography at one or more photo points (SOP #4, NPS 2018). Part of site condition module of protocol.
Field Sample & Specimen Collection and Processing	11	Water grab sample	Water column grab samples for field or laboratory analysis of major ions (SOP#7, NPS 2018). Part of water quality module of protocol.
Laboratory Data	12	Water chemistry (major ions)	Water column grab samples for field or laboratory analysis of major ions (SOP#7, NPS 2018). Part of water quality module of protocol.
	13	Turbidity	Water column grab samples for field analysis of turbidity (SOP#7, NPS 2018). Part of water quality module of protocol for SODN springs.
External Data	14	Climate	Analysis of nearby weather station and modeled data for temperature, precipitation, and potential evapotranspiration from variety of online sources. Part of data analyses.
Quality Control Data	15	Pre- and post-calibration of multiparameter meters	Calibration of multiparameter meters before and after sampling day to test for measurement drift (SOP#7, NPS 2018). Part of water quality module of protocol.

Sampling Design

Information regarding the sampling design is provided in Table 2.

Table 2. Activity-level sample design matrix for Chihuahuan and Sonoran Desert networks Springs, Seeps and Tinajas Monitoring Protocol (McIntyre et al. 2018).

Category	Activity Number	Activity	Sampling Design	Revisit Design
Site Recon, Establishment, and Maintenance	1	Site recon and establishment	Targeted; one to nineteen springs selected per park as sentinel sites.	–
Field Observations	2	Site characterization	Targeted; one to nineteen springs selected per park as sentinel sites.	Resampled once every five years
	3	Invasive non-native wildlife observations	Targeted; one to nineteen springs selected per park as sentinel sites.	Revisit annually (in spring)
	4	Invasive non-native plant observations and obligate/facultative wetland plants	Targeted; one to nineteen springs selected per park as sentinel sites.	Revisit annually (in spring)
	5	Condition and disturbance	Targeted; one to nineteen springs selected per park as sentinel sites.	Revisit annually (in spring)
	6	Discharge	Targeted; one to nineteen springs selected per park as sentinel sites.	Revisit annually (in spring)
	7	Wetted extent	Targeted; one to nineteen springs selected per park as sentinel sites.	Revisit annually (in spring)
Sensor Data	8	Core water quality parameters	Targeted; one to nineteen springs selected per park as sentinel sites.	Revisit annually (in spring)
	9	Continuous temperature measurements	Targeted; one to nineteen springs selected per park as sentinel sites.	Continuous, every 1-2 hours. Downloaded each spring.
	10	Photo point data	Targeted; one to nineteen springs selected per park as sentinel sites.	Revisit annually (in spring)
Field Sample & Specimen Collection	11	Water grab sample	Targeted; one to nineteen springs selected per park as sentinel sites.	Revisit annually (in spring)
Laboratory Data	12	Water chemistry (major)	Targeted; one to nineteen springs selected per park as sentinel sites.	Revisit annually (in spring)
	13	Turbidity	Targeted; one to nineteen springs selected per park as sentinel sites.	Revisit annually (in spring)

See Chapter 3 of McIntyre et al. 2018 for additional information on sampling and revisit design.

Data Quality Objectives

Data quality values and standards for implementation are provided in Table 3 through Table 8.

For activities that involve quantitative measurements taken by field personnel, requisite Measurement Quality Objectives (MQOs) are defined in Table 4. Standards for data collection and processing are included in Table 5.

Table 3. Data Quality Values (DQVs) for Chihuahuan and Sonoran Desert networks Springs, Seeps and Tinajas Monitoring Protocol (McIntyre et al. 2018, NPS 2018).

Category	Data Quality Value	Definition	Protocol Considerations
Intrinsic Data Quality	Accuracy	Measurements reflect the true value of the parameter being observed. This applies to measures (e.g., length, width, position, quality value) or classes (species, types, or categories). Includes components of precision and bias.	Pre- and post-sampling day calibration of multiparameter meters are conducted in accordance SOP #6 (NPS 2018). Crew members are selected and trained with species identification skills and use of instruments.
	Representativeness	Measurements represent conditions at the time of sampling. Combined with accuracy, leads to repeatable data collection.	Sites monitored are sentinel sites and will only be compared to themselves over time.
Contextual Data Quality	Comparability	The degree to which data can be compared among sample locations, data sources, or periods of time.	Sites monitored are sentinel sites (targeted design) and will therefore only be compared to themselves over time. Standard operating procedures, equipment, and calibration procedures are identical among sites.
	Timeliness / Currency	How recent the data need to be to be considered valid for their intended use. Data represents conditions and/or is available and in a format for use at the appropriate time in the decision-making process.	Data are collected annually with the exception of temperature measurements that are recorded every one or two hours by sensors and is downloaded annually. Data management is conducted in accordance with SOP #9 (NPS 2018).
	Completeness	All data/ measures required to evaluate accuracy representativeness are present; incomplete data sets (either at a location, across sampling locations, or over time) lose utility or relevance. Data records contain values as planned across the period of record.	Methods, sampling plans, and analyses are designed and implemented so that they result in a complete dataset across space and the planned period of record. However, instrument loss or failures, logistical issues, and safety issues may result in an incomplete record.
Representational Data Quality	Consistent Representation	Use of standard definitions when describing data quality or resource quality based on data	Provisional data are shared, but noted as not certified. Data certification takes place as described in Section 5.4 of McIntyre et al. 2018. Where appropriate, data are reported in the context of management assessment points (Section 6.3 of McIntyre et al. 2018).
Data Accessibility	Secure	Access to data, products, and systems limited to appropriate audiences.	Protected data may be released in limited cases only with park Superintendent or Chief of Resources approval following park procedures. Networks also are developing sensitive information plans.

Table 4. Measurement Quality Objectives for Chihuahuan and Sonoran Desert networks Springs, Seeps and Tinajas Monitoring Protocol (McIntyre et al. 2018).

Module / Parameter	Measure / Quality Indicator	Quality Objective
Site Establishment	Location accuracy	± 3m (horizontal)
	Site access and sampling location descriptions	Description contains enough detail to relocate without use of GPS equipment
Site Characterization	Spring type and characterization	Accurate determination of spring type, channel type, and slope variability; slope and aspect measured ± 2 degrees (SOP #3)
	Site description	Description contains enough detail to characterize the critical features of the spring and provide historical account over time (SOP #3)
	Vegetation community description	Description contains enough detail to characterize the vegetation of the spring (SOP #3)
	Site diagram	Diagram has enough detail to characterize the critical features of the spring and identifies sampling locations in order to correctly orient future observers (SOP #3)
Site Condition	Invasive non-native wildlife observations	Accurate identification of observed invasive non-native wildlife made at the species level (see taxonomic standards) (SOP #5)
	Invasive non-native plant observations	Accurate identification of observed invasive non-native plants made at the species or genera level (see taxonomic standards) (SOP #5)
	Obligate/facultative wetland plants	Using a picklist, accurate identification of observed obligate/facultative wetland plants made at the species, genera, or family level (see taxonomic standards) (SOP #5)
	Condition and disturbance	Using a picklist, accurate identification of categorical rating of observed anthropogenic and natural disturbances (SOP #5)
Discharge	Accuracy	± 5% of total volume per unit time (SOP #7)
	Resolution	5 mL
Wetted Extent	Accuracy	± 1 cm for length and width, ± 1 mm for depth for both detritus and substrate (SOP #7)
	Resolution	1 cm for length and width, 1 mm for depth for both detritus and substrate
Core Water Quality	pH Accuracy	± 0.2 units (SOP #6)
	pH Resolution	0.01 units
	Temperature Accuracy	± 0.2°C (SOP #6)
	Temperature Resolution	0.1°C
	Dissolved oxygen (DO) Accuracy	multiparameter meter: ± 2% of reading or air saturation (max) for values 0-200%; ± 6% of reading for values 200-500%; maximum of ± 2% of reading or ± 0.2 mg/L for values 0-20 mg/L; ± 6% of reading for values 20-50 mg/L optical: ± 1% of reading or air saturation (max) for values 0-200%; ± 10% of reading for values 200-500%; maximum of ± 1% of reading or ± 0.1 mg/L for values 0-20 mg/L; ± 10% of reading for values 20-50 mg/L
	Dissolved oxygen (DO) Resolution	multiparameter meter: 0.1% air saturation or 1%; 0.1% air saturation or 0.1 or 0.01 mg/L optical: 0.1% air saturation; 0.1 or 0.01 mg/L
	Conductivity Accuracy	± 3% for values >200 µS/cm; 5% for values ≤200 µS/cm
	Conductivity Resolution	0.001 mS/cm to 0.1 mS/cm (range dependent)
	Total dissolved solids Accuracy	Undefined, calculated value
	Total dissolved solids Resolution	0.001, 0.01 or 0.1 g/L depending on range
Turbidity	Accuracy	± 1% or 0.01 NTU, whichever is greater
	Resolution	0.01 NTU
Continuous Temperature	Accuracy	± 0.5°C at 25°C
	Resolution	0.1°C at 25°C
Photo points	Image resolution	10 megapixel
	Image format	JPG w/ embedded metadata

Table 5. Field analytical method performance requirements and analysis methods to be used for major ions and alkalinity water chemistry analysis for Chihuahuan and Sonoran Desert networks Springs, Seeps and Tinajas Monitoring Protocol (McIntyre et al. 2018).

Analyte	Units	MDL Objective	Tolerance
Alkalinity (as CaCO ₃)	mg/L	10	± 7 at 200
Chloride (Cl)	mg/L	0.5	± 5 at 10
Magnesium (Mg)	mg/L	2	± 1 at 20
Sulfate (SO ₄)	mg/L	5	± 4 at 50
Calcium (Ca)	mg/L	5	± 5 at 100
Potassium (K)	mg/L	0.5	± 0.5 at 5

MDL = minimum detection limit

Table 6. Taxonomic standards to be used in Chihuahuan and Sonoran Desert networks Springs, Seeps and Tinajas Monitoring Protocol (McIntyre et al. 2018).

Category	Activity	Standard to be Used	Reference / Authority
Collection of Observational Data	Invasive non-native wildlife observations	Field Subject Matter Expert	Field crew lead w/ identification proficiency
	Invasive non-native plant observations and obligate/facultative wetland plants	Field Subject Matter Expert	Field crew lead w/ identification proficiency
Reporting of Observational Data	Invasive non-native wildlife observations	Scientific Publication	ITIS
	Invasive non-native plant observations and obligate/facultative wetland plants	Scientific Publication	ITIS

Table 7. Professional and laboratory accreditation requirements for Chihuahuan and Sonoran Desert networks Springs, Seeps and Tinajas Monitoring Protocol for analysis of water chemistry of select springs where field measurements are deemed insufficient (McIntyre et al. 2018).

Category	Activity	Parameter	Accreditation Requirement	Location of Certification Documentation
Lab Accreditations	Major ions	All	NELAP	Copy of certification on file in Network office

Table 8. Data Protection standards for Chihuahuan and Sonoran Desert networks Springs, Seeps and Tinajas Monitoring Protocol (McIntyre et al. 2018). With the exceptions noted, all data collected are to be made publicly available in a timely fashion.

Category	Type of Data	Level of Protection	Rules for Dissemination
Resource Data and Information	Federal and State T&E species locations	Legally Protected	Locations of observations reported at park centroid or park extent (boundary polygon).
	Species of concern and/or commercially valuable	Operationally protected	Redacted or dissemination to non-NPS staff must be approved by park Chief of Resources (depending on park and species).
	Archeological and paleontological	Legally Protected	Redacted
	Spring locations and permanent sampling locations	Legally protected	Redacted
	Spring access descriptions and any other relevant notes	Legally protected	Redacted
Personally Identifiable Information	Non-NPS staff information	Legally Protected	All but first name and last initial redacted from public release

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