CENTRAL FLORIDA WATER INITIATIVE (CFWI)

MINIMUM STANDARDS FOR WATER RESOURCE DATA COLLECTION, SITE ESTABLISHMENT AND FIELD DATA COLLECTION PROTOCOLS

Purpose

Among the goals of the CFWI is an effort to ensure that available hydrologic, environmental, and other pertinent water resource data collected throughout the region are identified, inventoried, and accessible to support the CFWI technical initiatives and CFWI regulatory activities. It is the intent of this document to provide agencies and water use permittees and/or their consultants that collect these data with basic guidance on the development of a useful environmental monitoring infrastructure. This document contains guidelines for establishing a monitoring infrastructure that is designed for long-term use and consistent water resource data collection in the region. Most importantly it identifies minimum criteria that all agencies, including the St. Johns River Water Management District (SJRWMD), South Florida Water Management District (SFWMD), Southwest Florida Water Management District (SWFWMD) and permittees, should strive for to ensure that the data they gather is useful, reliable, and compatible with water resource data that is collected by others. The presented minimum standards also represent a screening tool for the selection of data collection sites for inclusion to the CFWI regional data inventory. Data collected in a manner not meeting the minimum standards may not be included due to the lack of assurances that the data has been collected in a manner that guarantees data compatibility and reliability. It is not a goal of the DMIT to conduct a quality assessment of any data.

The guidelines identified in this document are intended for data collection entities to utilize standards best suited to acquire data that are useful and compatible for supporting a regional water resource monitoring network in the central Florida region. While it is recognized that information collected by permittees is potentially useful and should be incorporated (when available) into the regional monitoring network, it is not the intent of this document to set a mandate to require permittees to collect information in a certain manner for the express purpose of supplementing this monitoring network. The requirements for monitoring by a single permittee as part of their demonstration of compliance under the conditions in their water use permit is specific to that permit and should meet the minimum requirements for the rules under which they are permitted, which may be more restrictive than this document.

CFWI Background

The SJRWMD, SFWMD and SWFWMD agreed in 2006 to a Central Florida Coordination Area (CFCA) Action Plan to address the near-term and long-term development of water supplies in the central Florida region, including southern Lake, Orange, Osceola, Seminole and Polk counties. The plan was updated in 2009 to address changing projected demands and to start a new collaborative process identified as the CFWI.

As part of this current initiative, technical collaborative teams were developed to build the Guiding Principles outlined in the CFWI. As part of the technical team objectives, outlined in the Central Florida Water Initiative Draft Guiding Document (August 23, 2012), the Data Monitoring and Investigations Team (DMIT) was charged with identifying minimum standards for future CFWI data collection, including data collected to meet consumptive use and water use regulatory requirements. Minimum standards for data collection address minimum quality control/ quality assurance (QA/QC) and reliability standards so that all data collected by agencies and permittees is useable, compatible and appropriate for potential inclusion to the regional monitoring inventory. The minimum standards identified are a first level screening standard designed to assure that the data selected for inclusion in the inventory have been filtered to remove data and/or data collection sites that do not contain basic information or the quality of information deemed to be useful for future technical assessments. As with any information the data should be checked for quality and accuracy before use in technical/scientific interpretation.

It is the objective of this document to provide standards and methods for consistent data collection station/site establishment and field data collection protocols. These minimum standards may also familiarize permittees with field, operation and data management procedures for the groundwater, surface water, vegetative, and hydrologic monitoring programs associated with specific elements of consumptive use or water use permits.

Monitoring Program Development

1. **Monitoring Station/Site Metadata**
    a. **Standard Inventory Datasheet**
    Information regarding location, elevation and other data collection station/site characteristics should be recorded during establishment of the monitoring location or shortly thereafter. All agencies and permittees whose data is included in the CFWI inventory should strive to include the station/site information provided in the standard inventory sheet (Attachment 1). The Water Management Districts (WMDs) are designated as maintaining this inventory so it is beneficial that the station/site metadata and associated water resource data be submitted in an electronic format. In addition, permits may require specified site identification name or number

formats. The preferred format of the station/site information and examples are also included in Attachment 1.
ADD ATTACHMENT 1, Inventory Datasheet

2. Monitoring Station/Site Installation and Construction Standards

a. Land Survey

i. **Horizontal (NAD83/NSRS) -** The horizontal accuracy of new monitoring features shall be within a minimum of +/- 10 feet relative to the NAD83/National Spatial Reference System (NSRS) horizontal datum using a preferred decimal degree coordinate system for reporting position of latitude and longitude (although other coordinate systems such as State Plane or UTM will be accepted). Promoting use of one coordinate system provides consistency among permittees and reduces potential introduction of errors associated with required conversion of multiple systems by the WMD or end user for spatial analyses.

ii. **Vertical (NAVD88) -** The vertical accuracy of new vertical control benchmarks shall not exceed +/- 0.10 feet local network accuracy and directly measured to another vertical control benchmark relative to North American Vertical Datum of 1988 (NAVD88).

iii. Benchmarks - The vertical reference for establishing site survey benchmarks shall be the NAVD88 datum. It is recommended that at least one permanent monument be established. This will facilitate any resurveying in the case of monitor well replacement or well head modification. All benchmarks must be established under the supervision of a Florida Licensed Professional Surveyor or Engineer in accordance with applicable minimum technical standards pursuant to Florida Statutes Chapter 472.

The surveyor will provide a surveyor's report for all newly-established vertical control benchmarks including benchmark name, benchmark location (latitude and longitude), and benchmark elevation. Photographs are also recommended.

b. Staff Gage Construction

The use of a staff gage allows for quick assessment of water level elevation when standing water is present. The most common type of staff gage is a vertical staff gage. *ASTM Standard D 5413-93, Measurement of Water Levels in Open-Water Bodies (2002)* describes different staff gage types and discusses calibration of gages to a known vertical datum. Construction methods vary but typically include a graduated face plate attached to an immobile staff or post.

c. **Monitor Well Design and Construction**

Monitor wells require well construction permits through the appropriate WMD or its approved delegated well construction entity, and must be constructed by a State of Florida Licensed Water Well Contractor, in

compliance with Chapter 62-532, F.A.C. It is highly recommended that well design and construction methods conform with the *Florida Department of Environmental Protection (FDEP) Monitoring Well Design and Construction Guidance Manual (2008).*

i. **Surficial and Floridan Aquifer Monitor Wells -** Surficial aquifer monitor well diameters are dependent on use (e.g. water level elevation and or water quality sampling) and the hydrogeology of the site, but should have an inside diameter of no less than 2 inches. Shallow groundwater monitoring wells are wells that are typically less than 15 feet deep and designed to measure the uppermost aquifer horizon. Monitor wells completed into the upper and lower Floridan aquifers typically have telescoping casing strings to seal the collection zone from the overlying hydrogeologic strata. Design, construction, and drilling methodologies for constructing monitor wells into the upper Floridan aquifer are varied, but should comply with Chapter 62-532, F.A.C. and other applicable water management district rules.

   Monitored Interval in Wells - Selection of the data collection zone/interval in a monitor well is site specific and based on the hydrogeologic interval of interest. The monitoring interval refers to the screened interval or the open interval (bottom of casing to total well depth or the open horizon between two cased intervals. Wetland monitoring wells should be installed such that the monitored interval is in direct hydraulic connection with the wetland or lake being monitored. Suitable monitoring intervals for monitoring wells should be selected after a soil or lithologic profile and depths to water are established to verify that the intended zone will be monitored.

ii. **Well Development** - The objective of well development is to repair damage done to the formation and restore the natural hydraulic properties adjacent to the well. All wells should be developed until it is indicated that the hydraulic connectivity to the aquifer is restored. Well development should be conducted in accordance with the FDEP's *Monitoring Well Design and Construction Guidance Manual (2008).*

iii. **Concrete Pads** – It is recommended that all wells be constructed with concrete pad measuring at a minimum of 2 feet in length by 2 feet in width by 4 inches thick. It is recommended that shallow groundwater monitoring wells constructed in wetlands not have concrete pads.

iv. **Wellhead Protection** – Locking protective covers are recommended for all monitor wells with concrete pads. Protective caps or seals are recommended for shallow groundwater monitoring wells where concrete pads and locking protective covers are not used. The protective cover, or seal, isolates any monitoring devices deployed in wells, protects the aquifer from debris that may fall down the well, and can provide a means of protecting the monitor well riser that extends above land surface. *ASTM Standard D5787* provides

guidance for monitoring well protection which identifies design and construction considerations.

v. **Wellhead Survey** – The elevation of the *natural ground surface at the monitor well or staff gage, the top of the well pad (if present), and the top of the casing elevation or other defined measuring point* must be measured and recorded. The location at the top of casing where the elevation was measured should be marked with a notch in the casing or a permanent mark made on the outside of the casing at the point where the elevation was measured. Elevation should be measured from the nearest NAVD88 benchmark to the hydrologic monitoring device (well or staff gage). Documentation of methods and calculations should be maintained, and the calculated *Measuring Point Elevation or Gage Adjustment Value (value to adjust a non-direct reading gage to NAVD88 elevation)* should be clearly labeled at the site, if at all possible.

d. Soil and Lithologic Logs and Well Construction Reports

Soil and/or lithologic logs and well construction completion reports must be compiled for each newly installed monitor well. Lithologic or well logs record the general physical characteristics of the rock and soil encountered in a borehole from the surface to the bottom. The contractor must complete and sign a Well Completion Report and the permittee or licensed well driller must provide the report to the appropriate well construction permitting entity and/or WMD. Information included in these reports are beneficial in determining site-specific features such as soil permeability and confinement which may influence the hydrologic connection between aquifers.

e. Vegetative and Soil transects

Transects are lines used to establish ecological or soil characteristic profiles and are also used as baselines to compare/establish changes over time. The number of transects, lengths, and intervals will be verified by each individual WMD; but all transects must include the following information:

- **i.** Groundwater level data based on monitor wells.
- **ii.** Wetland and or surface water edge established pursuant to "*Delineation of the Landward Extend of Wetlands and Surface Waters*," Chapter 62-340.
- **iii.** Quantitative vegetative data collection identifying a cover class hierarchy based on Chapter 62-340, FAC plant species indicator status (e.g.; obligate, facultative wetland, facultative and non-wetland) or other acceptable classification standard.
- **iv.** Deepest accessible point in wetland.
- v. Soils data: profile descriptions at wetland edge identifying depth to hydric soil indicator, and the point where hydric soil indicator and/or muck soil occur at surface (Reference: *Field Indicators of Hydric Soils in the United States*, *A Guide for Identifying and Delineating Hydric Soils;* U.S. Department of Agriculture, Natural resources Conservation Service).

vi. Classification of wetland community type using Florida Natural Area Inventory (FNAI) descriptors or Florida Land Use forms and Cover Classification System (FLUCCS0 (source: Florida Department of Transportation) or other acceptable classification standard.
vii. Water level data using staff gages and/or biological indicators.
viii. Rainfall data collection.
ix. Photographic documentation.

Ground elevations and position of latitude/longitude for wetland boundary points, where hydric soils indicator and a muck soil occur at surface, must be surveyed and reported preferably using a decimal degree coordinate system and to a precision of eight (8) significant figures (ie.; YY.yyyyyyyy°N, XX.xxxxxxxx°W), typical precision for sub-meter Global Positioning Systems. Although other coordinate systems such as State Plane or UTM will be accepted, use of one coordinate system provides consistency among permittees and reduces potential introduction of errors associated with required conversion of multiple systems by the WMD or end user for spatial analyses. All elevations shall be accurate to ± 0.1 feet and referenced to the North American Vertical Datum (NAVD) of 1988. All coordinates shall be accurate to <1 meter and referenced to World Geodetic System (WGS) 1984. It is recommended that the wetland/soils/and surface water level boundary point data be located by a licensed professional surveyor and that the data be provided on a survey certified pursuant to Ch 472, FS, to meet the Minimum Technical Standards for surveying; Chapter 5J-17, F.A.C.

3. Water Resource Data Collection Procedures

a. Water Level Monitoring

i. **Staff gages**- Section 8 in *ASTM Standard D 5413-93, Measurement of Water Levels in Open-Water Bodies (2002)* describes how to read a vertical staff gage. If the staff gage is not set to directly read elevation relative to an accepted vertical datum, all data must be adjusted to record values relative to said datum. Measurements should be recorded to the nearest 0.05 foot.
ii. **Wells**- *Groundwater Technical Procedures of the U.S. Geological Survey: U.S. Geological Survey Techniques and Methods 1-A1* describes techniques for measurement of groundwater levels in wells. All water level measurements must be made relative to an established survey reference point, typically the top of casing of the monitor well (see Section 2a of this document). The marked location at the top of casing is the elevation at the top on the monitor well pipe, minus the cap measured in NAVD 88. Measurements should be recorded to the nearest 0.01 foot.
iii. **Data loggers** - Data loggers, pressure transducers, or encoder/float systems are encouraged as a method to collect frequent and reliable water level readings. Data loggers should be inspected monthly to ensure water levels are being recorded accurately, that adequate battery life remains and to download the recorded data to an external source and to perform equipment maintenance. It is good practice for field personnel charged with inspecting the loggers to carry spare loggers, sensors, desiccants, and batteries so that data recording can resume should the deployed logger malfunction.

b. Water Quality Monitoring

~~Water quality monitoring should be performed following the~~ *Florida Department of Environmental Protection (FDEP) Standard Operating Procedure FS-2200 for groundwater sampling, and FS-2100 for surface water sampling* should be utilized as guidelines for all water-quality monitoring efforts~~. Well purging techniques will differ dependent on the hydrogeologic properties of the aquifer and well construction design. A flowchart which summarizes purging procedures is provided in FS-2200 Figure FS-2200-2~~. Where field conditions require deviations from those standard procedures (e.g. samples collected during drilling or from large diameter wells), these should be documented in the project monitoring plan prior to sample collection, or explained in the resulting data using data value qualifiers or result comments. Water quality field data collected with calibrated instruments are acceptable for field measurements (e.g. pH, temperature, specific conductivity and turbidity) during well purging and water quality sampling procedures. These results are considered part of the sampling procedure and should be archived along with any laboratory analysis.

Data collection sites included in this inventory should~~must~~ have all routine groundwater and surface water quality analyses performed by a laboratory that is certified by the Florida Department of Health (FDOH) and the National Environmental Laboratory Accreditation Program (NELAP). All laboratory analyses must be performed using methods for which the laboratory has FDOH certification.

There are some less routine analytes (e.g. natural or anthropogenic tracers/isotopes/radionuclides) for which NELAP sampling and analysis protocols do not exist. For analytes of this nature, protocols should be followed based on guidance available from the lab providing analytical services. For example, samples to be analyzed by USGS labs should use USGS r~~3~~ecommended sampling methods and standard operating procedures. Where formal guidance sampling methods and standard operating procedures is unavailable, industry best practices and professional judgment should be used.

~~Water quality field data collected with calibrated instruments equipped with probe sensors are acceptable for field measurements (e.g. pH, temperature, specific conductivity and turbidity) during well purging and water quality sampling procedures. These results are considered part of the sampling procedure. Water samples should not be collected until field parameters are stabilized from three successive readings, and then collected samples must be preserved in accordance with the acceptable sampling and analysis plan.~~

c. Atmospheric Monitoring

Rainfall- Permittees are encouraged to reference atmospheric data obtained by the appropriate water management district for evaluating meteorological stressors that may influence changes in water level and water quality. Gauge-adjusted radar rainfall data is the most accurate and consistent method to identify rainfall patterns. Accurate rainfall data collection with electronic recording equipment at professionally installed, maintained, calibrated and telemetered measuring stations, combined with reflectivity data obtained from the National Weather Services WSR-88D units is the chosen method of rainfall data collection, as it covers the wide areas between gauged stations.

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Although not typically required, permittees may elect to independently monitor atmospheric conditions. If so, standards in National Weather Service Instruction (NWSI) 10-1302 "Instrument Requirements and Standards for the NWS Surface Observing Programs (Land)" and National Weather Service Manual (NWSM) 10-1315 "Cooperative Station Observation" should be followed as closely as possible to ensure uniformity of observations.

4. **Frequency of Water Resource Data Collection:**
The recommended minimum frequency of data collection will depend on the water resource being monitored and type of data being collected. The following is a list of common parameters included in the inventory, and the recommended minimum frequency of data acquisition:
    a. Water Level: (*confined or unconfined aquifers*) – recommended hourly for sites with data loggers, reported as daily average; minimum weekly (*with documentation*) and reported as elevation relative to NGVD88.
    b. Rainfall/meteorological: recommended hourly and reported as daily total; at a minimum record daily totals.
    c. Water Quality: (aquifers) (*major ion suite*) – recommended quarterly; minimum annually.
    d. Wetland/vegetation Transects: typically once every 5 years

5. **Data Management**
For a data management plan that encompasses reporting, storage, and QA/QC, processes are necessary for safeguarding the integrity of the monitoring program. Therefore, associated records for site metadata and water resource data results should be maintained for a minimum of one year as back-up regardless if the information has been reported to another agency. Each individual agency may have records retention guidelines that will override the minimum requirements suggested here. Also, the information must be stored in an ASCii, tabular or other electronic format that allows editing and storage in a common database.

6. **Quality Assurance Practices**
A quality assurance program should be designed and implemented so that problems with instrumentation and/or measurement/sampling procedures are quickly detected and resolved in order to provide a level of confidence that a reliable, continuous data stream has been compiled for end user evaluation. Corrective action protocols prepared in advance is a good idea to minimize data gaps. Typically, these protocols should have a corrective action plan established for detecting and correcting issues as quickly as possible. This might include preventive maintenance steps, field audits, and the collection of duplicate samples in the case of water quality monitoring.

7. **Quality Control Practices**
    a. **General quality control practices**
        i. **Periodic Data Review** -The permittee should review water resource monitoring data on a regular basis as necessary to prevent extended gaps of ambiguous or missing values. The regulatory agency should review the

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monitoring data submitted by the permittee as soon as possible after receipt to detect problematic values.

ii. **Internal Audits -** Random, periodic audits of water level and water quality monitoring data should be performed internally by both the permittee and the regulatory agency to assess the performance of the QA/QC program.

iii. **Annotation/Explanation of missing record -** A mechanism for documenting ambiguous or non-measured values due to equipment malfunction and/or anthropogenic or meteorological stressors should be provided in the reporting-submittal process.

b. Data-specific quality control measures

Water level elevation and water quality data should be reviewed for the presence of unusually high or low values, sudden shifts up or down, extended gaps of no measurements, upward or downward trends that do not correspond to meteorological or anthropogenic stressors and no slope (flatline) all of which may indicate the presence of outliers potentially due to equipment malfunction, field sampling, or laboratory error.

i. **Water level monitoring -** At a minimum, water level elevations and corresponding rainfall should be graphically plotted versus time to qualitatively assess data consistency by visual interpretation. More robust procedures using statistical methods are encouraged to provide for quantitative assessment of data.

ii. **Water quality monitoring -** At a minimum, both field and laboratory data should be reviewed relative to historical records to qualitatively assess data consistency by visual inspection. More robust procedures using tests in *"Standard Methods for the Examination of Water and Wastewater"* and statistical methods are encouraged to provide for quantitative assessment of data.

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