

# Upper San Marcos Creek Hydrologic Area Monitoring and Assessment Report 2022-2023

## Prepared For:

County of San Diego  
City of San Marcos  
City of Escondido



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## Acronyms and Abbreviations

CEDEN	California Environmental Data Exchange Network
County	County of San Diego
EDD	electronic data deliverable
HA	Hydrologic Area
HOA	Homeowner's Association
HPWQC	highest priority water quality condition
IC/ID	illicit connection/ illegal discharge
MS4	municipal separate storm sewer system
MOE	Mikhail Ogawa Engineering
NA	not applicable
QA	quality assurance
QAPP	quality assurance project plan
QC	quality control
Responsible Agencies	San Diego County Responsible Agencies
RPD	relative percent differences
San Diego Water Board	San Diego Regional Water Quality Control Board
SAP	sampling and analysis plan
SWAMP	Surface Water Ambient Monitoring Program
TTWQ	threat to water quality
USGS	United States Geological Survey
USMC	Upper San Marcos Creek
Weston	Weston Solutions, Inc.
WMA	Watershed Management Area
WQIP	Water Quality Improvement Plan
WQO	water quality objective

## Units of Measure

%	percent
cfs	cubic feet per second
°C	degree Celsius
L	Liter
Lbs/yr	pounds per year
mg	milligram
mg/L	milligram per Liter
mL	milliliter
NTU	nephelometric turbidity units
pH	hydrogen ion concentration
sf	square feet
µS/cm	microsiemens per centimeter

## **1    OVERVIEW**

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The San Marcos Hydrologic Area (HA) is located in Northern San Diego County, within the Carlsbad Watershed Management Area (WMA). The San Marcos HA, the second largest HA within the WMA at approximately 36,000 acres, is divided into two distinct areas separated by the Lake San Marcos impoundment; the Upper San Marcos HA (i.e., Upper San Marcos Creek HA) and the Lower San Marcos HA. The Upper San Marcos HA includes portions of the County of San Diego (County), the cities of San Marcos and Escondido, and includes hydrologic subareas 904.52 and 904.53 (Figure 1-1).

The San Diego County Responsible Agencies (Responsible Agencies) in the Carlsbad WMA developed the Water Quality Improvement Plan (WQIP) (Carlsbad WMA Responsible Agencies, 2018) to prioritize and address water quality stressors in the WMA with the ultimate goal of protecting and improving water quality. The WQIP identifies the highest priority water quality conditions (HPWQCs) in the Carlsbad WMA and includes strategies focused on improvements in the quality of discharges from the storm drain system and within the receiving waters, as well as goals and schedules for implementing the strategies. The WQIP identifies nutrients as the HPWQC for the Upper San Marcos Creek (USMC) HA and establishes goals to reduce nutrient loads and associated eutrophic conditions in support of ongoing efforts to improve water quality in Lake San Marcos.

The Responsible Agencies in the USMC HA (the City of Escondido, the City of San Marcos, and the County of San Diego), implement multiple monitoring programs to assess progress toward achieving WQIP goals. Results are assessed and reported annually with the Carlsbad WMA WQIP Annual Report.

The WQIP goals that were evaluated for the 2022-2023 Carlsbad WMA WQIP Annual Report are the second set of interim goals (2018-2023). The wet weather goals are summarized below:

- Wet weather (receiving water based)
  - 10% nutrient load reduction from baseline
  - (OR) Meet nutrient water quality objectives (WQOs)

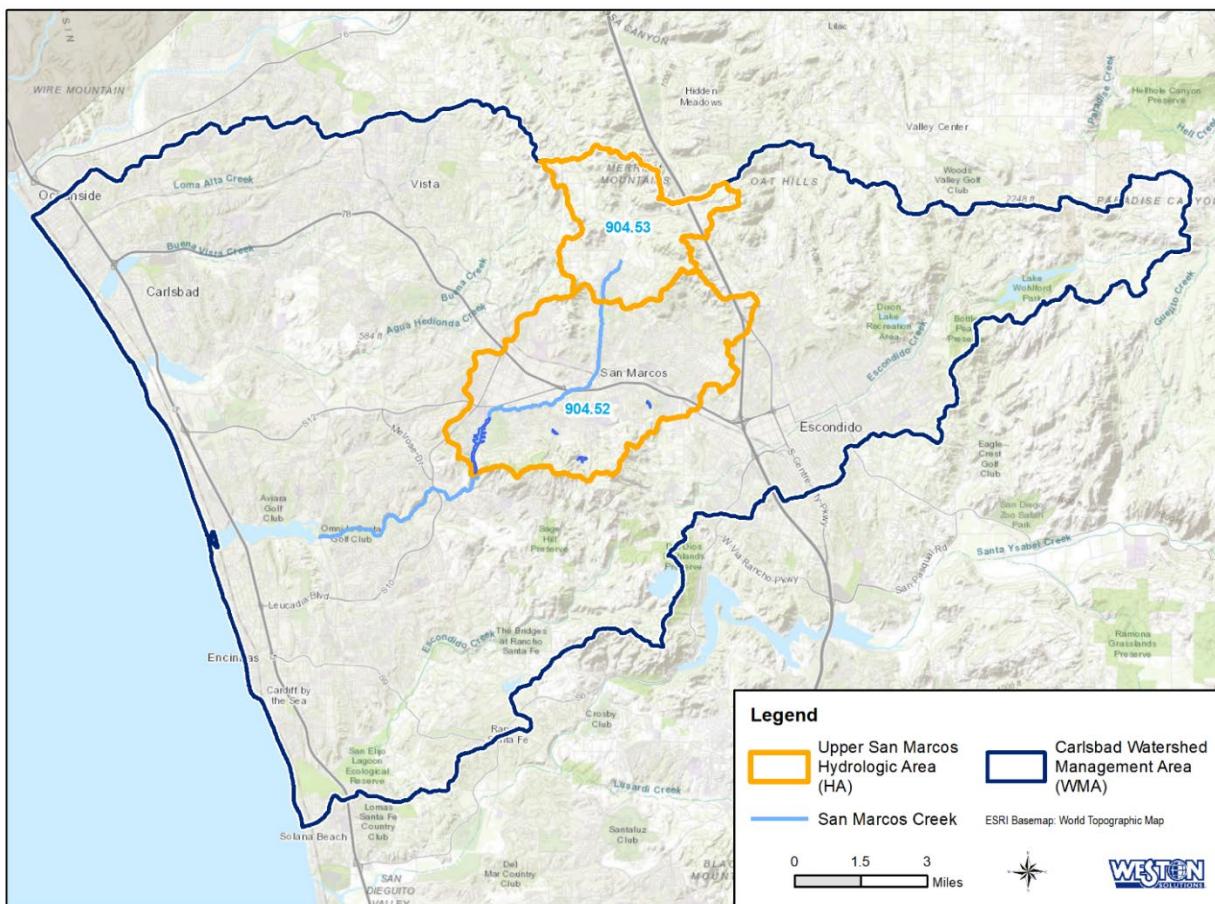
To determine progress toward the wet weather goals in the USMC HA, the Responsible Agencies conduct year-round flow monitoring in the USMC and monitor one wet weather event annually.

The USMC HA dry weather goals are as follows:

- Dry weather (storm drain outfall based)
  - Effectively eliminate 20% of dry weather flow from identified outfall(s),
  - (OR) Effectively eliminate two persistently flowing outfalls,
  - (OR) Discharge meets the nutrient WQO for the applicable water body segment.
  - (OR) Address all items below:
    - Inspect high threat to water quality (TTWQ) agricultural facilities at least annually. Inspect all other (i.e. medium and low TTWQ) inventoried agricultural facilities at least once every five years.
    - (AND) Inspect all inventoried golf courses once every two years.
    - (AND) Conduct outreach to 10% of identified Homeowner's Associations (HOAs) and completion of the Fairways HOA Retrofit Pilot Project.

- (AND) 10% of identified residences and businesses on septic systems receive outreach.

To assess progress towards the dry weather interim goals, the Responsible Agencies implement specific monitoring programs, and stormwater inspection and outreach programs within the USMC HA. The County and the City of San Marcos conduct monitoring at the highest priority major storm drain outfalls located within the USMC HA and conduct field screening of major outfalls in accordance with the Carlsbad WMA municipal separate storm sewer system (MS4) Monitoring Plan (Carlsbad Participating Agencies, 2023). In addition, the County and City of San Marcos conduct additional studies at select major storm drain outfalls during dry weather. The City of Escondido has not identified any major storm drain outfalls in its jurisdictional portion of the USMC HA.



**Figure 1-1. Carlsbad WMA and Upper San Marcos Creek HA**

## **2 RECEIVING WATER MONITORING**

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### **2.1 Project Overview**

The Responsible Agencies implement the USMC Monitoring Program to determine progress toward the receiving water based WQIP wet weather goals. This program includes year-round flow monitoring in the Creek as well as sampling of one wet weather event annually.

### **2.2 Materials and Methods**

#### **2.2.1 Monitoring Locations**

For the 2022-23 monitoring year two stations were selected for continuous flow measurement along the Creek and are summarized in Table 2-1 and shown in Figure 2-1. Due to ongoing construction at the previous wet weather monitoring station, SM-TWAS-1a was selected for flow monitoring and nutrient levels during the wet weather season. Weston Solutions, Inc. (Weston) installed monitoring equipment at SM-TWAS-1a including a knock box, flow meter, auto-sampler, sensor, and solar panel. The monitoring equipment was inspected and calibrated bi-weekly during the wet weather season.

Once conditions just upstream of Lake San Marcos were appropriate to relocate the monitoring location for the dry weather season, the monitoring location was moved further downstream to monitoring station SM-TWAS-1a-DS. Flows were continuously monitored at SM-TWAS-1a-DS using a pressure transducer level sensor and data logger.

Due to changes in the hydrologic conditions that occurred during the wet weather seasons, the dry season monitoring location has been adjusted several times during previous monitoring years. Table 2-1 and Figure 2-1 provide the monitoring locations for the dry weather station (SM-TWAS-1a-DS) monitored during the 2023 dry season, as well as the stations monitored in previous dry season years (SM-TWAS-1a-DSb and SM-TWAS-1a-DSa).

**Table 2-1. Upper San Marcos Creek Station Locations**

Station ID	Station Description	Latitude	Longitude	Location Description
<b>2022-2023 Monitoring Stations</b>				
SM-TWAS-1a-DS	2023 dry weather monitoring location	33.128699	-117.203763	San Marcos Creek upstream of Lake San Marcos
SM-TWAS-1a	2022-2023 wet weather monitoring location	33.130386	-117.200407	San Marcos Creek upstream of Discovery Street Bridge
<b>Previous monitoring locations</b>				
SM-TWAS-1b	2022 wet weather monitoring station	33.13166	-117.1869	San Marcos Creek at Via Vera Cruz
SM-TWAS-1a-DSb	2022 dry weather monitoring location	33.130007	-117.20231	San Marcos Creek downstream of Discovery Street Bridge

Station ID	Station Description	Latitude	Longitude	Location Description
SM-TWAS-1a-DSa	2020 dry weather monitoring location	33.128576	-117.203627	San Marcos Creek upstream of SM-TWAS-1a-DS

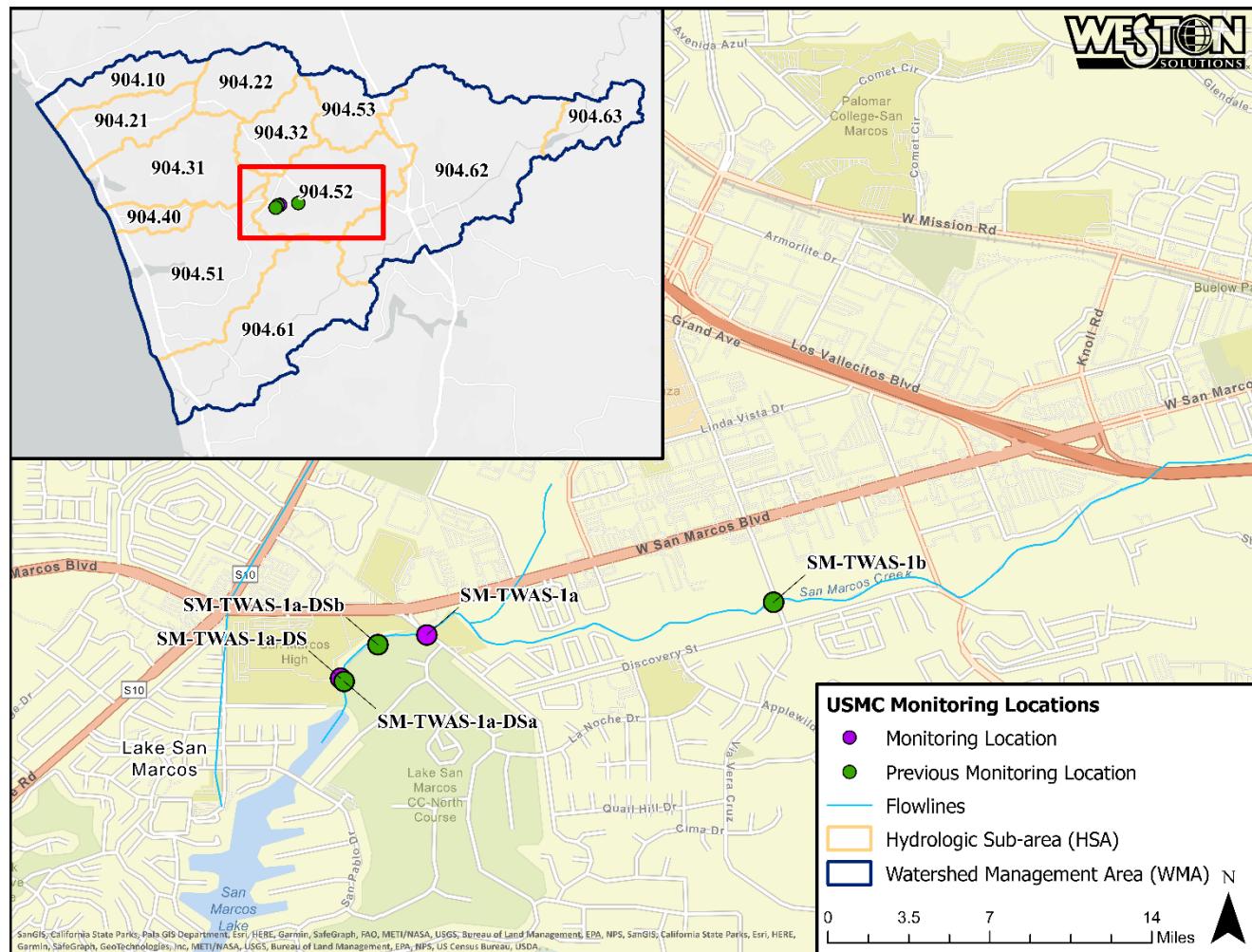


Figure 2-1. Upper San Marcos Creek Station Locations

## 2.2.2 Flow Monitoring

At station SM-TWAS-1a, flow was monitored using a METER CTD-10 pressure transducer as the primary measuring device. An American Sigma flowmeter was also used at this location. Continuous flow data were collected at five-minute intervals from November 18, 2022 through October 4, 2023. Flow data are included as Attachment 2B.

At SM-TWAS-1a-DS, dry season flow was monitored using a METER CTD-10 pressure transducer and data logger to measure water level. Continuous flow data were collected every fifteen minutes from April 28, 2023 to October 4, 2023. The flow meter was removed from August 19-August 22,

20023 due to Tropical Storm Hilary. During site visits, level measurements were taken by hand to verify the measurements taken by the data logger. Flow rates were calculated during post-processing of data using the stage-discharge relationship developed for the site using United States Geological Survey (USGS) stream rating techniques.

### **2.2.3 Wet Weather Monitoring**

One wet weather event was monitored at SM-TWAS-1a February 23-25, 2023. During the wet weather event, a flow-weighted composite sample was collected and analyzed for the constituents identified in Table 2-2. Sample aliquots were collected over approximately 48 hours. The nearby San Diego County Rainfall and Stream Level Information System rain gauge (San Marcos CRS 27090) measured 3.20 inches of rainfall. Field measurements were collected using a YSI 6920 sonde.

During the February 2023 wet weather event the American Sigma flow meter was used to continuously measure stage (i.e., stream height) and velocity and to continually calculate flow rates by inserting the stage information into the pre-programmed head-flow rating table. The autosampler was triggered to draw a sample aliquot every time a certain volume was measured to have flowed past. The final discharge equations used to create the head-flow table were calculated using USGS stream rating techniques.

### **2.2.4 Load Calculation Methods**

Flow data collected from SM-TWAS-1a as well as measured nutrient concentrations from the flow-weighted composite sample collected during the annual wet weather event were used to calculate the event and annual wet weather loads.

For the February 23-25, 2023, monitored storm event, discharge volume during the storm was calculated using measured flow data from SM-TWAS-1a. The discharge volume was multiplied by the concentration of the analyte measured in the flow-weighted composite sample and a unit conversion factor to obtain the event load:

$$Load_{event} = Volume_{event} \times Measured\ Concentration_{event} \times Conversion\ Factor$$

For non-detect results, one half of the method detection limit was used for calculating the load. To calculate the annual wet weather load for total nitrogen and total phosphorus, the measured concentrations from the one monitored wet weather event were applied to each of the unmonitored storm events (defined as at least 0.1 in of precipitation within 24 hours with 72 hours antecedent dry weather).

$$Load_{unmonitored\_storm\_x1} = Volume_{unmonitored\_storm\_x1} \times Measured\ Concentration_{event} \times Conversion\ Factor$$

$$Load_{unmonitored\_storm\_x2} = Volume_{unmonitored\_storm\_x2} \times Measured\ Concentration_{event} \times Conversion\ Factor$$

$$Load_{unmonitored\_storm\_x3} = Volume_{unmonitored\_storm\_x3} \times Measured\ Concentration_{event} \times Conversion\ Factor$$

Unmonitored storm events were determined based upon the nearest San Diego County Rainfall and Stream Level Information System rain gauge (San Marcos CRS 27090).

The calculated loads for each unmonitored storm event were summed together and added to the load from the monitored storm event to determine the overall wet weather annual load:

$$Load_{unmonitored\_storms} = Load_{unmonitored\_storm\_x1} + Load_{unmonitored\_storm\_xn} \dots$$

$$Annual\ Wet\ Weather\ Load = Load_{event} + Load_{unmonitored\_storms}$$

## 2.3 Results

Laboratory reports and California Environmental Data Exchange Network (CEDEN) formatted electronic data deliverables (EDDs) are provided as Attachment 2C. Field data sheets are included as Attachment 2D.

### 2.3.1 Wet Weather Analytical Results

Analytical results from the flow-weighted composite wet weather sample collected at SM-TWAS-1a are presented in Table 22. Laboratory reports and CEDEN formatted EDDs are provided as Attachment 2C.

**Table 2-2 Wet Weather Flow Weighted Composite Monitoring Results**

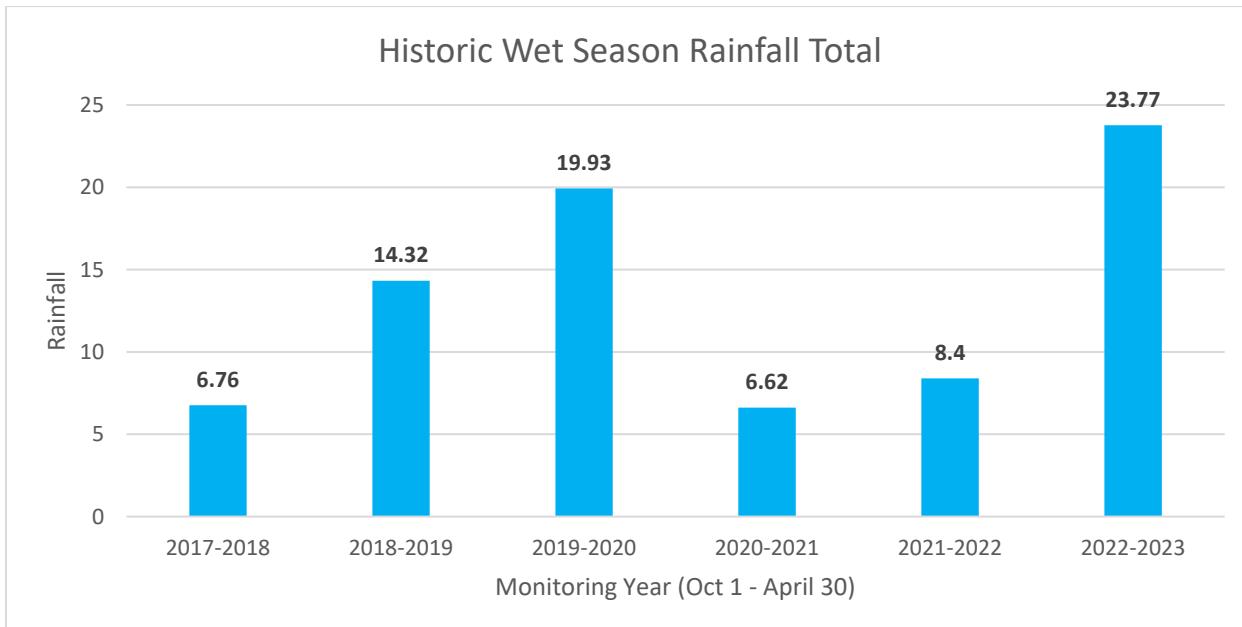
Analyte	Unit	SM-TWAS-1a
		2/23/2023-2/25/2023
<b>Field Measurements</b>		
Dissolved Oxygen	mg/L	10.25
pH	pH units	8.26
Specific Conductivity	µS/cm	270.1
Water Temperature	Celsius	11.61
Turbidity	FNU	85.75
<b>General Chemistry</b>		
Total Suspended Solids	mg/L	100
<b>Nutrients</b>		
Ammonia as N	mg/L	0.10
Nitrate + Nitrite as N	mg/L	1.1
Nitrate as N	mg/L	1.0
Nitrite as N	mg/L	0.051J
Total Nitrogen (calculated)	mg/L	2.1
Total Kjeldahl Nitrogen	mg/L	1.0
Orthophosphate	mg/L	0.17
Total Phosphorus	mg/L	0.29

< - Results less than the method detection limit.

J - Analyte was detected at a concentration below the reporting limit and above the method detection limit. Reported value is estimated.

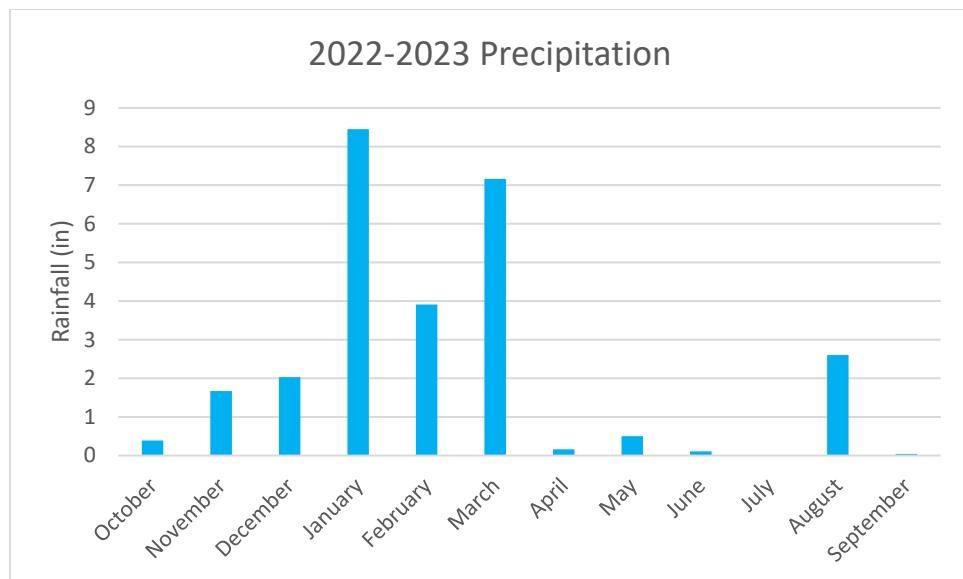
### 2.3.2 Precipitation

For purposes of assessing overall annual precipitation, the nearby San Diego County Rainfall and Stream Level Information System rain gauge (San Marcos CRS 27090) was utilized. Precipitation during 2022-2023 was the highest measured over the past six monitoring years with 23.77 inches of rain recorded between October 1, 2022 and April 30, 2023. Historic wet season rainfall totals are presented in Figure 2-2.



**Figure 2-2. Historical Wet Season Rainfall Totals at San Marcos CRS 27090 Station**

Rainfall data for the entire 2022-2023 monitoring year are presented in Figure 2-3. The highest precipitation was measured in the month of January 2023, with 8.45 inches of rainfall. The second highest precipitation was measured in March 2023, with 7.16 inches of rainfall. On August 20, 2023, Tropical Storm Hilary made landfall and 2.59 inches of rainfall was recorded.



**Figure 2-3. Rainfall Measured at San Marcos CRS 27090 Station**

### 2.3.3 Wet Weather Flow and Loads

Figure 2-4 presents the hydrograph for the monitored wet weather event at SM-TWAS-1a on February 23-25, 2023. The hydrograph graphically presents the precipitation that triggered the storm event, the subsequent increase in discharge, an eventual peak, and finally a decline in discharge. Equal-volume flow-weighted sample aliquots were collected over the course of the storm. The timing of the aliquots is also identified on the graph.

Wet weather event loads were calculated for this storm event using the event flow data and measured constituent concentrations from the collected sample, as described in Section 2.2.2. Wet weather event loads are presented in Table 2-3.

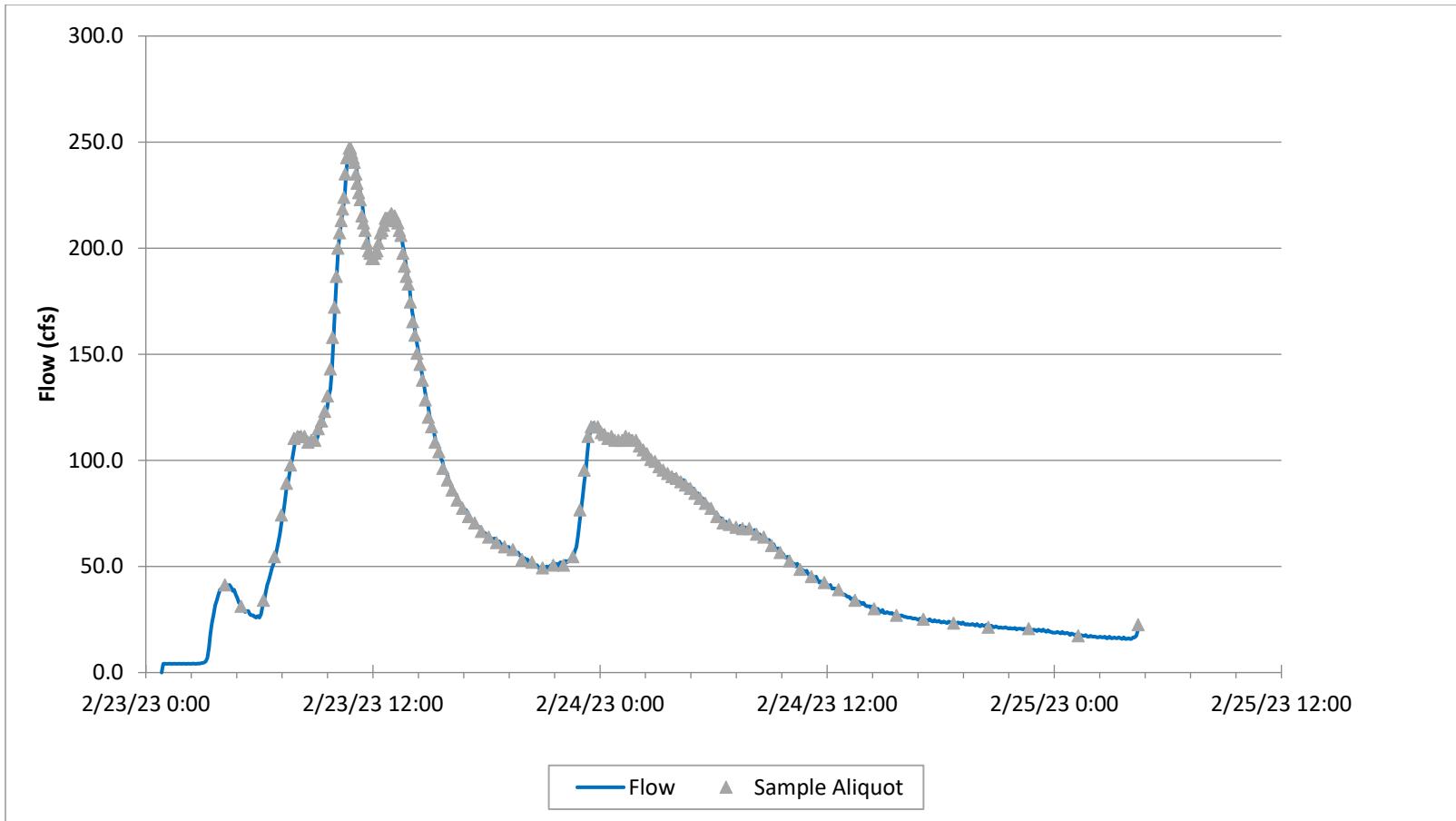


Figure 2-4. February 23-25, 2023 Wet Weather Event Hydrograph at SM-TWAS-1a

**Table 2-3. February 23-25, 2023 Wet Weather Event Loads at SM-TWAS-1a**

Analyte	Units	Monitored Wet Weather Load
		2/23/2022-2/25/2022
Precipitation*	inches	3.20
Percent of Annual Wet Weather Volume^	%	4.79%
Volume	gallons	92,484,932
<b>General Chemistry Loads</b>		
Total Suspended Solids	Pounds	77,181.6
<b>Nutrient Loads</b>		
Ammonia as N	Pounds	77.2
Nitrate + Nitrite as N	Pounds	849.0
Nitrate as N	Pounds	771.8
Nitrite as N	Pounds	39.4
Total Nitrogen	Pounds	1,620.8
Total Kjeldahl Nitrogen	Pounds	771.8
Orthophosphate as P	Pounds	131.2
Total Phosphorus	Pounds	223.8

\*Precipitation data from San Marcos CRS 27090

^ Volume of storm events greater than 0.1 inch of precipitation within 24 hours with 72 hours antecedent dry weather

In order to calculate the annual wet weather loads the concentrations from the one monitored wet weather event were applied to flow data collected for the unmonitored storm events. During the 2022-2023 wet weather season (October 1, 2022 through April 30, 2023), there were 15 unmonitored storm events (defined as greater than 0.1 in of precipitation within 24 hours with 72 hours antecedent dry weather). Table 24 presents a summary of the rain events, precipitation measured at CRS 27090, and estimated volume in gallons.

**Table 2-4. Summary of All Rain Events (>0.1 in) and Volumes at SM-TWAS-1a**

Storm Event	Dates	Precipitation	Volume
		(inches)	(gallons)
<b>Monitored Event</b>			
1	2/23/2023	3.20	92,484,932
	2/25/2023		
<b>Unmonitored Events</b>			
1	10/11/2022	0.23	443,955
	10/11/2022		
2	11/7/2022	1.59	3,199,201
	11/9/2022		
3	12/11/2022	1.01	97,695,316
	12/13/2022		
4	12/27/2022	0.72	59,821,269
	12/29/2022		

**Table 2-4. Summary of All Rain Events (>0.1 in) and Volumes at SM-TWAS-1a**

Storm Event	Dates	Precipitation	Volume	
		(inches)	(gallons)	
5	12/30/2022 <sup>1</sup>	2.82	409,829,567	
	1/6/2023			
6	1/10/2023 <sup>1</sup>	0.73	95,980,808	
	1/11/2023			
7	1/14/2023	4.28	679,317,649	
	1/18/2023			
8	1/29/2023	0.71	71,018,795	
	1/31/2023			
9	2/12/2023	0.21	10,382,637	
	2/14/2023			
10	2/27/2023	1.22	111,348,262	
	3/1/2023			
11	3/10/2023	1.04	92,641,180	
	3/12/2023 <sup>1</sup>			
12	3/14/2023	2.52	326,982,256	
	3/16/2023 <sup>1</sup>			
13	3/19/2023	1.68	249,854,972	
	3/23/2023			
14	3/29/2023	1.00	141,919,035	
	3/31/2023			
15	4/12/2023	0.13	326,982,256	
	4/13/2023			
		<b>23.09</b>	<b>2,362,101,601</b>	

<sup>1</sup> While not separated by 72 hours of dry weather, these storm events were considered separate due to the length of time between precipitation.

The total annual wet weather load at SM-TWAS-1a was calculated by summing the monitored storm wet weather load with the sum of the unmonitored storm wet weather loads (Table 2-5). The annual wet weather loads given in Table 2-5 have been extrapolated from a single storm event that represented only 3.77% of the total annual volume. Storm events vary in total volume, timing, intensity, antecedent dry days, and duration; all of which can affect constituent concentrations in the creek. Therefore, the total annual loads extrapolated from a single storm event for the entire season are estimates only and may not accurately represent actual loads for the season.

**Table 2-5. Estimated 2022-2023 Annual Wet Weather Loads at SM-TWAS-1a**

Analyte	Units	Monitored Wet Weather Load 2/23-2/25/2023	Un-monitored Wet Weather Load	Total Annual Wet Weather Load
Precipitation*	inches	3.2	19.89	23.09
Percent of Annual Volume	%	3.77%	96.23%	100%
Volume	gallons	92,484,932	2,362,101,601	2,454,586,533
<b>General Chemistry Loads</b>				
Total Suspended Solids	Pounds	77,181.6	1,971,247	2,048,429
<b>Nutrient Loads</b>				
Ammonia as N	Pounds	77	1,971	2,048

**Table 2-5. Estimated 2022-2023 Annual Wet Weather Loads at SM-TWAS-1a**

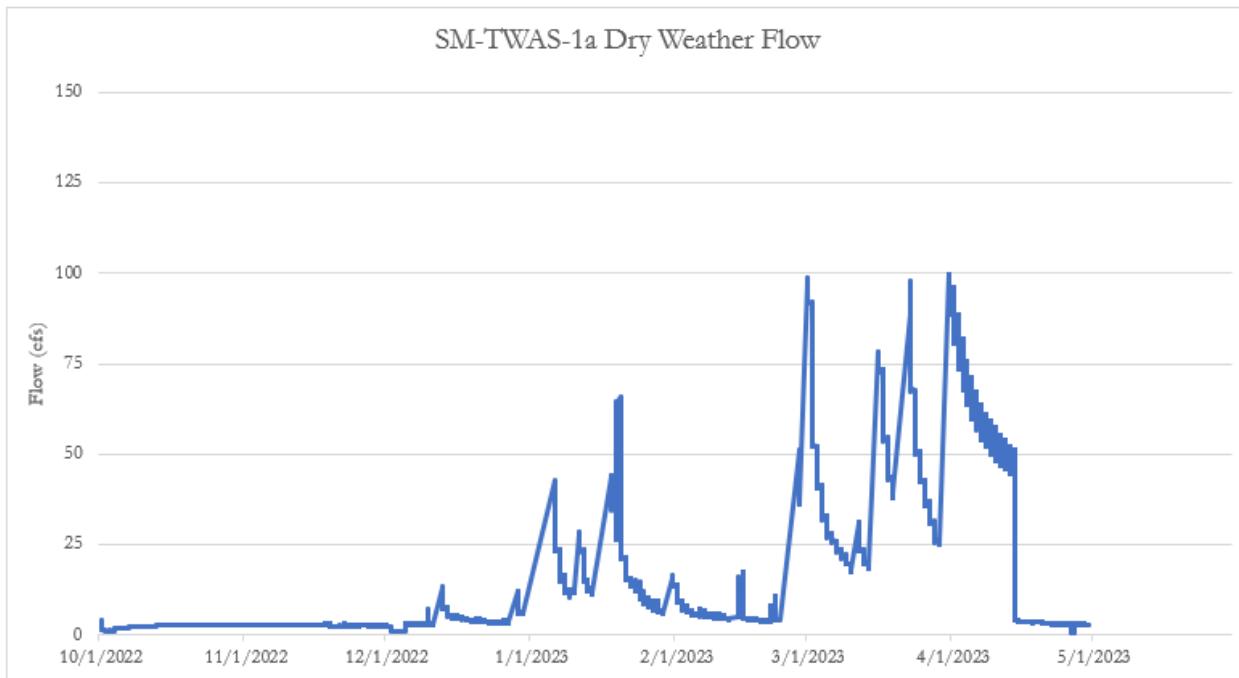
Analyte	Units	Monitored Wet Weather Load 2/23-2/25/2023	Un-monitored Wet Weather Load	Total Annual Wet Weather Load
Nitrate + Nitrite as N	Pounds	849	21,684	22,533
Nitrate as N	Pounds	772	19,712	20,484
Nitrite as N <sup>Ω</sup>	Pounds	39	1,005	1,045
Total Nitrogen	Pounds	1,621	41,396	43,017
Total Kjeldahl Nitrogen	Pounds	772	19,712	20,484
Orthophosphate as P	Pounds	131	3,351	3,482
Total Phosphorus	Pounds	224	5,717	5,940

\*Precipitation data from San Marcos CRS 27090

<sup>Ω</sup> Analyte was not detected, one half of the method detection limit was used to calculate the load.

### 2.3.4 Dry Weather Flow Data

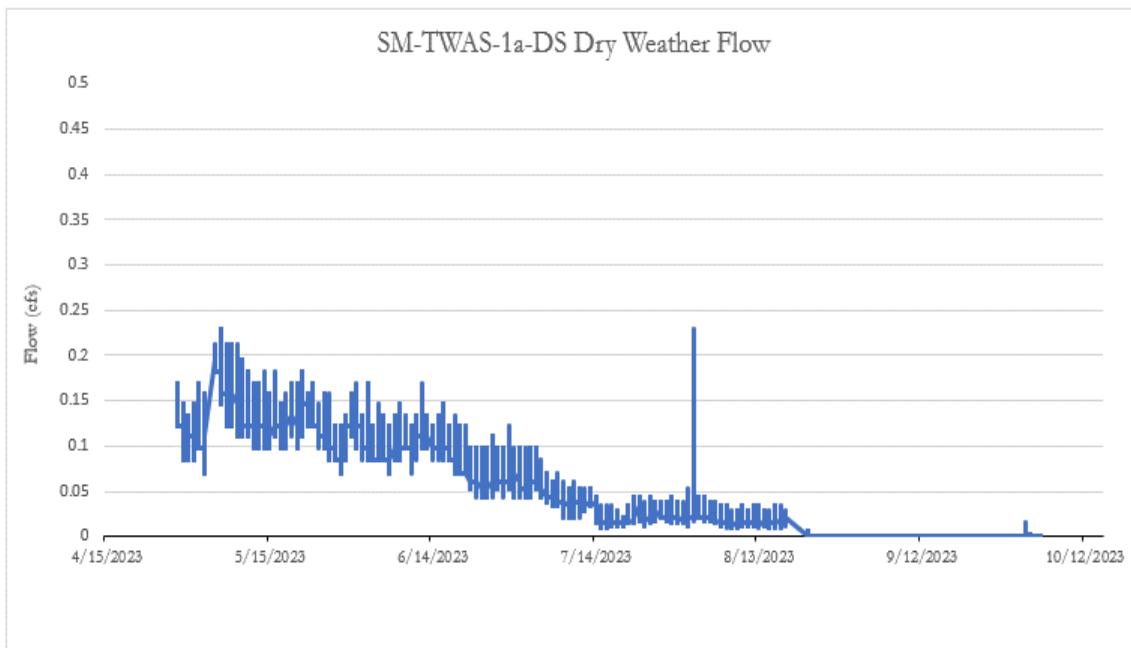
Dry weather flows recorded at SM-TWAS-1a are presented in Figure 2-5. Gaps in the hydrographs indicate periods of wet weather (precipitation day greater than 0.1 inches and the subsequent 72 hours) and increased flow following a dry season storm event. The wet event flow data were removed from the hydrographs to better illustrate dry weather conditions.



**Figure 2-5. Dry Weather Flow Hydrograph at SM-TWAS-1a**

The dry weather flow data collected at SM-TWAS-1a-DS are presented in Figure 2-6. There are two additional gaps in the flow data from SM-TWAS-1a-DS. First, the monitoring equipment was removed

from August 18, 2023 to August 22, 2023 due to Tropical Storm Hilary. The second data gap between September 14, 2023 and September 29, 2023 was due to equipment malfunction. Flow data are provided in Attachment 2B.



**Figure 2-6. Dry Season Dry Weather Flow Hydrograph at SM-TWAS-1a-DS**

### 2.3.5 Quality Assurance/Quality Control

Quality assurance (QA)/ quality control (QC) samples, including field duplicates and field blanks, were collected to assess sample variability and contamination arising from the collection, transport, or storage of samples. Field QA/QC samples were collected in sufficient numbers to meet Surface Water Ambient Monitoring Program (SWAMP) recommended guidelines of 5% of total samples collected. One field duplicate and one field blank were collected during the wet weather event at SM-TWAS-1a. Results for QA/QC samples are provided in Table 2-6. Relative percent differences (RPDs) were calculated for field duplicates and no samples exceeded SWAMP recommended limits (25%) for the wet weather sample duplicate. Constituents were not detected in the field blank above the reporting limit.

**Table 2-6. Field QA/QC Sample Results**

Analyte	Unit	SM-TWAS-1a	SM-TWAS-1a-DUP	Field Blank
		2/23-25/2023	2/23-25/2023	2/23-25/2023
<b>General Chemistry</b>				
Total Suspended Solids	mg/L	100	98	<1
<b>Nutrients</b>				
Ammonia as N	mg/L	0.10	0.10	0.030J
Nitrate + Nitrite as N	mg/L	1.1	1.1	<0.036

**Table 2-6. Field QA/QC Sample Results**

Analyte	Unit	SM-TWAS-1a	SM-TWAS-1a-DUP	Field Blank
		2/23-25/2023	2/23-25/2023	2/23-25/2023
Nitrate as N	mg/L	1.0	1.0	<0.040
Nitrite as N	mg/L	0.051J	0.042J	<0.042
Total Nitrogen (calculated)	mg/L	2.1	2.1	<0.036
Total Kjeldahl Nitrogen	mg/L	1.0	1.1	<0.065
Orthophosphate	mg/L	0.17	0.17	<0.0012
Total Phosphorus	mg/L	0.29	0.30	<0.018

< - Results less than the method detection limit.

J - Analyte was detected at a concentration below the reporting limit and above the method detection limit.  
Reported value is estimated.

### 3 DRY WEATHER OUTFALL MONITORING

The Responsible Agencies conducted dry weather monitoring at outfalls in the USMC HA as part of three monitoring approaches. These include the dry weather field screening of major storm drain outfalls in accordance with Permit Provision D.2.b(1), dry weather highest priority outfall monitoring in accordance with Permit Provision D.2.b.(2), and additional flow studies. Locations that were monitored in the 2022-2023 monitoring year are provided in Figure 3-1. Details of the monitoring programs can be found in the Carlsbad WMA MS4 Outfall Monitoring Plan (Carlsbad Participating Agencies, 2023 and in Attachment 2A).

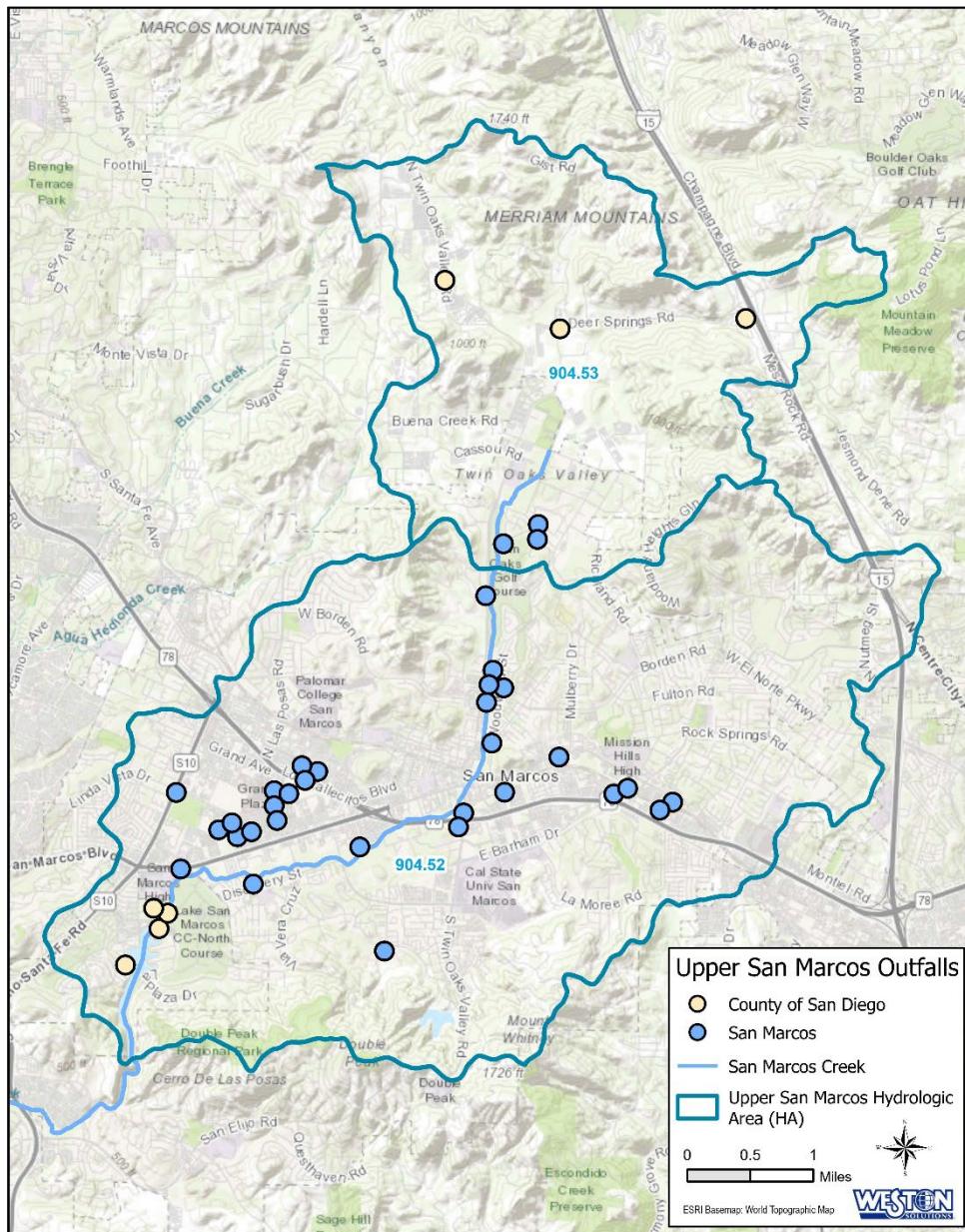


Figure 3-1. 2022-2023 Monitored Dry Weather Storm Drain Outfall Monitoring Locations

### **3.1 Dry Weather Field Screening of Major MS4 Outfalls**

The Permit requires Responsible Agencies to conduct field screening of major MS4 outfalls during dry weather (Permit Provision D.2.b(1)). Field screening is conducted to determine the outfall flow status, identify non-stormwater and illicit discharges, and prioritize those discharges that will be investigated and eliminated. Each Responsible Agency performs field screening of major storm drain outfalls to maintain an up-to-date inventory of major outfalls and to initiate follow-up investigations that identify and mitigate the source(s).

The County and City of San Marcos conducted dry weather field screenings at 41 major storm drain outfalls in the 2022-2023 monitoring year for a total of 84 visits (Table 3-1). The City of Escondido has not identified any major storm drain outfalls in its jurisdictional portion of the USMC HA.

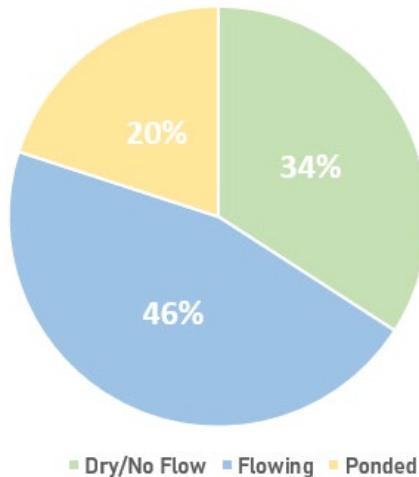
During field screening, the Responsible Agencies recorded visual observations of outfall and flow characteristics including:

- flow conditions (flowing, ponded, dry, or tidal);
- whether flow reached the receiving water;
- whether there was a non-stormwater flow source;
- potential non-stormwater sources;
- whether the flow source was eliminated;
- evidence of obvious illicit connections or illegal discharges (IC/IDs);
- whether trash was present, and relative amount; and
- whether there was evidence of illegal dumping.

**Table 3-1. 2022-2023 Field Screening Summary in USMC HA**

Responsible Agency	Number of Outfalls Screened	Total Number of Visits
City of San Marcos	34	68
County of San Diego	7	16
<b>Total</b>	<b>41</b>	<b>84</b>

Of the field screenings conducted 34% were classified as dry/no flow, 20% were observed with ponded or standing water, and 46% were observed with flowing water (Figure 3-2). Field screening data are provided in Attachment 3 of the 2022-2023 Carlsbad WMA WQIP Annual Report.



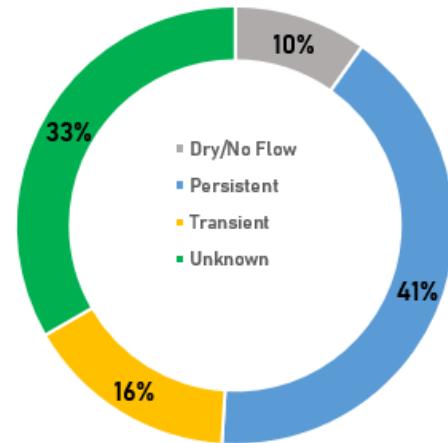
**Figure 3-2. Flow Observations by Category**

When flow was observed during field screening, the Responsible Agencies also recorded the estimated flow rate. The average flow rate observed for flowing outfalls during field screening visits in the USMC HA was 5.6 gallons per minute (gpm) and the median flow rate was 1 gpm.

Based on the field screening visits and available historical data, the Responsible Agencies determined the flow status of each major storm drain outfall as persistent, transient, or dry:

- Dry – no flowing or ponded water is observed at the outfall over three most recent visits.
- Persistent – presence of flowing or standing water upon three most recent visits.
- Transient – outfalls not meeting definition of dry or persistent.
- Unknown – outfalls where there is not enough information to classify as persistent, transient, or dry.

Figure 3-3 presents the number of outfalls in the USMC HA by flow status classification. 41% of the major storm drain outfalls were categorized as persistent, 16% were categorized as transient, 10% as dry, and 33% were categorized as unknown. The City of San Marcos added sixteen new major outfalls to their inventory, leading to a higher number of outfalls being categorized as unknown.



**Figure 3-3. Station Flow Status Categorization**

### **3.2 Dry Weather Highest Priority Outfall Monitoring**

Permit Provision D.2.b.(2) specifies requirements for dry weather monitoring of the highest priority MS4 outfalls with persistent flow. The purpose of this monitoring is to evaluate the potential impacts from MS4 outfall discharges on receiving water quality during dry weather conditions and to assess the ability of programs to effectively eliminate non-stormwater discharges to receiving waters.

All five of the City of San Marcos' highest priority persistently flowing outfalls in the Carlsbad WMA are located within the USMC HA as are three of the County's highest priority outfalls (Table 3-2). During the 2022-2023 monitoring year, the City of San Marcos replaced one of the highest priority persistent flow outfalls with a new monitoring location. OUT064 was removed and replaced with a downstream monitoring location INL11196, which was determined to be the start of the receiving water. Additional details can be found in Attachment 3 of the 2022-2023 Carlsbad WMA WQIP Annual Report

**Table 3-2. Highest Priority Outfalls Located in the USMC HA**

Outfall	Latitude	Longitude
<b>County of San Diego</b>		
MS4-CAR-069	33.12606	-117.2042
MS4-CAR-070	33.12631	-117.20506
MS4-CAR-072	33.12007	-117.20991
<b>City of San Marcos</b>		
INL11196	33.141520	-117.185570
OUT026	33.140360	-117.143040
OUT053	33.131170	-117.202480
OUT10236*	33.134930	-117.194780
OUT10330	33.138430	-117.137030

\*OUT10236 was monitored at an upstream proxy location

Two sampling events were conducted at each of the outfalls and grab samples were collected and analyzed for constituents, including nutrients. For complete results please refer to Attachment 3 of the 2022-2023 Carlsbad WMA WQIP Annual Report. For purposes of the USMC HA Monitoring and Assessment Report, only results for the HPWQC (nutrients) are presented in Table 3-3.

**Table 3-3. Nutrient Results from Highest Priority Outfall Monitoring Locations in the USMC HA**

Outfall	WQO for Assessment (mg/L)	Sample Date	Total Nitrogen (mg/L)	Total Phosphorus (mg/L)
<b>County of San Diego</b>				
MS4-CAR-069	Total nitrogen 0.25	5/24/2023	3.2	0.59
	Total phosphorus 0.025	7/31/2023	1.5	0.23
MS4-CAR-070		5/24/2023	2	0.03J

**Table 3-3. Nutrient Results from Highest Priority Outfall Monitoring Locations in the USMC HA**

Outfall	WQO for Assessment (mg/L)	Sample Date	Total Nitrogen (mg/L)	Total Phosphorus (mg/L)	
MS4-CAR-072		7/31/2023	1.4	0.05	
		5/24/2023	3.4	0.2	
		7/31/2023	1.3	0.16	
<b>City of San Marcos</b>					
INL11196	Total nitrogen 1.0 Total phosphorus 0.1	8/16/2023	3.6	0.097	
OUT026		8/30/2023	1.6	0.17	
OUT053		8/15/2023	0.62	<0.050	
OUT10236-1		8/29/2023	1.1	0.077	
OUT10330		8/16/2023	0.87	0.2	
		8/30/2023	1.8	0.22	
OUT10330		8/15/2023	1.7	0.15	
		8/29/2023	1.4	0.15	
OUT10330		8/17/2023	5.4	0.13	
		8/31/2023	4.9	0.11	

< - Results less than the reporting limit

J – Results are greater than the method detection limit but below the reporting limit. Reported result is estimated.

### 3.3 Additional Studies

#### 3.3.1 County of San Diego Monitoring

To measure progress toward dry weather goals and to better understand flow sources of dry weather outfall discharges, the County has conducted dry weather continuous flow monitoring from 2016-2023 at several sites within the USMC HA. During the 2022-2023 monitoring year, the County of San Diego conducted a dry season continuous flow monitoring study within the Carlsbad WMA from 2016. During the 2023 monitoring year, the County monitored two HPPF outfalls, MS4-CAR-070 and MS4-CAR-072, and three additional upstream outfalls MS4-CAR-072C, MS4-CAR-072H, and MS4-CAR-072Q. All sites will be revisited and considered in the prioritization process prior to the 2024 monitoring year.

To be consistent with previous analyses, continuous flow data from 2023 was compared to 2017 to evaluate progress towards interim dry weather goals. In 2023, the combined mean daily dry weather discharge rate from MS4-CAR-070 and MS4-CAR-072 decreased by 37% when compared to 2017. Table 3-4 provides an overview of dry weather continuous flow results from 2017-2023.

The highest flows observed during seven years of monitoring were attributable to MS4-CAR-072 (Table 3-4). Stable isotope analysis results were inconclusive at this site for evaluating the source of the water discharged. Geochemistry analysis showed that flow from the main outfall, MS4-CAR-072, consisted predominantly of groundwater mixed with some tap water. The golf course and several of the HOAs in the drainage area irrigate with water from groundwater wells. A flow

pattern was noted on the hydrograph with peaks of flow recorded in late evenings or early morning hours, which is typical of an over-irrigation signature.

To further investigate the relative contributions of various potential sources of flow, additional locations upstream of MS4-CAR-072 (MS4-CAR-072C, MS4-CAR-072H, and MS4-CAR-072Q) were outfitted in 2023 with weirs and continuous flow monitoring equipment. The location MS4-CAR-072C drains several HOA neighborhoods. The outfall locations MS4-CAR-072H and MS4-CAR-072Q were installed to specifically measure contributions from the golf course and adjacent neighborhoods.

For the 2023 dry season, flow from MS4-CAR-072C, MS4-CAR-072H and MS4-CAR-072Q accounted for approximately 104% of the flow. Previous year's results from outfall locations MS4-CAR-072H and MS4-CAR-072Q indicate that approximately 40% of flow at the main outfall is attributable to these sites, with less than 10% from the residential areas upstream of the golf course. For the 2023 dry season, flow from these two locations accounted for approximately 44% of the total flow. The location MS4-CAR-072C was designed to measure contributions from the private residential storm drain system located west of MS4-CAR-072. Flow from this location accounted for approximately 60% of the flow. The location may be capturing flow from the residences and main outfall network, but the information suggests a significant contribution of flow is coming from this private residential system.

**Table 3-4. County of San Diego Dry Weather Continuous Flow Results 2017-2023**

Outfall	Hydrologic Area	Mean Flow (gal/day)								% Difference					
		2016	2017	2018	2019	2020	2021	2022	2023	(2017-2018)	(2017-2019)	(2017-2020)	(2017-2021)	(2017-2022) <sup>1</sup>	(2017-2023)
MS4-CAR-070	San Marcos	1,472	2,240	1,594	2,760	2,822	1,067	-	1,982	-29%	23%	26%	-52%	-	-12%
MS4-CAR-070E		-	-	-	-	2,131	437	-							
MS4-CAR-072		4,264	7,320	4,245	3,059	6,984	2,816	-	4,063	-42%	-58%	-5%	-62%	-	-44%
MS4-CAR-072C		-	-	-	-	7,142	1,887	-	2,419						
MS4-CAR-072O		-	-	259	185	648	-	-	-						
MS4-CAR-072H		-	-	-	-	1,181	697	1,327	1,009						
MS4-CAR-072Q		-	-	-	-	518	518	-	778						
Mean of San Marcos HA Sites		2,868	4,780	2,920	2,909	4,903	1,942	1,327 <sup>1</sup>	6,045	-39%	-39%	3%	-59%		-37%

<sup>1</sup> Only one site was monitored in 2022, MS4-CAR-072H. This site was not monitored in 2017; therefore the percent difference and mean could not be calculated.

### 3.3.2 City of San Marcos Monitoring

The City of San Marcos completed continuous flow monitoring at several locations for each of the past several summers as described in the City of San Marcos MS4 Outfall Monitoring and Special Study Implementation Sampling and Analysis Plan (SAP)/Quality Assurance Project Plan (QAPP) (Mikhail Ogawa Engineering (MOE, 2018). The special study described in that monitoring plan concluded in summer 2021.

In summer 2023, the City of San Marcos completed additional dry season monitoring consistent with the Upper San Marcos Creek Preliminary Monitoring Plan (Attachment 2A). This included continuous flow monitoring at two selected outfalls (Table 3-5).

**Table 3-5. USMC HA Continuous Flow Monitoring Outfalls – City of San Marcos**

Location Type	Station Name	Years with Continuous Monitoring
Highest priority persistently flowing outfalls	OUT002	2016-2017, 2017-2018, 2018-2019, 2019-2020, 2020-2021, 2021-2022
	OUT023 <sup>1</sup>	2016-2017, 2017-2018, 2018-2019
	<b>OUT053</b>	2016-2017, 2017-2018, 2018-2019, 2019-2020, 2020-2021, 2021-2022, 2022-2023
	OUT1023 <sup>2</sup>	2016-2017, 2017-2018, 2018-2019
	OUT10330 <sup>1</sup>	2016-2017, 2017-2018, 2018-2019
Alternative sites	INL086 <sup>2,3</sup>	2019-2020, 2020-2021
	<b>CH043C<sup>3</sup></b>	2019-2020, 2020-2021, 2021-2022, 2022-2023

Bold text indicates site was monitored during the 2021-2022 monitoring year.

<sup>1</sup> OUT023 and OUT10330 were not monitored in monitoring years 2019-2020 and 2020-2021 due to change of study focus to address commercial and industrial inputs.

<sup>2</sup> In 2022 it was determined that OUT10237 and INL086 were located in the receiving water. These sites were removed from the MS4 outfall inventory.

<sup>3</sup> Alternative sites for OUT10237.

Average daily dry weather flows monitored during the summer months (July through September) are presented by year in Table 3-5. To ensure accurate representation of dry weather flows, wet weather days (rainfall >0.1 inch) and the following 72 hours were removed from consideration. The list of monitored outfalls was changed during the 2019-2020 monitoring year to refine the study to specific commercial/industrial areas.

**Table 3-6. City of San Marcos Dry Season Continuous Flow Results**

Outfall	Mean Flow (gallons/day)						
	2017	2018	2019	2020	2021	2022	2023
OUT002	18,919	14,678	11,715	12,074	13,762	16,808*	-
OUT023	10,685	6,724	5,083	-	-	-	-
OUT053	18,785	15,230	13,304	14,800	16,618	15,280	17,523

**Table 3-6. City of San Marcos Dry Season Continuous Flow Results**

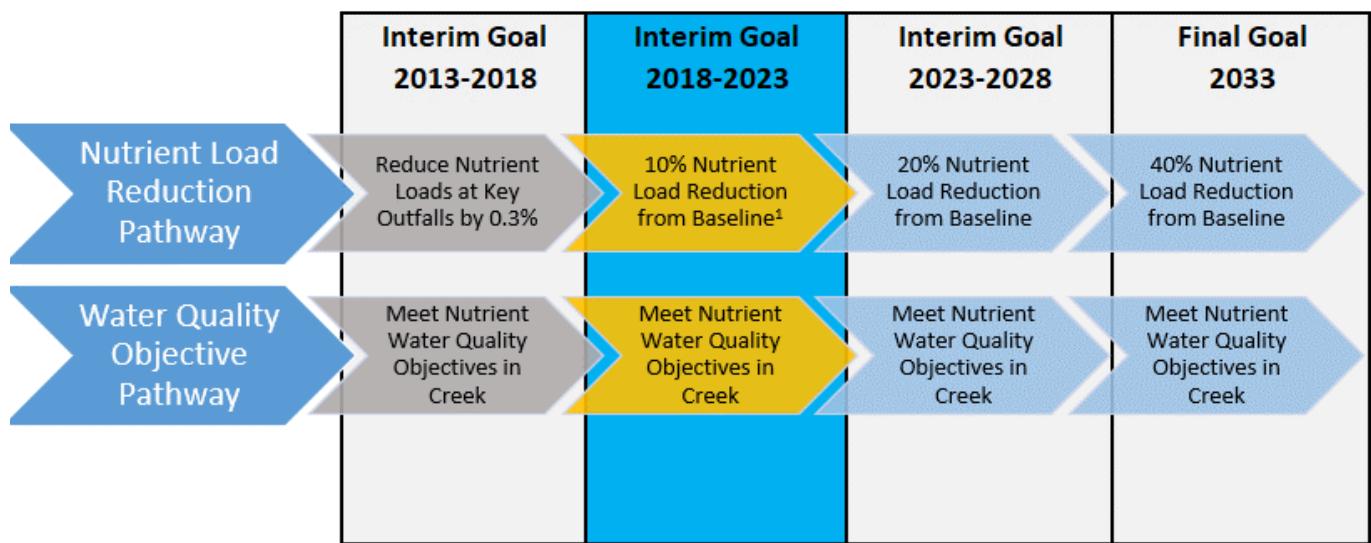
Outfall	Mean Flow (gallons/day)						
	2017	2018	2019	2020	2021	2022	2023
INL086	-	-	-	20,058	18,842	-	-
CH043C	-	-	-	10,377	10,296	9,037	6,267
OUT10237	72,003	40,085	36,758	-	-	-	-
OUT10330	35,821	27,190	26,110	-	-	-	-

\* Visual observations indicate that only a portion of measured flow reached the receiving water, though the exact amount is unknown.

## 4 PROGRESS TOWARDS GOALS ASSESSMENT

### 4.1 Wet Weather Goals Assessment

The Carlsbad WMA WQIP provides multiple pathways to achieve milestones for wet weather nutrient reductions in the USMC HA. Achievement of the interim wet weather goals for 2018-2023 can be demonstrated in one of two ways; by measuring a 10% nutrient load reduction from the baseline in the WQIP or by meeting nutrient WQOs at the receiving water station in the HA. These pathways are summarized in Figure 4-1.



1 – The WQIP Baseline was the annual load calculated in Appendix D of the 2010-2011 Receiving Waters and Urban Runoff Monitoring Report at Station SM-TWAS.



Figure 4-1. Current WQIP Wet Weather Compliance Pathway Summary

#### 4.1.1 2022-2023 Wet Weather Load Assessment Method Modification

For the 2020-2021 assessment, the Responsible Agencies updated the wet weather baseline load to improve comparability between the baseline and data collected under the current monitoring program. The Responsible Agencies adjusted the methodology again for the 2021-2022 assessments in response to comments received from the San Diego Regional Water Quality Control Board (San Diego Water Board) in the August 2022 letter. The updated methodology is described in the following sections as well as in Attachment 2A (Upper San Marcos Creek Preliminary Monitoring Plan).

##### 4.1.1.1 Baseline Load Updates

For the WQIP, the annual wet weather load from the 2010-2011 year was selected as the baseline load for Upper San Marcos Creek. This baseline represented the most recent monitoring conducted at the

SM-TWAS-1a station prior to the issuance of Investigative Order R9-2011-0033. Under the current monitoring program, wet weather monitoring is conducted at the upstream location, SM-TWAS-1b (Via Vera Cruz) when possible. In 2022-2023, wet weather monitoring was conducted at SM-TWAS-1a due to ongoing construction preventing access to SM-TWAS-1b. Station locations are provided in Figure 4-2.

To improve comparability between yearly loads calculated from data collected at the two different stations, the loads for monitoring years 2017 through 2022 were adjusted to include an estimate of volume from the Los Posas Branch and tributary area. Estimate volumes were not included in this year's assessment due to SM-TWAS-1a being located downstream of the Los Posas Branch and tributary areas.

Table 4-1 presents the volume and annual loads at station SM-TWAS-1a for the baseline (2010-2011) year.

**Table 4-1. Baseline (2010-2011) Annual Wet Weather Load Calculation at SM-TWAS-1a**

Monitoring Year	Site	Rain (in)	Volume (Gallons)	Loads (Baseline) (lbs/yr)	
				Total Nitrogen	Total Phosphorus
2010-2011	SM-TWAS-1a	16.16	3,302,007,603	88,904	6,867

#### **4.1.1.2 Wet Weather Loads Assessment and Comparability**

To assess the progress toward the load reduction goals, the wet weather loads from the baseline annual wet weather at station SM-TWAS-1a (2010-2011) were compared to the 2022-2023 loads for the SM-TWAS-1a monitoring station. The Las Posas Tributary Area loads were captured by monitoring station SM-TWAS-1a. Table 4-2 shows the wet weather loads for the 2022-2023 assessment year.

**Table 4-2. 2022-2023 Wet Weather Load Assessment Calculations**

Constituent	SM-TWAS-1a (lbs/yr)
Total Nitrogen	33,883
Total Phosphorus	4,679

Table 4-3 presents the annual wet weather loads, the volume of discharge, measured concentrations in USMC, and rainfall for the baseline year (2010-2011) and the 2017-2018, 2018-2019, 2019-2020, 2020-2021, 2021-2022, and 2022-2023 monitoring years for the equivalent watershed and SM-TWAS-1a. Annual wet weather loads are impacted by a number of factors including the number, size, and intensity of storm events in a given year.

As shown in Table 4-3, the 2022-2023 loads are lower than the baseline for total nitrogen and total phosphorus loads (reduced by 51.22% and 38.41%, respectively). Therefore, the Responsible Agencies

are currently meeting the 2018-2023 wet weather interim goal for total nitrogen and total phosphorus. The load reductions calculated for the 2022-2023 year are lower than those calculated for previous years due to the higher precipitation measured in 2022-2023 than previous years. The Responsible Agencies are continuing to implement WQIP strategies to address nutrient load reduction and overall water quality improvement. Additional strategy details are provided in Appendix D of the 2022-2023 Carlsbad WMA WQIP Annual Report.

**Table 4-3. Wet Weather Receiving Water Loads Assessment for SM-TWAS-1a Watershed**

Condition	Volume (gallons)	Rainfall (inches) <sup>1</sup>	Concentrations (mg/L)		Loads (lbs/yr) *		Percent Reduction from Baseline	
			Total Nitrogen	Total Phosphorus	Total Nitrogen	Total Phosphorus	Total Nitrogen	Total Phosphorus
Baseline Annual Wet Weather Load (2010-2011)	3,302,007,603	16.16	3.2	0.35	88,904	6,867	NA	NA
2017-2018 Annual Wet Weather Load*	317,460,935	6.76	2.5	0.38	6,623	1,007	92.49%	89.56%
2018-2019 Annual Wet Weather Load*	1,545,028,119	14.32	1.61	0.28	20,759	3,610	76.46%	62.57%
2019-2020 Annual Wet Weather Load*	1,301,145,442	19.93	1.67	0.36	18,134	3,909	79.44%	59.47%
2020-2021 Annual Wet Weather Load*	284,224,458	6.7	2.1	0.37	4,981	878	94.35%	90.90%
2021-2022 Annual Wet Weather Load*	393,260,822	7.3	1.57	0.2	5,153	656	94.16%	93.19%
2022-2023 Annual Wet Weather Load	2,454,586,533	23.09	2.1	0.29	43,017	5,940	51.22%	38.41%

mg/L – milligrams per Liter, lbs/yr – pounds per year

\*Loads for SM-TWAS-1a Equivalent (measured loads for station SM-TWAS-1b plus the estimated load for Las Posas Tributary Area based on Transposition Factor of 0.27)

<sup>1</sup> Rainfall from San Marcos CRS Station 27090 from October 1 – April 30

#### **4.1.2 Comparison to Water Quality Objectives**

Achievement of the interim wet weather goal for 2018-2023 may also be demonstrated through nutrient concentrations below the receiving water WQO. The WQOs used for comparison are specified in the WQIP and are WQOs for nutrients in a creek just before it enters a standing body of water (0.5 milligrams per Liter (mg/L) for total nitrogen and 0.05 mg/L for total phosphorus). Total nitrogen and total phosphorus concentrations were above these WQOs during the February 23-25, 2023 wet weather event (Table 4-4).

**Table 4-4. Wet Weather Receiving Water Results Assessment**

Parameter	WQO (mg/L)	2022-2023 Concentration (mg/L)
Total Nitrogen	0.5	2.1
Total Phosphorus	0.05	0.29

WQO – water quality objective, mg/L – milligrams per Liter

#### **4.2 Dry Weather Goals Assessment**

During the 2021-2022 monitoring year, the Responsible Agencies re-evaluated the USMC HA dry weather goals to factor in data and information acquired since the development of the WQIP goals. With this information, the Responsible Agencies and the San Diego Water Board staff coordinated to revise dry weather goals which were submitted in the 2021-2022 Carlsbad WMA WQIP Annual Report and subsequently approved by the Regional Board. These revisions included changes to the current dry weather goals and included a new implementation-based goal. A summary of the goals is provided in Table 4-5.

**Table 4-5. Dry Weather Compliance Pathway Summary<sup>1</sup>**

Interim Goal (2018-2023) 2023	Final Goal (2023-2028) 2028
<ol style="list-style-type: none"> <li>1. Effectively eliminate 20% of the dry weather flow<sup>2</sup> from identified outfall(s)<sup>3</sup>. OR</li> <li>2. Effectively eliminate two persistently flowing outfalls. OR</li> <li>3. Dry weather flow from identified outfalls meets the nutrient WQO<sup>4</sup> for the applicable water body segment. OR</li> <li>4. Address all items below:             <ol style="list-style-type: none"> <li>a. Inspect high TTWQ agricultural facilities annually and inspect all other (i.e., medium and low TTWQ) inventoried agricultural facilities at least once every five years<sup>5</sup>. AND</li> <li>b. Inspect all inventoried golf courses once every two years<sup>5</sup>. AND</li> <li>c. Conduct outreach to 10% of identified HOAs and completion of the Fairways HOA Retrofit Pilot Project<sup>6</sup>. AND</li> <li>d. 10% of identified residences and businesses on septic systems receive outreach<sup>7</sup>.</li> </ol> </li> </ol>	<ol style="list-style-type: none"> <li>1. Effectively eliminate 40% of the dry weather flow<sup>2</sup> from identified outfall(s)<sup>3</sup>. OR</li> <li>2. Dry weather flow from identified outfalls meets the nutrient WQO for the applicable water body segment. OR</li> <li>3. Address of items below:             <ol style="list-style-type: none"> <li>a. Inspect all high TTWQ agricultural facilities at least once per year and up to four times annually, depending on compliance history. Inspect medium TTWQ inventoried agricultural facilities at least once every two years and low TTWQ inventoried agricultural facilities at least once every five years. AND</li> <li>b. Inspect all inventoried golf courses once every two years. AND</li> <li>c. Conduct outreach to 20% of identified HOAs and implementation of additional incentive and rebate programs where opportunities arise.</li> <li>d. 20% of identified residences and businesses on septic systems receive outreach.</li> <li>e. Implement a Septic System Pump-out Rebate Program offered on a first come, first served basis to partially offset the cost of septic system pumping.</li> </ol> </li> </ol>

TTWQ = Threat to Water Quality; HOA = Homeowners Association

<sup>1</sup> The City of Escondido has not identified any major MS4 outfalls within its portion of the watershed.

<sup>2</sup> Dry weather flow included all non-stormwater discharges from an outfall including exempt or permitted non-stormwater discharges in accordance with the MS4 Permit.

<sup>3</sup> Baseline: Total discharge of 13,746,581 gallons/year, calculated from continuous dry weather flow monitoring conducted during the 2016-2017 monitoring year. A list of identified outfalls and associated baseline calculations are included in the Upper San Marcos Creek HA Preliminary Monitoring Plan. <http://www.projectcleanwater.org/download/carlsbad-wma-monitoring-plans/>

<sup>4</sup> WQO for nutrients: In a creek = 0.1 mg/L Total Phosphorous and 1.0 mg/L Total Nitrogen; in a creek just before it enters a standing body of water = 0.05 mg/L Total Phosphorous and 0.5 mg/L Total Nitrogen; standing body of water = 0.025 mg/L Total Phosphorous and 0.25 mg/L Total Nitrogen.

<sup>5</sup> Baseline: Inspect all inventoried facilities once every five years per MS4 Permit Provisions E.5.c (1)

<sup>6</sup> Baseline: Limited to no outreach to HOAs regarding incentive and rebate programs.

<sup>7</sup> Baseline: Residences and businesses on septic systems receive outreach on proper use and maintenance as needed (0% residences and businesses receive outreach). No Septic System Pump-out Rebate Program Offered.

#### **4.2.1 Dry Weather Flow Reduction**

The first of the dry weather pathways (Table 4-5) was updated in the 2021-2022 Carlsbad WMA WQIP Annual Report. At the time of the WQIP publication, there was no available data to quantify the baseline anthropogenic flows. The Responsible Agencies of San Diego County and the City of San Marcos began dry weather flow monitoring at select priority outfalls in the USMC HA in 2016 and 2017 with the goal of determining flow sources and establishing a baseline of anthropogenic flows. While the studies provided valuable information, it did not result in a clear methodology to partition flows in this watershed. For that reason, the pathway was revised to an interim goal (2018-2023) to effectively eliminate 20% of the total dry weather flow from identified outfalls. Dry weather flow includes all non-stormwater discharges from an outfall including exempt or permitted non-stormwater discharges in accordance with the MS4 Permit.

The total flows at the monitored outfalls were used to establish a baseline for each of the outfalls. To establish the baseline, the daily volume of discharge was calculated for each station for each dry weather day monitored. Rainfall data from the San Diego County Rainfall and Stream Level System (San Marcos Station) were used to exclude days with >0.1 inch of flow and the following 72 hours. The average of the daily volumes was calculated for each month and applied to the number of dry weather days in that month to determine the monthly volume. For months occurring outside of the monitoring period, the average daily volume for the entire monitoring period was calculated and applied to the number of dry weather days. All calculated monthly volumes were summed to quantify the yearly volume of dry weather discharge from the 2016-2017 monitoring year for each outfall (Table 4-6). Additional information on the baseline calculation is provided in Attachment 2A.

To determine progress on overall flow reductions, the same approach was then used to calculate the dry weather total discharge for the outfalls monitored during the 2022-2023 monitoring year (Table 4-6). Flow data was collected either by continuous flow monitoring or instantaneous flow measurements. Additional details on the approach are provided in Attachment 2A, data are provided in Attachment 3 to the 2022-2023 Carlsbad WMA WQIP Annual Report.

Based on this analysis, the Responsible Agencies have reduced an estimated 30.40% of total flows at these outfalls when comparing 2022-2023 to the 2016-2017 baseline. The Responsible Agencies are currently meeting the interim goal of a reduction of dry weather flow from the monitored outfalls.

**Table 4-6. Outfall Dry Weather Annual Discharge Assessment**

Station ID	2016-2017 Baseline Total Discharge (gallons) <sup>1</sup>	2017-2018		2018-2019		2019-2020		2020-2021		2021-2022		2022-2023	
		Total Discharge (gallons) <sup>1</sup>	Percent Change from Baseline	Total Discharge (gallons)	Percent Change from Baseline	Total Discharge (gallons)	Percent Change from Baseline						
MS4-CAR-070	750,490	744,115	-0.85%	642,621	-14.37%	834,786	11.23%	499,013	-33.51%	608,433 <sup>2</sup>	-18.23% <sup>4</sup>	438,519 <sup>1</sup>	-41.57%
MS4-CAR-072	2,172,041	2,095,116	-3.54%	752,001	-65.38%	2,159,495	-0.58%	1,248,936	-42.50%	430,018 <sup>2</sup>	-79.48% <sup>4</sup>	1,019,388 <sup>1</sup>	-53.07%
OUT002	5,237,440	4,077,739	-22.14%	3,127,896	-40.28%	3,436,792	-34.38%	4,512,642	-13.84%	4,814,781 <sup>1,3</sup>	-8.41%	-	NA
OUT023	3,283,171	1,857,955	-43.41%	1,357,112	-58.66%	-	NA	-	NA	-	NA	-	NA
OUT053	5,586,610	4,230,406	-24.28%	3,552,144	-36.42%	4,072,360	-27.10%	5,375,223	-3.78%	4,846,878	-14.18%	4,464,666 <sup>1</sup>	-20.08%
OUT10237	26,398,126	11,075,609	-58.04%	9,814,420	-62.82%	-	NA	-	NA	-	NA	-	NA
OUT10330	12,628,294	7,534,912	-40.33%	6,971,427	-44.80%	-	NA	-	NA	-	NA	-	NA
Total for Monitored Outfalls		31,615,853	<b>-43.60%</b>	26,217,620	<b>-53.23%</b>	10,503,433	<b>-23.59%</b>	11,635,813	<b>-15.35%</b>	10,700,110	<b>-22.16%</b>	5,992,573	<b>-30.40%</b>

<sup>1</sup> Flow was monitored continuously during the dry weather season.

<sup>2</sup> Flow was monitored in 2021-2022 by instantaneous flow measurements (n=8 for MS4-CAR-070 and n= 8 for MS4-CAR-072).

<sup>3</sup> As discussed in Section 3.3.2 the measured discharge volume is an overestimate as a hydrologic disconnect was observed between the outfall and receiving water body, the exact contribution is unknown.

<sup>4</sup> The percent change from baseline was updated after an error in the calculation.

## 4.2.2 Comparison to Water Quality Objectives

The interim dry weather goal for 2018-2023 may also be demonstrated by MS4 outfall discharge concentrations meeting the nutrient WQO for the applicable water body segment. During the 2022-2023 monitoring year, 8 outfalls were sampled in the USMC HA. Nutrient results were compared to WQOs specified in the WQIP. For MS4-CAR-069, MS4-CAR-070, and MS4-CAR-072 the WQOs for a standing body of water (0.025 mg/L for total phosphorus and 0.25 mg/L for total nitrogen) were applied. For the remaining outfalls, the WQO for flowing streams (0.1 mg/L for total phosphorus and 1.0 mg/L for total nitrogen) were used.

Total nitrogen concentrations were above the applicable WQOs in 14 of the 16 samples collected during the highest priority outfall monitoring in the 2022-2023 monitoring year. One sample each from OUT026 and OUT053 had total nitrogen concentrations below WQOs. Total phosphorus concentrations were above the applicable WQOs in 13 out of 16 samples collected. Both samples from OUT026 and one sample from INL11196 were below the WQOs.

**Table 4-7. Assessment of Nutrient Results from the Highest Priority Outfall Monitoring Locations in the USMC HA**

Outfall	WQO for Assessment (mg/L)	Sample Date	Total Nitrogen (mg/L)	Total Phosphorus (mg/L)	
<b>County of San Diego</b>					
MS4-CAR-069		5/24/23	3.2	0.59	
		7/31/23	1.5	0.23	
MS4-CAR-070	Total nitrogen 0.25 Total phosphorus 0.025	5/24/23	2.0	0.037J	
		7/31/23	1.4	0.05	
MS4-CAR-072		5/24/23	3.4	0.2	
		7/31/23	1.3	0.16	
<b>City of San Marcos</b>					
OUT026	Total nitrogen 1.0 Total phosphorus 0.1	8/15/23	0.62	<0.05	
		8/29/23	1.1	0.077	
OUT053		8/16/23	0.87	0.2	
		8/30/23	1.8	0.22	
INL11196		8/16/23	3.6	0.097	
		8/30/23	1.6	0.17	
OUT10236-1*		8/15/23	1.7	0.15	
		8/29/23	1.4	0.15	
OUT10330		8/17/23	5.4	0.13	
		8/31/23	4.9	0.11	

WQO – water quality objective, mg/L – milligram per liter

< - Results are less than the reporting limit

J – Results are greater than the method detection limit but below the reporting limit. Reported result is estimated.

Shaded cells indicate result is above the WQO.

\*Proxy site for OUT10236

### **4.2.3 Elimination of Persistently Flowing Outfalls**

The third pathway to demonstrate achievement of the 2018-2023 interim goal is the effective elimination of two persistently flowing outfalls. The County and City of San Marcos are continuing their efforts to reduce and eliminate dry weather flows at persistent outfalls. Table 4-8 presents the number of persistently flowing outfalls in the USMC HA by monitoring year.

The total number of persistent outfalls in the USMC HA is three outfalls higher in 2022-2023 compared with the baseline year of 2016-2017. It should be noted that a large contributor to the increase seen in 2019-2020 was the classification of outfalls that did not have enough information in 2016-2017 to classify them as either persistent, transient, or unknown. During the 2019-2020 monitoring year, thirteen outfalls previously labelled as unknown became classified as persistent (seven outfalls), transient (five outfalls), or dry (one outfall). In 2021-2022, the City of San Marcos conducted a review of its major outfall inventory and removed eight locations and added six new outfalls to their inventory. During the 2022-2023 monitoring year, the City of San Marcos reviewed its major outfall inventory and added fifteen locations and removed six locations. The additional outfalls added after the review led to several outfalls being classified as unknown and accounts for a portion of the decrease of major MS4 outfalls classified as persistent.

**Table 4-8. Persistently Flowing Major MS4 Outfalls in the USMC HA**

Jurisdiction	Baseline 2016-2017	Number of Persistently Flowing Outfalls					
		2017-2018	2018-2019	2019-2020	2020-2021	2021-2022	2022-2023
City of San Marcos	14	14	15	23	26	16	17
County of San Diego	4	4	5	5	4	4	4
<b>Total</b>	<b>18</b>	<b>18</b>	<b>20</b>	<b>28</b>	<b>30</b>	<b>20</b>	<b>21</b>
<b>Change</b>	<b>NA</b>	<b>0</b>	<b>+2</b>	<b>+10</b>	<b>+12</b>	<b>+12</b>	<b>+3</b>

### **4.2.4 Stormwater Program Implementation**

The fourth pathway to meet the interim 2018-2023 goal is through the implementation of stormwater inspection and outreach programs by the Responsible Agencies. In fiscal year (FY) 22-23, the Responsible Agencies implemented inspection programs at facilities that could pose a threat to water quality and provided outreach and educational materials to HOAs and properties that utilize septic systems. The Responsible Agencies have met the interim goal as described below.

#### ***4.2.4.1 Inspect High Threat to Water Quality (TTWQ) Agricultural Facilities Annually and Inspect All Other Inventoried Facilities At Least Once Every Five Years***

During FY22-23, there was a total of 84 inventoried commercial agricultural facilities within the USMC HA; 30 facilities were ranked as a high TTWQ and 54 were ranked as a medium TTWQ. There were no sites ranked as low TTWQ.

The Responsible Agencies conducted 147 inspections at these facilities. A total of 76 inspections were conducted at sites ranked as high TTWQ and 71 were conducted at medium TTWQ sites. Of the 84

inventoried facilities, all but one high TTWQ sites were inspected. One high TTWQ facility in the City of San Marcos was not inspected due to access issues from the property owner. The City of San Marcos is continuing to work with the property owner to facilitate access. All medium TTWQ sites have been inspected at least once in the past five years.

#### **4.2.4.2 *Inspect all Inventoried Golf Courses Once Every Two Years***

The Responsible Agencies inspected all three inventoried golf courses in FY22-23. Only one site had violations related to routine maintenance. All violations were resolved, and corrective actions were completed within 30 days.

#### **4.2.4.3 *Conduct Outreach to 10% of Identified HOAs and Complete the Fairways HOA Retrofit Pilot Project***

Eight of 22 (36%) identified HOAs were provided outreach on the County's Waterscape Rebate Program. Outreach included phone calls, emails, and/or in person meetings. Six HOAs are participating in the Program's Landscape Optimization Service where each HOA has committed to converting at least 10,000 square feet (sf) of turf grass to sustainable landscaping.

In FY19-20, the County initiated a partnership with The Fairways HOA in the Lake San Marcos area (MS4-CAR-072 Drainage/Focus Area) with the goal of establishing a pilot demonstration project for the County's Waterscape Rebate Program. The pilot project included replacing old irrigation controllers with smart weather-based irrigation controllers. The HOA installed four new controllers that operate 136 stations and completed nozzle upgrades. Five years (June 2018 through June 2023) of water usage data collected from four dedicated irrigation meters at The Fairways HOA indicate approximately 36% decrease in water usage since completing the project. It should be noted that there was a 53.07% dry weather flow reduction measured at Outfall MS4-CAR-072 during the 2022-2023 monitoring year.

After completion of the pilot project in FY22-23, the HOA also replaced approximately 23,000 sf of turf with sustainable landscaping, including 10,000 sf with native plants, as shown in Figure 4-2 and Figure 4-3 below.



**Figure 4-2.Fairways HOA Turf Replacement – Before**



**Figure 4-3.Fairways HOA Turf Replacement - After**

In FY22-23, the City of San Marcos refined the existing HOA and property manager database through collaboration with several city departments and Vallecitos Water District. In FY23-24, the City will conduct HOA outreach activities in conjunction with the City's Water Smart Landscape Initiative to support irrigation runoff reduction.

#### **4.2.4.4 10% of Identified Residences and Businesses on Septic Systems Receive Outreach**

Based on available data, the Responsible Agencies have identified 53 residences and businesses that are likely on septic systems. A total of 26 of the 53 (49%) identified residences and businesses received outreach consisting of mailed letters and fliers.

## 5 REFERENCES

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Carlsbad WMA Responsible Agencies. 2018. *Carlsbad Watershed Management Area Water Quality Improvement Plan*. Prepared by MOE, et. al. Revised January 2021.

Carlsbad WMA Responsible Agencies. 2019. *Carlsbad WMA MS4 Monitoring Plan*. Prepared by Wood Environmental. Revised by Weston Solutions, Inc. January 2022 and January 2023

MOE (Mikhail Ogawa Engineering). 2018. *City of San Marcos MS4 Outfall Monitoring and Special Study Implementation SAP/QAPP*. Prepared for the City of San Marcos. May, 2018.

Weston (Weston Solutions, Inc.). 2019. *Upper San Marcos Creek Preliminary Monitoring Plan*. Revised January 2022, January 2023, and 2024

**Attachment 2A – Upper San  
Marcos Creek Preliminary  
Monitoring Plan**

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# Upper San Marcos Creek Preliminary Monitoring Plan

## Prepared For:

County of San Diego  
City of San Marcos  
City of Escondido



## Prepared By:

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WESTON Project Number: 13245.563.087

December 2019  
Revised August 2020  
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## Acronyms and Abbreviations

CDFW	California Department of Fish and Wildlife
CEDEN	California Environmental Data Exchange Network
COC	chain-of-custody
County	County of San Diego
Creek	Upper San Marcos Creek
EDDs	electronic data deliverables
HA	Hydrologic Area
HOA	Homeowner's Association
HPWQC	highest priority water quality condition
IC/ID	illicit connection/illicit discharges
Lake	Lake San Marcos
MOE	Mikhail Ogawa Engineering
Monitoring Plan	Preliminary Upper San Marcos Creek Monitoring Plan
MQO	measurement quality objective
MS4	municipal separate storm sewer system
NA	not applicable
Permit	San Diego Water Board Order No. R9-2013-0001, as amended by Order Nos. R9-2015-0001 and R9-2015-0100
QA	quality assurance
QA/QC	quality assurance/quality control
QAPP	quality Assurance Project Plan
QC	quality control
Responsible Agencies	San Diego County Responsible Agencies
SAP	sampling and analysis plan
San Diego Water Board	San Diego Regional Water Quality Control Board
SM	standard method
SOPs	standard operating procedures
SWAMP	Surface Water Ambient Monitoring Program
SWRCB	State Water Resources Control Board
TKN	total Kjeldahl nitrogen
TSS	total suspended solids
TTWQ	threat to water quality
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
Weck	Weck Laboratories, Inc.
Weston	Weston Solutions, Inc.
WMA	watershed management area
WQIP	Water Quality Improvement Plan
WQO	water quality objective

## **Units of Measure**

°C	degrees Celsius
cfs	cubic feet per second
mg/L	milligram per Liter
NTU	nephelometric turbidity unit
pH	hydrogen ion concentration
µS/cm	microsiemens per centimeter

## **1.0 BACKGROUND AND INTRODUCTION**

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### **1.1 Watershed Overview**

Upper San Marcos Creek (Creek), located in Northern San Diego County drains an area of approximately 18,540 acres (DBSA, 2016) within the Carlsbad Watershed Management Area (WMA). The Creek receives flow from areas under the jurisdiction of the Cities of San Marcos and Escondido and unincorporated areas of the County of San Diego (County) (San Diego Regional Water Quality Control Board [San Diego Water Board], 2019) before flowing into Lake San Marcos (Lake). Both the Lake and Creek are designated as impaired water bodies on the California 303(d) list of water quality limited segment for nutrients and other pollutants. (San Diego Water Board, 2019).

### **1.2 Background**

The San Diego County Responsible Agencies (Responsible Agencies) are required to conduct water quality monitoring in accordance with the criteria set forth in the San Diego Water Board Order No. R9-2013-0001, as amended by Order Nos. R9-2015-0001 and R9-2015-0100 (Permit), effective November 18, 2015 (San Diego Water Board, 2013). The Permit requires the development of a Water Quality Improvement Plan (WQIP) for each of the WMAs. The WQIP guides the Responsible Agencies' jurisdictional runoff management programs towards achieving the outcome of improved water quality in municipal separate storm sewer system (MS4) discharges and receiving waters. Specifically, the Responsible Agencies must develop a program to monitor and assess progress towards 1) achieving the numeric goals and schedules incorporated into the WQIP and 2) addressing the highest priority water quality conditions identified by the WQIP.

The Responsible Agencies of the Carlsbad WMA developed the Carlsbad WQIP (Mikhail Ogawa Engineering [MOE], 2016) to meet the requirements of the Permit. The Carlsbad WQIP addresses the following Hydrologic Areas (HAs): Loma Alta HA, Buena Vista HA, Agua Hedionda HA, Encinas HA, Escondido Creek HA, and San Marcos HA. The San Marcos HA, the second largest HA within the WMA at approximately 36,000 acres, is divided into two distinct areas separated by the Lake San Marcos impoundment; the Upper San Marcos HA and the Lower San Marcos HA. The Upper San Marcos HA includes drainage areas that fall within the jurisdiction of the cities of San Marcos and Escondido as well as the County of San Diego. The Lower San Marcos HA includes drainage areas that fall within the jurisdiction of the cities of Carlsbad, Encinitas, San Marcos, and the County of San Diego.

The Carlsbad WQIP identified nutrients as the highest priority water quality condition (HPWQC) within the Upper San Marcos HA during both dry and wet weather and identified goals for the HA. The Responsible Agencies re-evaluated the dry weather goals and pathways in 2021-2022. The identified goals for the HA are:

- Wet weather (receiving water based)
  - Reduce nutrient loads from baseline:
    - interim goals of 10% by 2023, and 20% by 2028
    - final goal of 40% by 2033
  - (OR) Meet nutrient water quality objectives (WQOs).
- Dry weather (storm drain outfall based)
  - Effectively eliminate dry weather flow from identified outfall(s):

- interim goal of 20% by 2023
  - final goal of 40% by 2028
- (OR) Effectively eliminate two persistently flowing outfalls by 2023 (interim goal)
- (OR) Discharge meets the nutrient WQO for the applicable water body segment.
- (OR) Address all items below:
  - Inspect high threat to water quality (ITWQ) agricultural facilities annually and inspect all other (i.e. medium and low TTWQ) inventoried at least once every five years (2023 interim goal)
  - Inspect all high TTWQ agricultural facilities at least once per year and up to four times annually, depending on compliance history. Inspect medium TTWQ inventoried agricultural facilities at least once every two years and low TTWQ inventoried agricultural facilities at least once every five years (2028 final goal)
  - Inspect all inventoried golf courses once every two years (2023 interim goal and 2028 final goal)
  - Conduct outreach to 10% of identified Homeowner's Associations (HOAs) and completion of the Fairways HOA Retrofit Pilot Project (2023 interim goal)
  - Conduct outreach to 20% of identified HOAs and implementation of additional incentive and rebate programs where opportunities arise (2028 final goal)
  - 10% of identified residences and businesses on septic systems receive outreach (2023 interim goal)
  - 20% of identified residences and businesses on septic systems receive outreach (2028 final goal)
  - Implement a Septic System Pump-out Rebate Program offered on a first come, first served basis to partially offset the cost of septic system pumping (2028 final goal).

The Preliminary Upper San Marcos Creek Monitoring Plan (Monitoring Plan) was developed to monitor and assess progress towards meeting the nutrient goals identified in the WQIP for the Upper San Marcos HA. The Monitoring Plan describes the wet weather receiving water sample collection and monitoring activities that will be performed in the Creek to determine progress toward the wet weather goals in the Upper San Marcos HA. The Plan includes year-round flow monitoring in the Upper San Marcos Creek as well as monitoring of one wet weather composite event annually.

The Monitoring Plan also includes the data assessment methodology to assess progress towards the dry weather interim and final goals. The County of San Diego and the City of San Marcos conduct dry weather outfall monitoring at the highest priority major storm drain outfalls located within the Upper San Marcos HA, and conduct field screening of major outfalls in accordance with the Carlsbad WMA MS4 Monitoring Plan (Carlsbad Responsible Agencies, 2023). In addition, the County and City of San Marcos conduct additional monitoring at select persistently flowing major storm drain outfalls during the dry weather season. The City of Escondido has not identified any major storm drain outfalls in its jurisdictional portion of the Upper San Marcos HA.

### **1.3 Sampling and Testing Objectives**

The objective of the Monitoring Plan is to assess progress towards achieving both interim and final goals identified in the Carlsbad WQIP for nutrients in the Upper San Marcos Creek HA (Section 1.2). This Monitoring Plan describes the framework that will be used for receiving water data collection and analysis in a manner consistent with Surface Water Ambient Monitoring Program (SWAMP)

protocols (State Water Resources Control Board [SWRCB], 2017) and in compliance with the Carlsbad WQIP (MOE, 2016) and the Upper San Marcos Creek Quality Assurance Project Plan (QAPP) (Weston Solutions, Inc. [WESTON®], 2019). This Monitoring Plan also includes the framework for assessment of dry weather data collected under the Carlsbad WMA MS4 Monitoring Plan and the additional monitoring programs conducted by the County of San Diego and City of San Marcos.

Data collected from this monitoring program will be used to address the following question:

*Are interim and final goals listed in the Carlsbad WQIP for nutrients in Upper San Marcos Creek being met during wet weather?*

As additional studies are completed and management actions adapted, updates to this Monitoring Plan may be necessary.

## **2.0 MATERIALS AND METHODS**

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### **2.1 Receiving Water Monitoring**

The materials and methods described in this section are designed to meet the requirements of the Carlsbad WQIP, Section 3.5.5, as set forth in the Permit under Provision B.4.a. Flow and water quality monitoring will be conducted along Upper San Marcos Creek during dry and wet weather. Flow measurements and analytical data collected during the monitoring year will be provided to the Responsible Agencies at the completion of monitoring.

#### **2.1.1 Sampling Approach Summary**

Continuous flow monitoring will be conducted year-round in Upper San Marcos Creek. Although the WQIP does not contain dry weather receiving water-based goals, flow monitoring will be conducted during dry weather to provide data to inform additional studies including studies taking place in Lake San Marcos. During the dry season (approximately May – September), flow monitoring will be conducted just upstream of Lake San Marcos. During the wet season (approximately October – April) the monitoring station will be moved farther upstream to avoid the potential for ponding just upstream of the Lake.

In addition to continuous flow monitoring, one wet weather event will be sampled each year. A flow-weighted composite will be collected across the storm event (up to 24 hours), which will be used to determine nutrient concentrations in the Creek.

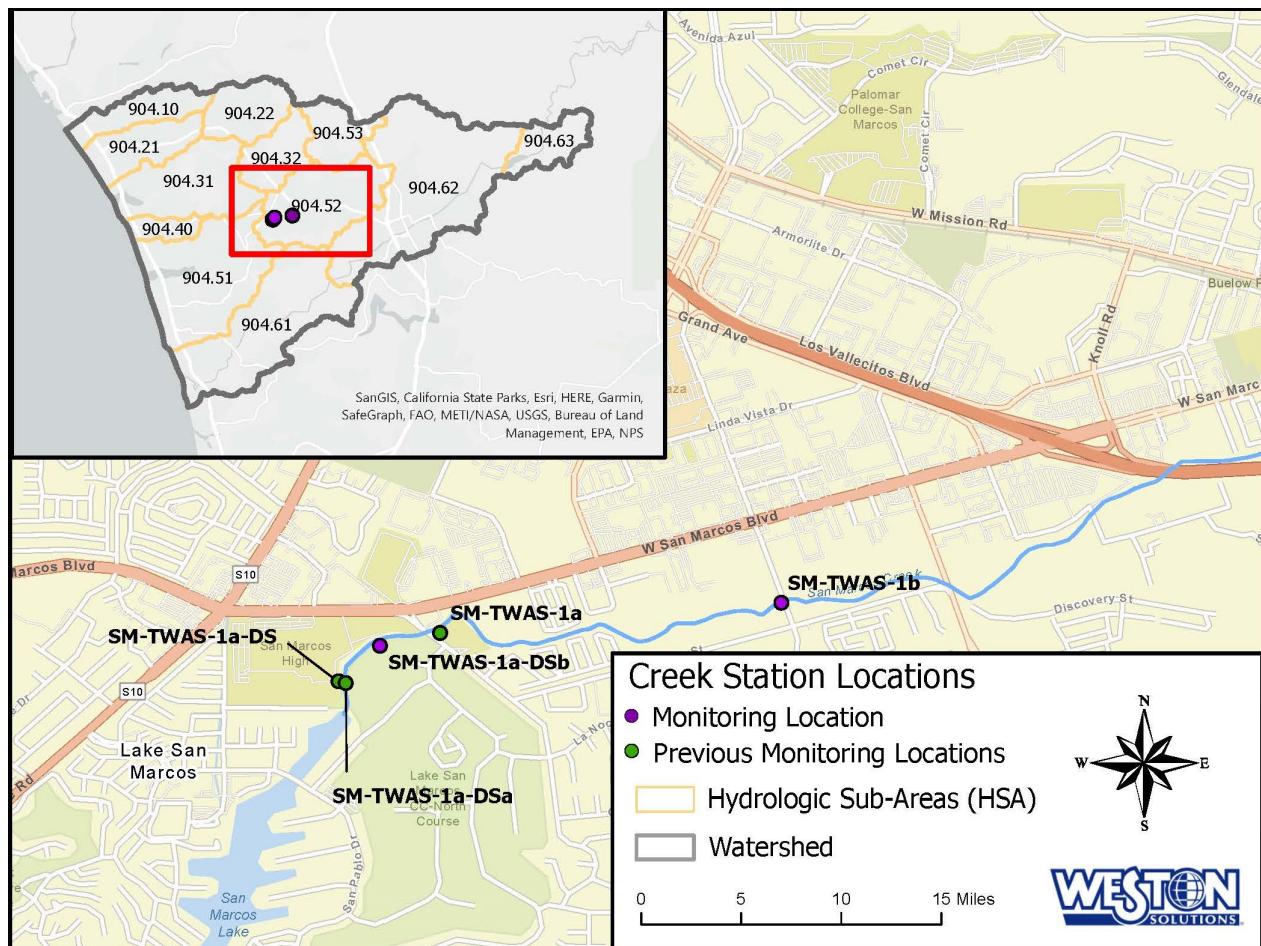
#### **2.1.2 Monitoring Locations**

During the wet weather season (October 1 – April 30) monitoring will typically occur at station SM-TWAS-1b, located on Upper San Marcos Creek at Via Vera Cruz (Table 2-1, Figure 2-1). This station was monitored historically and will be used when feasible to monitor flow and nutrient levels during the wet season as part of this monitoring program (Figure 2-2). Due to the City of San Marcos' stream restoration and bridge improvements, it may not be possible to monitor at SM-TWAS-1b for several years beginning with the 2022-2023 monitoring year. During the restoration activities, flow will be monitored further downstream at the SM-TWAS-1a station.

For dry season monitoring (May 1 – September 30), the monitoring station will be relocated downstream in order to capture additional inputs to the Creek. Due to changes in the hydrologic conditions that may occur during the wet weather seasons, the dry season monitoring location may be adjusted from year to year. Table 2-1 and Figure 2-1 provide the monitoring locations for the dry weather stations (SM-TWAS-1a-DS, SM-TWAS-1a-DSa, SM-TWAS-1a-DSb) that have been monitored as of January 2023.

**Table 2-1: Monitoring Station Locations**

Station ID	Station Description	Latitude	Longitude	Location Description
SM-TWAS-1b	Via Vera Cruz. Wet season monitoring location	33.13166	-117.1869	Upper San Marcos Creek at Via Vera Cruz
SM-TWAS-1a	Discovery Street. Location of wet season monitoring during stream restoration activities	33.130386	-117.200407	Upper San Marcos Creek at Discovery Street
SM-TWAS-1a-DS	2018 and 2019 dry weather monitoring location. Downstream of Discovery Street	33.12864	-117.2039	Upper San Marcos Creek downstream of Discovery Street Bridge
SM-TWAS-1a-DSa	2020 dry weather monitoring location	33.128576	-117.203627	San Marcos Creek upstream of SM-TWAS-1a-DS
SM-TWAS-1a-DSb	2021, 2022 dry weather monitoring location	33.130007	-117.20231	San Marcos Creek upstream of SM-TWAS-1a-DSa



**Figure 2-1. Station Locations along Upper San Marcos Creek**



**Figure 2-2. SM-TWAS-1b Monitoring Location**

#### **2.1.2.1 Permitting**

Prior to initial installation of monitoring equipment, the appropriate encroachment permits will be obtained from the County of San Diego and/or the City of San Marcos.

If a weir is determined to be necessary for monitoring at a California Department of Fish and Wildlife (CDFW) stream bed alteration, notification will be submitted and either an agreement or notification that an agreement is not necessary will be obtained from CDFW. Additionally, appropriate notifications will be made to the San Diego Water Board and United States Army Corps of Engineers (USACE) for installation of the weir.

#### **2.1.2.2 Installation of Wet Season Monitoring Equipment**

Installation of a monitoring station at SM-TWAS-1b or alternate location at SM-TWAS-1a, will occur prior to the beginning of the wet weather season. Monitoring equipment includes a Knaack box, flow meter, auto-sampler, sensor, solar panel, and rain gauge. A concrete pad will be installed at the monitoring station in order to secure the equipment. All flow monitoring equipment will be calibrated during installation and periodically throughout the season, as required.

During the equipment installation, initial stream ratings will be performed using approved United States Geological Survey (USGS) methods (Rantz, 1982). WESTON field staff will measure the stream flow rate at regular intervals across the creek's channel using a hand-held flowmeter at multiple locations near the monitoring station. Next, a laser level will be used to survey the longitudinal slope of the creek bed in the vicinity of the station and will also be used to survey a cross section of the creek bed at the location of the mounted flow sensor in the creek bed. Based on this information, a rating curve (head flow table) will be generated that will be used by the flow monitoring equipment. Periodic reassessment of the stream flow rate will be made if changes in channel conditions are observed. The rating curve for station may require periodic validation or recalibration since channel dimensions may shift somewhat throughout the year because of channel bed erosion or deposition.

The station will be visited at least monthly for regular station maintenance activities, and stream ratings (up to three annually) will be conducted when the station is installed and after large storm events that may have altered the stream channel.

#### **2.1.2.3 Dry Season Monitoring Station**

To capture inputs to the Creek downstream of SM-TWAS-1b and upstream of Lake San Marcos, the monitoring location will be relocated as soon as conditions are amenable to dry weather flow monitoring. For scheduling purposes, the relocation is scheduled for the end of the wet season (April 30). A temporary weir may be constructed in the creek at the dry weather station by WESTON scientists to assist with flow data collection. Monitoring equipment will include a level sensor and data logger.

At the time of equipment installation at the dry weather station, stream ratings will be performed using USGS stream rating techniques. The channel near the monitoring location will be surveyed, and a rating curve will be developed using appropriate flow equations. Field personnel will measure the stream flow rate using a hand-held flowmeter and following USGS stream profiling guidelines as described in Section 2.1.2.2. The resulting discharge rate will be used to calculate a rating curve. Periodic reassessment of the stream flow rate will be made if changes in channel conditions are observed. Rating curves may require periodic validation or recalibration based on channel dimensions that may shift because of channel bed erosion or deposition throughout the year.

#### **2.1.3 Monitored Constituents**

The physical and chemical analyses listed in Table 2-2 were selected for Upper San Marcos Creek water samples based on information and guidance in the Carlsbad WQIP (MOE, 2018). A YSI (or similar) water quality meter will be used to collect the following water quality measurements from a grab sample collected in the field: dissolved oxygen, hydrogen ion concentration (pH), specific conductivity, temperature, and turbidity. Physical analyses of the flow weighted composite water sample will include total suspended solids (TSS) and chemical analyses will include total nitrogen, nitrate as N, nitrite as N, total Kjeldahl nitrogen (TKN), ammonia as N, total phosphorus, and orthophosphate as P. Analytical methods are suggested and may be substituted by the laboratory for a comparable method.

**Table 2-2. Wet Weather Receiving Water Monitored Parameters**

Analyte	Analytical Method	Target Reporting Limit	Units
<b>Field Parameters (Grab Sample)</b>			
Dissolved Oxygen	YSI water quality sonde	0.01	mg/L
pH		0.01	pH
Specific Conductivity		1	µS/cm
Temperature		0.1	°C
Turbidity		0.1	NTU
<b>General Chemistry (Composite Sample)</b>			
Total Suspended Solids	SM 2540D	5	mg/L
<b>Nutrients (Composite Sample)</b>			
Ammonia as N	USEPA 350.1	0.1	mg/L

**Table 2-2. Wet Weather Receiving Water Monitored Parameters**

Analyte	Analytical Method	Target Reporting Limit	Units
Nitrate as N	USEPA 353.2	0.1	mg/L
Nitrite as N	USEPA 353.2	0.1	mg/L
Orthophosphate as P	USEPA 365.1	0.002	mg/L
Total Kjeldahl Nitrogen (TKN)	USEPA 351.2	0.1	mg/L
Total Nitrogen	Calculated from TKN, Nitrate, and Nitrite	NA	NA
Total Phosphorus	USEPA 365.1	0.01	mg/L

°C - degrees Celsius; µS/cm - microsiemens per centimeter; mg/L - milligram per liter; NA - not applicable; NTU - nephelometric turbidity unit; pH -hydrogen ion concentration; USEPA - United States Environmental Protection Agency

#### **2.1.4 Documentation of Chain-of-Custody**

This section describes the program requirements for sample handling and Chain of Custody (COC) procedures. Samples are considered to be in custody if they are:

1. In the custodian's possession or view,
2. Retained in a secured place (under lock) with restricted access, or
3. Placed in a secured container.

The principal documents used to identify samples and to document possession are COC records, field log books, and field tracking forms. COC procedures will be used for all samples throughout the collection, transport, and analytical process, and for all data and data documentation, whether in hard copy or electronic format.

COC procedures will be initiated during sample collection. A COC record will be provided with each sample or sample group (sample form provided in Appendix A). Each person who has custody of the samples will sign the form and ensure that the samples are not left unattended unless properly secured. Minimum documentation of sample handling and custody will include the following:

- Sample identification,
- Sample collection date and time,
- Any special notations on sample characteristics,
- Initials of the person collecting the sample,
- Date the sample was sent to the laboratory,
- Type of sample analysis, and
- Courier or shipping company and waybill information.

The completed COC form will be placed in a sealable plastic envelope that will travel inside the ice chest containing the listed samples. The COC form will be signed by the person transferring custody of the samples. The condition of the samples will be recorded by the receiver. COC records will be

included in the final analytical report prepared by the laboratory and will be considered an integral part of that report.

## 2.1.5 Monitoring and Sampling Methods

### 2.1.5.1 Wet Season Monitoring

Flow will be continuously monitored throughout the wet season (October – April). Flow rates will be monitored using a METER CTD-10 pressure transducer and/or American Sigma flowmeter with an ultrasonic sensor, bubbler, or submerged pressure transducer as the primary measuring device. The primary sensor will continuously measure the Creek's stage (i.e., water level) and relay that information to the flowmeter. Continuous data will be downloaded from the monitoring station frequently to provide a better understanding of flow estimates for constituent loading information and to verify equipment functionality.

A flow-weighted composite sample will be collected during one storm event during the wet season (October 1 – April 30, Table 2-3). The flow-weighted composite sample will be collected during representative flow conditions and will be comprised of a minimum of three sample aliquots per hour. A forecast of greater than or equal to 0.5 inch of rain in a 24-hour period will be required to trigger the mobilization of WESTON field staff. The storm event must be preceded by a minimum of 72 hours of dry weather (< 0.1 in rainfall).

**Table 2-3. Wet Season Monitoring Events**

Event Type	Collection Method	Target Period
Wet	Flow-weighted Composite	October 1- April 30

The flow-weighted composite will be analyzed for the following parameters (laboratory analyses are further discussed in Section 2.1.6):

- Nutrients (total nitrogen, nitrate as N, nitrite as N, TKN, ammonia as N, total phosphorus, and orthophosphate as P); and
- TSS

During the wet weather sampling event, WESTON scientists will record pertinent sample information, such as sample time, date, weather conditions, water appearance, and presence of trash on designated field data sheets (Appendix B). Photographs will also be taken during each sampling event to document station conditions. Field measurements will be collected from a grab sample from the Creek with a YSI or similar device and will include pH, dissolved oxygen, water temperature, turbidity, and specific conductivity. All samples will be collected, processed, and analyzed in accordance with the QAPP (WESTON, 2019).

### **2.1.5.2 Dry Season Flow Monitoring**

Although the WQIP does not contain dry weather receiving water-based goals, flow monitoring will be conducted during dry weather to provide data to inform additional studies including studies taking place in Lake San Marcos. Dry season monitoring will be conducted at the dry weather station (Figure 2-1). Flow will be continuously monitored throughout the dry weather season (May–September) using a HOBO level logger, METER CTD, or similar device. The sensor will continuously measure stage (i.e., stream height). Level data will be downloaded from the monitoring station frequently to verify equipment functionality and minimize data gaps. Monitoring equipment at this location will be maintained throughout the project to ensure it is in proper working order.

### **2.1.5.3 Sample Handling and Processing**

All samples collected will be stored in the appropriate container type along with the appropriate preservative (if required) for the analytical method(s) being performed, in accordance with United States Environmental Protection Agency (USEPA) sampling protocols and the QAPP (WESTON, 2019). All samples will be collected in laboratory-supplied, laboratory-certified, contaminant-free sample bottles. Additionally, the samples will be stored chilled in ice chests for transfer to the analytical laboratory, Weck Laboratories, Inc. (Weck). COC forms will be completed for each sample and will accompany the samples to the laboratory at all times.

Sample volumes and recommended holding times for each parameter are based on Standard Methods (SMs) or USEPA method requirements. All samples will be transported from the field to the laboratory under WESTON COC procedures. Samples moved between laboratories will be transported under those laboratories' COC procedures.

## **2.1.6 Laboratory Methods**

Target laboratory analytical methods and reporting limits are provided in Table 2-4 for constituents collected during the wet weather monitoring event. Analytical methods may be substituted for comparable methods by the laboratory.

**Table 2-4. Suggested Laboratory Methods and Recommended Target Reporting Limits**

Analyte	Analytical Method	Target Reporting Limit	Units
<b>General Chemistry</b>			
Total Suspended Solids	SM 2540D	5	mg/L
<b>Nutrients</b>			
Ammonia as N	USEPA 350.1	0.1	mg/L
Nitrate as N	USEPA 353.2	0.1	mg/L
Nitrite as N	USEPA 353.2	0.1	mg/L
Orthophosphate as P	USEPA 365.1	0.002	mg/L
Total Kjeldahl Nitrogen (TKN)	USEPA 351.2	0.1	mg/L
Total Nitrogen	Calculated from TKN, Nitrate, and Nitrite	NA	NA
Total Phosphorus	USEPA 365.1	0.01	mg/L

mg/L – milligram per liter; NA – not applicable; USEPA – United States Environmental Protection Agency

## **2.1.7 Quality Assurance/Quality Control**

Quality assurance (QA) and quality control (QC) for sampling processes will include proper collection of the samples to minimize the possibility of contamination. All samples will be collected in laboratory-supplied, laboratory-certified, contaminant-free sample bottles. Field staff will wear powder-free nitrile or similar gloves at all times during sample collection. QC samples, such as blanks and duplicate samples, will be collected and analyzed in compliance with SWAMP protocols (SWRCB, 2017). QC requirements will be reviewed and discussed with the appropriate staff to verify the proper working order of equipment, to refresh monitoring personnel in monitoring techniques, and to determine whether measurement quality objectives (MQOs) are being met.

Quality assurance methods and procedures needed to maintain consistency in sample collection, processing, and analysis to produce scientifically defensible data are provided in the Upper San Marcos QAPP (WESTON, 2019). The QAPP provides acceptability criteria for the collection and analysis of duplicate field samples, blanks, laboratory methods, and laboratory spikes. The QAPP should be used as a reference to ensure proper methods are used consistently throughout the monitoring program.

### **2.1.7.1 Laboratory Quality Assurance/Quality Control**

The QA objectives for analyses conducted by Weck are detailed in their laboratory QA manual. The objectives for accuracy and precision involve all aspects of the testing process, including the following:

- Methods and standard operating procedures (SOPs);
- Calibration methods and frequency;
- Data analysis, validation, and reporting;
- Internal QC;
- Preventive maintenance; and
- Procedures to ensure data accuracy and completeness.

The results of the laboratory QC analyses will be reported with the final data. QC samples that fail to meet the specified QC criteria in the methodology will be identified, and the corresponding data will be appropriately qualified in the final report. All quality assurance/quality control (QA/QC) records for the various testing programs will be kept on file for review by regulatory agency personnel.

## **2.1.8 Training and Certification**

All field personnel will have current and relevant experience in all aspects of standard field monitoring, including use of relevant equipment such as field instruments and monitoring devices. Field personnel will be trained and will have experience in proper sample collection, handling/storage, and COC procedures. Only staff with proficiency in these areas of sample collection and processing will be permitted to conduct the field work.

All personnel are responsible for complying with the QA/QC requirements that pertain to their organizational/technical function. Technical staff members must have a combination of experience and education to adequately demonstrate a specific knowledge of their particular function and a general knowledge of laboratory operations, test methods, QA/QC procedures, and records management.

### **2.1.9 Equipment Calibration**

All instruments used for field and laboratory analyses will be calibrated in accordance with manufacturer's specifications. Calibration of the flow monitoring and sampling equipment will be conducted immediately prior to its deployment or use and will be field verified during field visit or sampling event.

Field measurements for pH, specific conductance, dissolved oxygen, turbidity, and temperature will be made using a YSI data sonde or similar device according to the manufacturer's specifications. The YSI data sonde will be calibrated per manufacturer's recommended guidelines.

### **2.1.10 Data Review and Management**

All laboratory data will initially be reviewed and verified by the analytical laboratory (Weck) to determine whether all MQOs have been met per the QAPP (WESTON, 2019), and that appropriate corrective actions have been taken, when necessary. The laboratory will supply analytical results and related QC information in electronic formats and have the responsibility of ensuring that reports and electronic data deliverables (EDDs) are accurate.

WESTON's QA Officer will be responsible for the final review of all data generated in the field and laboratory including ensuring that all of the MQOs in the QAPP (WESTON, 2019) have been met. Chemistry results will be reported to the County project manager, who may direct changes to the monitoring plan based on sample results.

The laboratory will document and track sample receipt, storage, analyses, and reporting pertaining to respective laboratory analyses. Laboratory results will be stored in a database system at Weck's office and will be provided to WESTON electronically in laboratory reports and California Environmental Data Exchange Network (CEDEN) formatted EDDs. Further details of Weck's data management protocols can be found in the QAPP (WESTON, 2019).

All data, including laboratory and field QC results, collected under the QAPP (WESTON, 2019) will be submitted to CEDEN. Additionally, an electronic data deliverable that includes all data, photographs, and copies of datasheets and COCs will be submitted to the County at the completion of the project as well as accumulated into project-specific files that are maintained at WESTON's Carlsbad, CA, office. Records will be maintained for at least five years or transferred according to agreement between WESTON and the County.

## **2.2 Dry Weather Outfall Monitoring**

The Responsible Agencies conduct dry weather monitoring at outfalls in the Upper San Marcos HA as part of three monitoring approaches. These include the dry weather field screening of major storm drain outfalls in accordance with Permit Provision D.2.b(1), dry weather highest priority outfall monitoring in accordance with Permit Provision D.2.b.(2), and additional monitoring studies.

### **2.2.1 Dry Weather Field Screening of Major MS4 Outfalls**

The Permit requires Responsible Agencies to conduct field screening of major MS4 outfalls during dry weather (Permit Provision D.2.b(1)). Field screening is conducted to determine the outfall flow status, identify non-stormwater and illicit discharges, and prioritize those discharges that will be

investigated and eliminated. Each Responsible Agency performs field screening of major storm drain outfalls on an annual basis to maintain an up-to-date inventory of major outfalls and to initiate follow-up investigations that identify and mitigate the source(s).

During field screening, the Responsible Agencies record visual observations of outfall and flow characteristics including:

- flow conditions (flowing, ponded, dry, or tidal);
- whether flow reached the receiving water;
- whether there was a non-stormwater flow source;
- potential non-stormwater sources;
- whether the flow source was eliminated;
- evidence of obvious illicit connections or illicit discharges (IC/IDs);
- whether trash was present, and relative amount; and
- whether there was evidence of illegal dumping.

Additional monitoring program details can be found in Section 2.2 of the Carlsbad WMA MS4 Outfall Monitoring Plan (Carlsbad Responsible Agencies, 2023).

## **2.2.2 Dry Weather Highest Priority Outfall Monitoring**

Permit Provision D.2.b.(2) specifies requirements for dry weather monitoring of the highest priority MS4 outfalls with persistent flow. The purpose of this monitoring is to evaluate the potential impacts from MS4 outfall discharges on receiving water quality during dry weather conditions and to assess the ability of programs to effectively eliminate non-stormwater discharges to receiving waters. Additional monitoring program details can be found in Section 2.3 of the Carlsbad WMA MS4 Outfall Monitoring Plan (Carlsbad Responsible Agencies, 2023).

## **2.2.3 Flow Monitoring Studies**

The Responsible Agencies may also conduct additional studies in the Upper San Marcos HA to assess dry weather flows at priority outfalls.

Outfalls selected for additional flow monitoring will be re-evaluated each year and may change based on reprioritization of efforts. Monitoring methods, including flow measurement methodology, may also differ each monitoring year and may include the use of continuous flow monitoring or instantaneous flow monitoring.

Continuous flow measurements will be conducted using sensors that measure level (stage) and/or area/velocity. Data will be downloaded periodically from the sensors/data loggers and checked for quality control and to prevent data gaps. Depending upon the sites, it may be necessary to install weirs in order to completely submerge the sensors. Flow rates can then be calculated from the sensor measurements, channel/pipe dimensions and weir equations specific to the type of weir (if any) installed.

Flow may also be measured using instantaneous measurement methods. Methods will be in accordance with the USEPA NPDES storm water sampling guidance (USEPA, 1992).

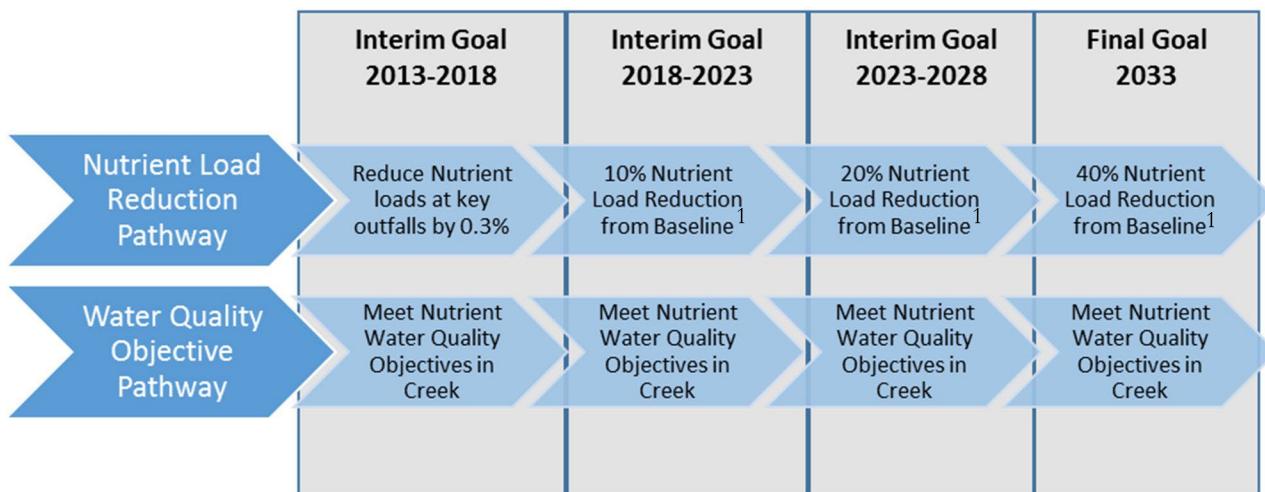
## 3.0 DATA ASSESSMENT

Data collected will be assessed to determine progress toward achievement of WQIP interim and final nutrient goals in the Upper San Marcos HA. The Carlsbad WMA WQIP provides multiple pathways to achieve milestones for both wet weather and dry weather nutrient reductions. The following sections describe the data assessment methods specific to wet weather (receiving water-based goals) and dry weather (MS4 outfall-based goals).

### 3.1 Wet Weather

Receiving water data collected as described in Section 2.1 will be assessed to determine progress towards interim and final wet weather goals.

The Carlsbad WMA WQIP provides multiple pathways to achieve milestones for wet weather nutrient reductions in the Upper San Marcos HA. Achievement of the interim and final wet weather goals can be demonstrated in one of two ways; by measuring a specified percent nutrient load reduction or by meeting nutrient WQOs at the receiving water station in the HA. These pathways are summarized in Figure 3-1.



1 – The WQIP Baseline was originally the annual load calculated in Appendix D of the 2010-2011 Receiving Waters and Urban Runoff Monitoring Report at Station SM-TWAS.

**Figure 3-1. Wet Weather Compliance Pathway Summary**

#### 3.1.1 Nutrient Loads

The Responsible Agencies may demonstrate compliance with the interim and final wet weather goals by achieving a specified percent reduction in wet weather receiving water nutrient loads (Figure 3-1). The percent reduction is in relation to the baseline load provided in the WQIP, which was calculated from data collected during the 2010-2011 monitoring year.

##### 3.1.1.1 Updates to Wet Weather Load Methodology

For the 2020-2021 assessment, the Responsible Agencies updated the wet weather load calculation methodology to improve comparability with baseline wet weather loads that were established during

WQIP development. In response to the San Diego Water Board's comments in the letter dated August 30 2022<sup>1</sup>, the Responsible Agencies updated the wet weather load calculation methodology for the 2021-2022 assessment. This section describes the updated methodology. The annual wet weather load from the 2010-2011 year was selected as the baseline load for Upper San Marcos Creek, as this was the most recent monitoring conducted at the SM-TWAS-1a station prior to the issuance of Investigative Order R9-2011-0033 (Table 3-1). Under the current monitoring program, wet weather monitoring is typically conducted at the upstream location, SM-TWAS-1b (Via Vera Cruz). Station locations are provided in Figure 3-2. As evident on the figure, a tributary (Las Posas Branch, San Marcos Creek) enters the main stem of the creek between the two stations.

**Table 3-1. Baseline (2010-2011) Annual Wet Weather Load Calculation at SM-TWAS-1a**

Monitoring Year	Site	Rain (in)	Volume (Gallons)	Loads (Baseline) (lbs/yr)	
				Total N	Total P
2010-2011	SM-TWAS-1a	16.16	3,302,007,603	88,904	6,867

To improve comparability between yearly loads calculated from data collected at the two different stations, loads for years when wet weather monitoring is conducted at SM-TWAS-1b will be adjusted to include an estimate of the loads from the Los Posas Branch and tributary area.

The drainage area ratio method was used to estimate the flow coming from the Las Posas Branch and the tributary drainage area to the main stem of San Marcos Creek. Figure 3-2 shows the drainage areas for SM-TWAS-1a and SM-TWAS-1b stations, and the tributary drainage area including the Las Posas Branch.

The method is summarized below:

The tributary flow including the Las Posas Branch can be estimated using the following equation:

$$Q_Y = \frac{Q_x * A_y}{A_x} \quad \text{Equation 1}$$

Where:

$Q_x$ = SM-TWAS-1b Flow (cfs)

$A_x$ = Drainage Area to SM-TWAS-1b station (8,589 acres)

$Q_Y$ = Los Posas Tributary Flow (cfs)

$A_y$ = Los Posas Tributary drainage area (2,353 acres)

The SM-TWAS-1b station watershed was used as the reference watershed (x).

A transposition factor  $T_F$  was calculated based on the ratio between the reference drainage area and the tributary area. The following equation was used to estimate the  $T_F$

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<sup>1</sup> Comment 3.a.1 in the 2020-2021 Water Quality Improvement Plan Annual Report Review: Carlsbad Watershed Management Area (WM4)letter from the San Diego Water Board dated August 30, 2022

$$T_F = \frac{A_y}{A_x} \quad \text{Equation 2}$$

Table 3-2 presents the results obtained with the previous equations to estimate the transposition factor.

**Table 3-2. Estimation of Transposition Factor**

Site	Description	Drainage area (acres)	TF
SM-TWAS-1b	Reference watershed (x).	8,589	0.27
Tributary area	Estimated watershed (y)	2,353	-

To transpose volumes from station SM-TWAS-1b to station SM-TWAS-1a the following equation was used:

$$\text{Recalculated Volume} = V_{1b} + (V_{1b} * T_F) \quad \text{Equation 3}$$

Where:

*Recalculated Volume:* Volume from station SM-TWAS 1a equivalent (SM-TWAS 1b + Los Posas)

$V_{1a}$ = Volume at SM-TWAS-1b station (gallons)

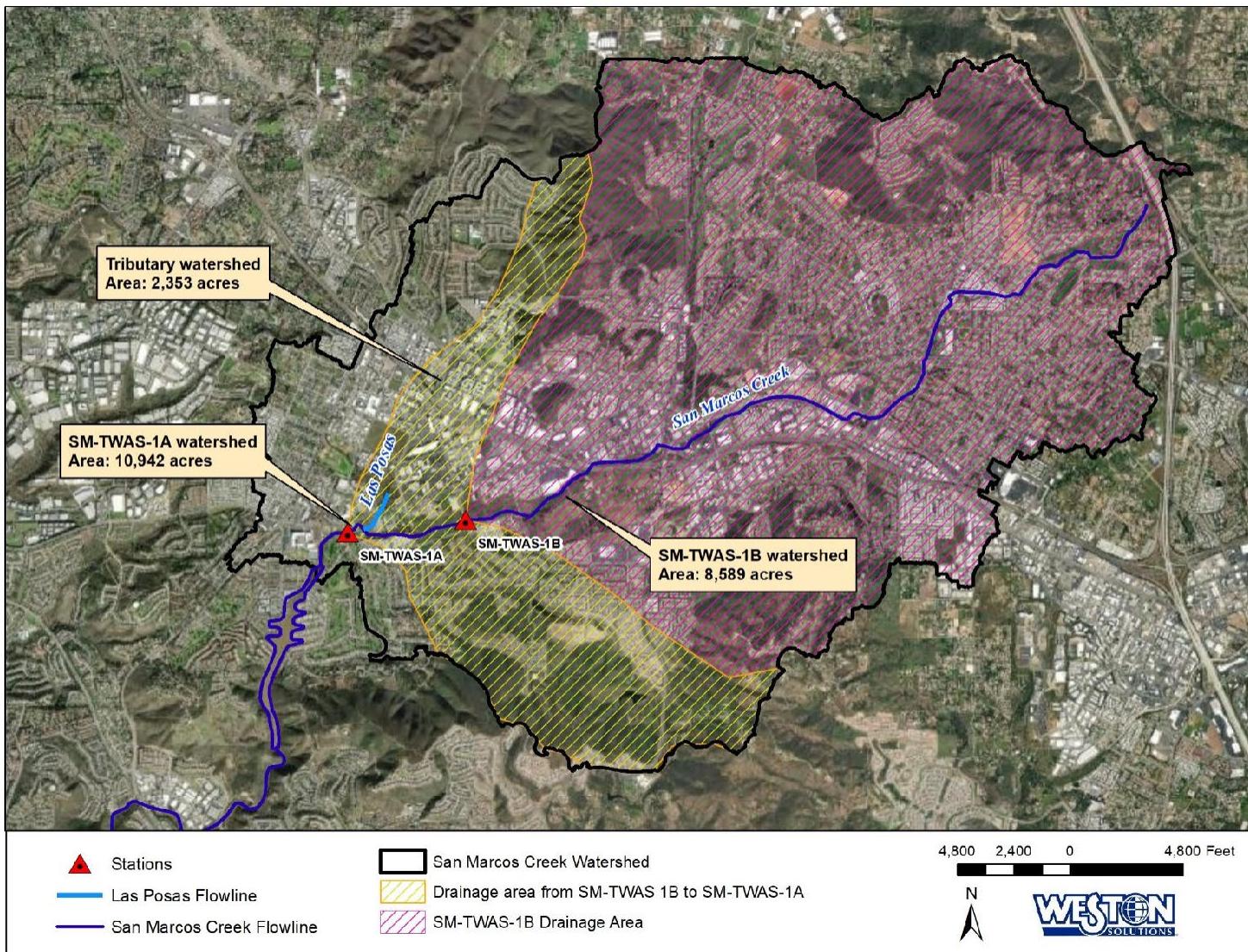


Figure 3-2. Drainage Areas for Upper San Marcos Creek Monitoring Locations

### **3.1.1.2 Nutrient Load Calculations**

The Responsible Agencies may demonstrate compliance with the interim and final wet weather goals by achieving a specified percent reduction in wet weather receiving water nutrient loads (Figure 3-1). The percent reduction is in relation to the baseline load (Table 3-1).

Flow data collected from the wet weather monitoring location (typically SM-TWAS-1b) as well as measured nutrient concentrations from the flow-weighted composite sample collected during the annual wet weather event will be used to calculate the event and annual wet weather loads.

For the monitored storm event, discharge volume during the storm will be calculated using measured flow data from the wet weather monitoring station. The discharge volume will be multiplied by the concentration of total phosphorus or total nitrogen measured in the flow-weighted composite sample and a unit conversion factor to obtain the event load:

$$\text{Load}_{\text{event}} = \text{Volume}_{\text{event}} \times \text{Measured Concentration}_{\text{event}} \times \text{Conversion Factor}$$

In order to calculate the annual wet weather load for total nitrogen and total phosphorus, the measured concentrations from the one monitored wet weather event will be applied to each of the unmonitored storm events (defined as at least 0.1 in of precipitation within 24 hours):

$$\text{Load}_{\text{unmonitored\_storm\_x1}} = \text{Volume}_{\text{unmonitored\_storm\_x1}} \times \text{Measured Concentration}_{\text{event}} \times \text{Conversion Factor}$$

$$\text{Load}_{\text{unmonitored\_storm\_x2}} = \text{Volume}_{\text{unmonitored\_storm\_x2}} \times \text{Measured Concentration}_{\text{event}} \times \text{Conversion Factor}$$

$$\text{Load}_{\text{unmonitored\_storm\_x3}} = \text{Volume}_{\text{unmonitored\_storm\_x3}} \times \text{Measured Concentration}_{\text{event}} \times \text{Conversion Factor}$$

Unmonitored storm events will be determined based upon the on-site rain gauge or the nearest San Diego County Rainfall and Stream Level Information System rain gauge (San Marcos CRS 27090).

The calculated loads for each unmonitored storm event will be summed together and added to the load from the monitored storm event to determine the overall wet weather annual load:

$$\text{Load}_{\text{unmonitored\_storms}} = \text{Load}_{\text{unmonitored\_storm\_x1}} + \text{Load}_{\text{unmonitored\_storm\_x2}} + \text{Load}_{\text{unmonitored\_storm\_xn}} + \dots$$

$$\text{Annual Wet Weather Load} = \text{Load}_{\text{event}} + \text{Load}_{\text{unmonitored\_storms}}$$

For years where the wet weather monitoring is conducted at SM-TWAS-1b, the annual wet weather Load for the station will be added to the estimated load from the Los Posas tributary. The resulting load (the SM-TWAS-1a equivalent load) will be compared to the baseline load (Table 3-1). The percent load change will be calculated between the current annual wet weather load and the baseline annual wet weather load. This percentage will be compared against the WQIP goals (Figure 3-1).

### **3.1.2 Nutrient Concentrations**

Achievement of the interim and final wet weather goals may also be demonstrated by meeting nutrient WQOs in the receiving water. The WQOs used for comparison are specified in the WQIP for a creek just before it enters a standing body of water (0.5 milligrams per Liter [mg/L] for total nitrogen and 0.05 mg/L for total phosphorus [Table 3-3]).

**Table 3-3. Wet Weather Receiving Water Nutrient Water Quality Objectives**

Parameter	WQO (mg/L)
Total Nitrogen	0.5
Total Phosphorus	0.05

### **3.2 Dry Weather**

Dry weather MS4 outfall data collected during the programs described in Section 2.2 will be assessed to determine progress towards interim and final dry weather goals.

During the 2021-2022 monitoring year, the Responsible Agencies re-evaluated the USMC HA dry weather goals to factor in data and information acquired since the development of the WQIP goals. With this information, the Responsible Agencies and the San Diego Water Board staff coordinated to revise dry weather goals which were submitted in the 2021-2022 Carlsbad WMA WQIP Annual Report and subsequently approved by the Regional Board. These revisions included changes to the current dry weather goals and included a new implementation-based goal. A summary of the goals is provided in Table 3-4.

**Table 3-4. Dry Weather Compliance Pathway Summary<sup>1</sup>**

Interim Goal (2018-2023) 2023	Final Goal (2023-2028) 2028
<ol style="list-style-type: none"> <li>1. Effectively eliminate 20% of the dry weather flow<sup>2</sup> from identified outfall(s)<sup>3</sup>. OR</li> <li>2. Effectively eliminate two persistently flowing outfalls. OR</li> <li>3. Dry weather flow from identified outfalls meets the nutrient WQO<sup>4</sup> for the applicable water body segment. OR</li> <li>4. Address all items below:             <ol style="list-style-type: none"> <li>a. Inspect high TTWQ agricultural facilities annually and inspect all other (i.e., medium and low TTWQ) inventoried agricultural facilities at least once every five years<sup>5</sup>. AND</li> <li>b. Inspect all inventoried golf courses once every two years<sup>5</sup>. AND</li> <li>c. Conduct outreach to 10% of identified HOAs and completion of the Fairways HOA Retrofit Pilot Project<sup>6</sup>. AND</li> <li>d. 10% of identified residences and businesses on septic systems receive outreach<sup>7</sup>.</li> </ol> </li> </ol>	<ol style="list-style-type: none"> <li>1. Effectively eliminate 40% of the dry weather flow from identified outfalls. OR</li> <li>2. Dry weather flow from identified outfalls meets the nutrient WQO for the applicable water body segment. OR</li> <li>3. Address all items below:             <ol style="list-style-type: none"> <li>a. Inspect all high TTWQ agricultural facilities at least once per year and up to four times annually, depending on compliance history. Inspect medium TTWQ inventoried agricultural facilities at least once every two years and low TTWQ inventoried agricultural facilities at least once every five years. AND</li> <li>b. Inspect all inventoried golf courses once every two years. AND</li> <li>c. Conduct outreach to 20% of identified HOAs and implementation of additional incentive and rebate programs where opportunities arise.</li> <li>d. 20% of identified residences and businesses on septic systems receive outreach.</li> <li>e. Implement a Septic System Pump-out Rebate Program offered on a first come, first served basis to partially offset the cost of septic system pumping.</li> </ol> </li> </ol>

TTWQ = Threat to Water Quality; HOA = Homeowners Association

<sup>1</sup> The City of Escondido has not identified any major MS4 outfalls within its portion of the watershed.

<sup>2</sup> Dry weather flow included all non-stormwater discharges from an outfall including exempt or permitted non-stormwater discharges in accordance with the MS4 Permit.

<sup>3</sup> Baseline: Total discharge of 13,746,581 gallons/year, calculated from continuous dry weather flow monitoring conducted during the 2016-2017 monitoring year. A list of identified outfalls and associated baseline calculations are included in the Upper San Marcos Creek HA Preliminary Monitoring Plan. <http://www.projectcleanwater.org/download/carlsbad-wma-monitoring-plans/>

<sup>4</sup> WQO for nutrients: In a creek = 0.1 mg/L Total Phosphorous and 1.0 mg/L Total Nitrogen; in a creek just before it enters a standing body of water = 0.05 mg/L Total Phosphorous and 0.5 mg/L Total Nitrogen; standing body of water = 0.025 mg/L Total Phosphorous and 0.25 mg/L Total Nitrogen.

<sup>5</sup> Baseline: Inspect all inventoried facilities once every five years per MS4 Permit Provisions E.5.c (1)

<sup>6</sup> Baseline: Limited to no outreach to HOAs regarding incentive and rebate programs.

<sup>7</sup> Baseline: Residences and businesses on septic systems receive outreach on proper use and maintenance as needed (0% residences and businesses receive outreach). No Septic System Pump-out Rebate Program Offered.

### 3.2.1 Reduction of Dry Weather Flows

The first dry weather pathway in Table 3-4 is the reduction of dry weather flows. At the time of the WQIP publication, there were no available data to quantify the baseline flows. The County of San Diego and the City of San Marcos (i.e., Responsible Agencies) began continuous dry weather flow monitoring at their highest priority outfalls in the Upper San Marcos HA in monitoring years 2015-2016 and 2016-2017 to inform determination of flow sources and to establish a baseline of anthropogenic

flows. The Responsible Agencies have conducted multiple studies aimed at partitioning flows to quantify anthropogenic non-stormwater flows and to then assess progress toward the interim and final numeric goals of reduced anthropogenic flows. While the studies provided valuable information, it did not result in a clear methodology to partition flows in this watershed. For that reason, the pathway was revised to an interim goal (2018-2023) to effectively eliminate 20% of dry weather flows from identified outfalls and a final goal to effectively eliminate 40% of dry weather flow from identified outfalls. Dry weather flow includes all non-stormwater discharges in accordance to with the MS4 permit.

The total flows at the monitored outfalls were used to establish a baseline for each of the outfalls that were monitored for continuous flow. The daily volume of discharge was calculated for each station for each dry weather day monitored. Rainfall data from the San Diego County Rainfall and Stream Level System (San Marcos Station) were used to exclude days with >0.1 inch of flow and the following 72 hours. The average of the daily volumes was calculated for each month and applied to the number of dry weather days in that month to determine the monthly volume.

$$\text{Monthly Volume}_{\text{station1}} = \text{Average Daily Volume}_{\text{month\_station1}} \times \text{Number of Dry Weather Days}_{\text{station1}}$$

For months occurring outside of the monitoring period, the average daily volume for the entire monitoring period was calculated and applied to the number of dry weather days.

All calculated monthly volumes were summed to quantify the yearly volume of dry weather discharge for the 2016-2017 monitoring year.

$$\text{Annual Volume}_{\text{station1}} = \text{Monthly Volume}_{\text{January\_station1}} + \dots + \text{Monthly Volume}_{\text{December\_}}$$

To determine progress of overall flow reductions for the HA the volume of discharge for each monitored station will be calculated using the method described above. Flow data may be collected using continuous flow monitoring or instantaneous measurements. Only those outfalls monitored in the current year will be included in the assessment.

To determine the percent reduction in dry weather flows, the percent change between the baseline estimated total annual discharge and the current year estimated total discharge will be calculated.

**Table 3-5. Baseline Dry Weather MS4 Outfall Annual Discharge**

Station ID	2016-2017 Baseline Total Annual Discharge (gallons)
MS4-CAR-070	750,490
MS4-CAR-072	2,172,041
OUT002	5,237,440
OUT023	3,283,171
OUT053	5,586,610
OUT10237	26,398,126
OUT10330	12,628,294
<b>Total</b>	<b>56,056,172</b>

### 3.2.2 Effectively Eliminate Discharge from Persistently Flowing Outfalls

The Responsible Agencies may demonstrate achievement of the interim WQIP dry weather nutrient reduction goal through the effective elimination of two persistently flowing outfalls. Dry weather field screening data (described in Section 2.2.1) will be used for this assessment. Outfall flow classifications from the County and the City of San Marcos will be compared to the number of persistently flowing outfalls observed in the baseline year (2016-2017, Table3-5). The City of Escondido has not identified any major MS4 outfalls in the Upper San Marcos HA. Final compliance for this pathway is demonstrated by effective elimination of 100% of anthropogenic flows.

**Table 3-6. Baseline Number of Persistently Flowing Major MS4 Outfalls in the Upper San Marcos HA**

Jurisdiction	Baseline 2016-2017
City of San Marcos	14
County of San Diego	4
<b>Total</b>	<b>18</b>

### 3.2.3 Nutrient Concentrations

Achievement of the dry weather nutrient goals may also be demonstrated by MS4 outfall discharge concentrations meeting the nutrient WQO for the applicable water body segment. Nutrient results from samples collected at the highest priority persistently flowing outfalls (Section 2.2.2) will be compared to the WQOs specified in the WQIP and identified in Table 3-6. The highest priority outfalls may change from year to year as programs are adaptively managed.

For MS4-CAR-069, MS4-CAR-070, and MS4-CAR-072 the WQOs for a standing body of water (0.025 mg/L for total phosphorus and 0.25 mg/L for total nitrogen) will be applied. For the remaining outfalls, the WQO for flowing streams (0.1 mg/L for total phosphorus and 1.0 mg/L for total nitrogen) will be used.

**Table 3-7. Nutrient Water Quality Objectives for Comparison to Dry Weather MS4 Outfall Discharge**

Outfall	Total Nitrogen (mg/L)	Total Phosphorus (mg/L)
MS4-CAR-069	0.25	0.025
MS4-CAR-070	0.25	0.025
MS4-CAR-072	0.25	0.025
OUT002	1.0	0.1
OUT023	1.0	0.1
OUT053	1.0	0.1
OUT10237	0.5	0.05
OUT10330	1.0	0.1
OUT064	1.0	0.1
OUT026	1.0	0.1

### **3.2.2 Stormwater Program Implementation**

Achievement of dry weather goals may also be demonstrated through implementation of stormwater programs by the Responsible Agencies. The Responsible Agencies will conduct inspection programs at facilities that could pose a threat to water quality and provide outreach and educational materials to HOAs and properties that utilize septic systems.

## **4.0 REPORTING**

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### **4.1 Project Reports and Data Submittal**

A Draft Assessment Report will be developed for submittal to the Responsible Agencies by November 30 of each year and will include data collected through September. The report will include the following elements:

- Project Overview
- Receiving Water Analytical Results
- Receiving Water Nutrient Wet Weather Event Loads
- Summary of Receiving Water Dry Weather Flow Data
- Summary of quality assurance/quality control results
- Summary of dry weather outfall data collected by County of San Diego and City of San Marcos including field screening, highest priority persistently flowing outfall monitoring, and continuous flow monitoring studies
- Assessment of progress toward WQIP numeric goals for both dry and wet weather
- Attachments with Receiving Water Laboratory Reports and EDDs in CEDEN-compatible format (appendix), flow data, field data sheets and COCs

The report is expected to be finalized by December 30 of each year, pending review by the Responsible Agencies.

Data from the receiving water study will be submitted to CEDEN by January 31 of each year for the previous monitoring year.

## **Appendix A – Chain of Custody Form**

---

## CHAIN OF CUSTODY

39630

- 5817 Dryden Place, Ste 101 • Carlsbad, CA 92008 • (760) 795-6900, FAX 931-1580  
 1340 Treat Blvd, Ste 210 • Walnut Creek, CA 94597 • (925) 948-2600, FAX 948-2601

DATE

PAGE

OF

PROJECT NAME/ SURVEY/ PROJECT NUMBER

PROJECT MANAGER / CONTACT

CLIENT

ADDRESS

PHONE/ FAX/ EMAIL

SITE ID (Location)      SAMPLE ID      DATE      TIME      MATRIX

## ANALYSIS/TEST REQUESTED

## FOR WESTON USE ONLY

PRESERVED  
HOWSAMPLE  
TEMP. (°C)  
UPON  
RECEIPT

WESTON LAB ID

Sample Matrix Codes: FW=fresh water    GW=ground water    SLT=salt water    SW=storm water    WW=waste water

SED=sediment    A=air    BIO=biologic    SS=soil    T=tissue    O=other (specify)

Container Code: G=glass    P=plastic    B=bags    O=other

Shipped By:  Courier     UPS     FedEx     USPS     Client drop off     OtherTurnaround Time:  2-day     5-day     7-day     10-day     14-day     Standard     OtherReporting Requirements:  PDF     EDD     Hard Copy     Email     Other

SAMPLER BY: PRINT

SIGNATURE

## COMMENTS/ SPECIAL INSTRUCTIONS

## RELINQUISHED BY

## RECEIVED BY

Print Name	Signature	FIRM	Date/Time	Print Name	Signature	FIRM	Date/Time
1.							
2.							
3.							
4.							
5.							
6.							

WHITE - return to originator • YELLOW - lab • PINK - retained by originator

## **Appendix B – Example Field Data Sheet**

---



**Upper San Marcos Creek Receiving Water Monitoring  
FIELD OBSERVATIONS AND TESTING LOG SHEET**

PROJECT/SURVEY NAME  Upper San Marcos Creek Monitoring		STATION ID	STATION NAME				
DATE		TIME STARTED (AT SITE)	TIME FINISHED (AT SITE)				
FIELD TEAM			RECORDER				
MONITORING PERIOD	<input type="checkbox"/> WET WEATHER		<input type="checkbox"/> DRY WEATHER				
WEATHER CONDITIONS <input type="checkbox"/> CLEAR <input type="checkbox"/> CLOUDY <input type="checkbox"/> FOGGY <input type="checkbox"/> DRIZZLING <input type="checkbox"/> RAINY							
SURFACE WATER APPEARANCE	ODOR	<input type="checkbox"/> ROTTEN EGG/H <sub>2</sub> S	<input type="checkbox"/> MUSTY	<input type="checkbox"/> SEWAGE	<input type="checkbox"/> AMMONIA	<input type="checkbox"/> GASOLINE/PETROLEUM	
		<input type="checkbox"/> FISH/DECAY	<input type="checkbox"/> CHLORINE	<input type="checkbox"/> NONE	<input type="checkbox"/> CHEMICAL	<input type="checkbox"/> OTHER	<input type="checkbox"/> NONE
	COLOR	<input type="checkbox"/> YELLOW	<input type="checkbox"/> GREEN	<input type="checkbox"/> BLUE	<input type="checkbox"/> BROWN	<input type="checkbox"/> RED	
	FLOATING MATERIALS (ALL THAT APPLY)	<input type="checkbox"/> SUDS/FOAM	<input type="checkbox"/> OILY SHEEN	<input type="checkbox"/> MATERIAL	<input type="checkbox"/> SCUM	<input type="checkbox"/> ALGAE	
	TRASH	<input type="checkbox"/> NONE	<input type="checkbox"/> STYROFOAM	<input type="checkbox"/> WOOD	<input type="checkbox"/> PLASTIC (CUPS, BOTTLES, <input type="checkbox"/> OTHER BAGS) ( <input type="checkbox"/> DESCRIBE)		
	TURBIDITY	<input type="checkbox"/> CLEAR	<input type="checkbox"/> CLOUDY	<input type="checkbox"/> HEAVY CLOUDINESS, OPAQUE			
Water Quality Appearance Comments:							
GRAB COLLECTION TIME: _____.			<b>Grab samples to be collected:</b> Bacteria (100 mL Poly)				
FIELD MEASUREMENTS (Taken in duplicate)			YSI Serial # _____.				
TEMP (°C)	pH	Salinity (ppt)	CONDUCTIVITY (uS/cm)	Dissolved Oxygen (mg/L)	Turbidity (NTU)		
TEMP (°C)	pH	Salinity (ppt)	CONDUCTIVITY (uS/cm)	Dissolved Oxygen (mg/L)	Turbidity (NTU)		
QA/QC SAMPLES:	<input type="checkbox"/> FIELD DUPLICATE		<input type="checkbox"/> EQUIPMENT BLANK	<input type="checkbox"/> FLOW METER PRESENT			
Level estimation at time of grab sample  = _____ inches			Time of flow estimation, if possible _____.				
			DEPTH		Inches		
			WIDTH		Inches		
			VELOCITY (choose one)		FT/SEC	IN/SEC	
SAMPLING ACTIVITIES (DESCRIBE ALL ACTIONS TAKEN AT EACH SITE VISIT AND PROVIDE ADDITIONAL COMMENTS AS NECESSARY)							
PHOTOS TAKEN: <input type="checkbox"/> YES <input type="checkbox"/> NO							
PHOTO NUMBERS AND NOTES: _____							
TEAM LEADER'S SIGNATURE: _____							

## **Appendix C – Upper San Marcos Creek Monitoring**

### **Quality Assurance Project Plan**

---

# **PRELIMINARY QUALITY ASSURANCE PROJECT PLAN**

## **Upper San Marcos Creek Monitoring**

Prepared for:

**County of San Diego**  
DPW/Watershed Protection  
5500 Overland Ave., Suite 310  
San Diego, California 92123

Contract Number: 551462 TO68

Prepared by:

**Weston Solutions, Inc.**  
2236 Rutherford Place, Suite 101  
Carlsbad, California 92008

January 2020

*Revised January 2024*



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## **GROUP A ELEMENTS: PROJECT MANAGEMENT**

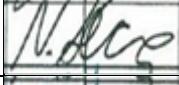
## TITLE AND APPROVAL SHEET

# Preliminary Quality Assurance Project Plan Upper San Marcos Creek Nutrient Monitoring

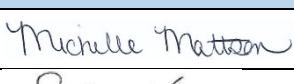
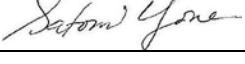
January 2024

## APPROVAL SIGNATURES

### PARTICIPATING AGENCIES:

Title	Name	Signature	Date
Project Manager (County of San Diego)	Neil Searing		1/27/2020
Stormwater Program Manager (City of San Marcos)	Reed Thornberry		1/27/2020
Environmental Programs Manager (City of Escondido)	Juan Magdaraog		1/23/2024

### WESTON SOLUTIONS, INC:

Title	Name	Signature	Date
Project Manager	Michelle Mattson		1/27/2020
QA Officer	Satomi Yonemasu		1/27/2020

### LABORATORIES

Title	Name	Signature	Date
Weck Laboratories, Inc.			
Project Manager	Kim Tu		1/17/2020
QA Officer	Alan Chiang		1/17/2020

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## LIST OF ACRONYMS AND ABBREVIATIONS

APHA	American Public Health Association
Babcock	Babcock & Sons Laboratories
CEDEN	California Environmental Data Exchange Network
COC	chain-of-custody
EDD	electronic data deliverable
ELAP	Environmental Laboratory Accreditation Program
EMA	EnviroMatrix Analytical, Inc.
ERB	equipment rinse blank
HA	Hydrologic Area
HPPF	highest priority persistent flow
HOA	Homeowner's Association
HPWQC	highest priority water quality condition
LCS	laboratory control sample
MOE	Mikhail Ogawa Engineering
MPN	Most Probable Number
MQO	Measurement Quality Objective
MS	matrix spike
MSD	matrix spike duplicate
MS4	municipal separate storm sewer system
NPDES	National Pollutant Discharge Elimination System
pH	hydrogen ion concentration
QA	quality assurance
QAPP	Quality Assurance Project Plan
QA/QC	quality assurance/quality control
QC	quality control
RPD	relative percent difference
San Diego Water Board	San Diego Regional Water Quality Control Board
SM	Standard Method
SOP	standard operating procedure
SWAMP	Surface Water Ambient Monitoring Program
TTWQ	threat to water quality
USEPA	United States Environmental Protection Agency
Weck	Weck Laboratories, Inc.
WESTON®	Weston Solutions, Inc.
WMA	Watershed Management Area
WQIP	Water Quality Improvement Plan

## UNITS OF MEASURE

°C	degrees Celsius
g	gram(s)
mg/L	milligram per liter
mL	milliliter
µS/cm	microsiemens per centimeter
NTU	nephelometric turbidity unit
%	percent

## DISTRIBUTION LIST

Table 1 identifies those individuals who will oversee the implementation of the approved Quality Assurance Project Plan (QAPP). Copies of the QAPP will be distributed via electronic format to the personnel listed in Table 1. These individuals will then be responsible for distributing this QAPP to their respective staff.

**Table 1. Quality Assurance Project Plan Distribution List**

Title	Name (Affiliation)	Telephone No.	QAPP No.
County Project Manager	Neil Searing (County of San Diego)	(858) 495-5513	02
Weston Solutions, Inc. (WESTON) Project Manager	Michelle Mattson (WESTON)	(760) 795-6984	02
Weck Laboratories, Inc. (Weck) Project Manager	Kim Tu (Weck)	(626) 336-2139	02
City of San Marcos Watershed Program Manager	Reed Thornberry (City of San Marcos)	(760) 744-1050 x3217	02
Environmental Programs Manager City of Escondido	Juan Magdaraog (City of Escondido)	(760) 839-4074	02

## PROJECT/TASK ORGANIZATION

### Involved Parties and Roles

This section of the QAPP describes individuals and their respective roles for this project. Table 2 provides a summary of individuals, their key role, and contact information. Figure 2 is an organizational chart showing the roles and lines of communication between key individuals.

**County of San Diego Project Manager:** Neil Searing will serve as the County Project Manager. He will be responsible for the day-to-day contract administration with Weston Solutions Inc. (WESTON), coordination with WESTON on field activities and schedules; and technical review of plans and reports.

**WESTON Project Manager:** Michelle Mattson will serve as WESTON's Project Manager. She will be responsible for all aspects of implementing the Upper San Marcos Creek Monitoring project including scheduling and implementation of field monitoring activities, coordination with the contract laboratory involved in this project, overseeing budgetary expenses and technical review of plans and reports.

**WESTON Field Sampling Lead:** Kyle Clouthier will serve as the WESTON Field Sampling Lead. He will be responsible for field team efforts and provide oversight for all field activities, including developing field schedules, coordinating field staff, maintaining equipment utilized for sampling, conducting the sampling, and ensuring samples are delivered to the analytical laboratory with proper documentation and sample preservation, and maintaining field records associated with each monitoring task.

**WESTON Quality Assurance (QA) Officer:** Satomi Yonemasu will serve as the WESTON QA Officer. She will be responsible for guaranteeing the overall QA and quality control (QC) procedures and will ensure that data reported by WESTON have been generated in compliance with the appropriate protocols. Ms. Yonemasu will report all findings to the WESTON Project Manager, including all requests for corrective actions. If there is evidence of significant deviations from protocols stated in this QAPP or if there is evidence of systematic failure, Ms. Yonemasu has the authority to stop all activities until corrective actions can be documented and performed.

**Weck Laboratory Project Manager:** Kim Tu will serve as the Laboratory Project Manager for Weck Laboratories (Inc.). She will be responsible for coordination of laboratory staff to conduct analyses of samples, coordination with the WESTON Project Manager for scheduling, and invoicing of laboratory charges.

**Weck Laboratory QA Officer:** Alan Ching will serve as the Laboratory QA Officer for Weck. The Laboratory QA Officer will be responsible for all analyses conducted by the laboratory and will ensure that the QAPP guidelines are being met.

**City of San Marcos Project Manager:** Reed Thornberry will serve as the City of San Marcos Project Manager. He will be responsible for implementation of the City of San Marcos' dry weather outfall monitoring programs in coordination with consultant staff.

**City of Escondido Project Manager:** Juan Magdaraog will serve as the City of Escondido's Project Manager. He will be responsible for implementation of the City of Escondido's dry weather outfall monitoring programs.

**Table 2. Personnel Contact Information**

Name	Organizational Affiliation	Title	Contact Information
Neil Searing	County of San Diego	Project Manager	(858) 495-5513 <a href="mailto:Neil.Searing@sdcounty.ca.gov">Neil.Searing@sdcounty.ca.gov</a>
Michelle Mattson	Weston Solutions, Inc.	Project Manager	(760) 795-6984 <a href="mailto:Michelle.Mattson@westonsolutions.com">Michelle.Mattson@westonsolutions.com</a>
Kyle Clouthier	Weston Solutions, Inc.	Field Sampling Lead	(760) 795-6903 <a href="mailto:Kyle.Clouthier@westonsolutions.com">Kyle.Clouthier@westonsolutions.com</a>
Satomi Yonemasu	Weston Solutions, Inc.	QA Officer	(760) 795-6907 <a href="mailto:Satomi.Yonemasu@westonsolutions.com">Satomi.Yonemasu@westonsolutions.com</a>
Kim Tu	Weck Laboratories, Inc.	Laboratory Project Manager	(626) 336-2139 <a href="mailto:Kim.Tu@WeckLabs.com">Kim.Tu@WeckLabs.com</a>
Alan Ching	Weck Laboratories, Inc.	Laboratory QA Officer	(626) 336-2139 <a href="mailto:Alan.Ching@WeckLabs.com">Alan.Ching@WeckLabs.com</a>
Reed Thornberry	Reed Thornberry	Stormwater Program Manager	(760) 744-1050 x3217 <a href="mailto:RThornberry@san-marcos.net">RThornberry@san-marcos.net</a>
Juan Magdaraog	City of Escondido	Environmental Programs Manager City of Escondido	(760) 839-6315 <a href="mailto:jmagdaraog@escondido.org">jmagdaraog@escondido.org</a>

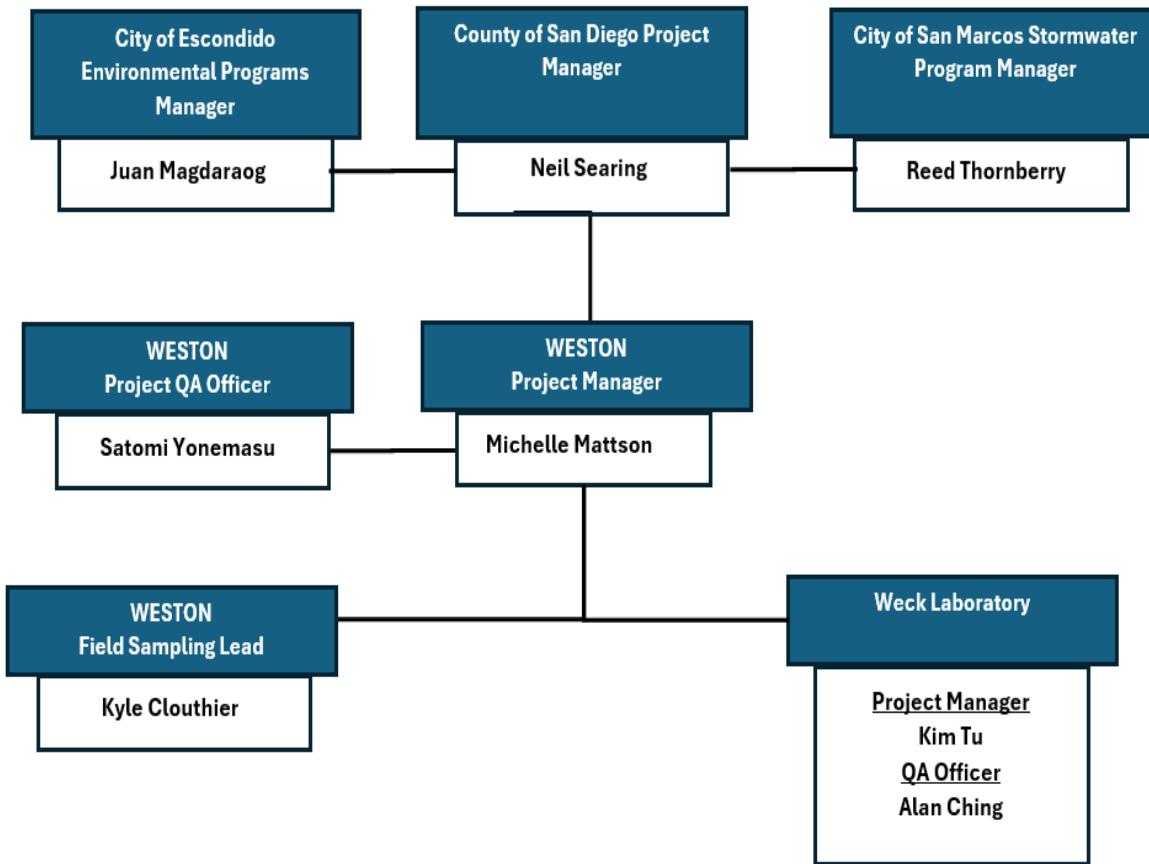


Figure 1. Organizational Chart

## **Quality Assurance Officer Role**

The Project QA Officer will be responsible for maintaining the QAPP and ensuring that personnel listed in Element 3 have the most recent version of the QAPP. The QA Officer will ensure that project staff understand and perform all QA/QC procedures related to field sample collection, laboratory analysis, and data analysis according to QAPP requirements throughout the duration of this project.

## **Persons Responsible for QAPP Update and Maintenance**

Changes and updates to this QAPP may be made after a review of the evidence for change by WESTON's Project Manager and QA Officer with the concurrence of the County of San Diego's Project Manager. WESTON's Project Manager, with input from the QA Officer, will be responsible for making the changes, submitting drafts for review, preparing a final amended copy, and submitting the final version for signature.

# 1.0 PROBLEM DEFINITION/BACKGROUND

## 1.1 Problem Statement

San Marcos Creek is included on the Clean Water Act Section 303(d) list of water quality limited waterbodies in due to beneficial use impairments associated with elevated levels of phosphorus and other pollutants. Beneficial uses in the Creek include warm freshwater habitat (WARM), wildlife habitat (WILD), contact water recreation (REC-1), and non-contact water recreation (REC-2).

San Diego Regional Water Quality Control Board (San Diego Water Board) Order No. R9-2013-0001, as amended by Order Nos. R9-2015-0001 and R9-2015-0100 (Permit) requires Responsible Agencies to develop a Water Quality Improvement Plan (WQIP) for each of their Watershed Management Areas (WMAs). The WQIP will be used to guide the Copermittees' jurisdictional runoff management programs towards achieving the outcome of improved water quality in municipal separate storm sewer system (MS4) discharges and receiving waters. Specifically, the Copermittees must develop a program to monitor and assess the progress towards 1) achieving the numeric goals and schedules incorporated into the WQIP and 2) addressing the highest priority water quality conditions (HPWQCs) identified by the WQIP.

The Carlsbad WQIP identified nutrients as the highest priority water quality condition (HPWQC) within the Upper San Marcos HA during both dry and wet weather and identified goals for the HA. The Responsible Agencies re-evaluated the dry weather goals and pathways in 2021-2022. The identified goals for the HA are:

- Wet weather (receiving water based)
  - Reduce nutrient loads from baseline:
    - interim goals of 10% by 2023, and 20% by 2028
    - final goal of 40% by 2033
  - (OR) Meet nutrient water quality objectives (WQOs).
- Dry weather (storm drain outfall based)
  - Effectively eliminate dry weather flow from identified outfall(s):
    - interim goal of 20% by 2023
    - final goal of 40% by 2028
  - (OR) Effectively eliminate two persistently flowing outfalls by 2023 (interim goal)
  - (OR) Discharge meets the nutrient WQO for the applicable water body segment.
  - (OR) Address all items below:
    - Inspect high threat to water quality (TTWQ) agricultural facilities annually and inspect all other (i.e. medium and low TTWQ) inventoried at least once every five years (2023 interim goal)
    - Inspect all high TTWQ agricultural facilities at least once per year and up to four times annually, depending on compliance history. Inspect medium TTWQ inventoried agricultural facilities at least once every two years and low TTWQ inventoried agricultural facilities at least once every five years (2028 final goal)
    - Inspect all inventoried golf courses once every two years (2023 interim goal and 2028 final goal)
    - Conduct outreach to 10% of identified Homeowner's Associations (HOAs)

- and completion of the Fairways HOA Retrofit Pilot Project (2023 interim goal)
- Conduct outreach to 20% of identified HOAs and implementation of additional incentive and rebate programs where opportunities arise (2028 final goal)
- 10% of identified residences and businesses on septic systems receive outreach (2023 interim goal)
- 20% of identified residences and businesses on septic systems receive outreach (2028 final goal)
- Implement a Septic System Pump-out Rebate Program offered on a first come, first served basis to partially offset the cost of septic system pumping (2028 final goal).

This QAPP address the water quality monitoring activities that will be performed in the Upper San Marcos Creek receiving water along with the quality assurance measures associated with sound, scientifically defensible data collection, processing and reporting. The monitoring activities for the Upper San Marcos Creek receiving water include continuous year-round flow monitoring and collection and analysis of one wet weather event sample. The results of these data will allow the County of San Diego to calculate wet weather event loads and estimate wet weather annual loads in Upper San Marcos Creek to evaluate progress toward wet weather interim and final goals.

The QAPP also addresses the three dry weather MS4 outfall monitoring programs that are implemented by the County of San Diego. These include the dry weather field screening of majorstorm drain outfalls in accordance with Permit Provision D.2.b(1); dry weather highest priority persistent flow (HPPF) outfall monitoring in accordance with Permit Provision D.2.b.(2); and dry weather continuous flow monitoring special studies.

The City of San Marcos also implements dry weather field screening, HPPF monitoring, and dry weather continuous flow monitoring programs.

The City of Escondido has not identified any major storm drain outfalls in its jurisdictional portion of the Upper San Marcos HA and therefore is not required to conduct dry weather MS4 outfall monitoring in the HA.

The Carlsbad WMA MS4 Monitoring Plan (Carlsbad Responsible Agencies, 2024) provides additional details on the HPPF and dry weather field screening programs.

## **2.0 DECISIONS OR OUTCOMES**

### **2.1 Wet Weather (Receiving Water Based)**

Flow monitoring data will be collected year-round along Upper San Marcos Creek and one wet weather event will be sampled annually to assess current nutrient levels and nutrient loading during wet weather. The wet weather event sample will be tested for TSS, ammonia as N, nitrate as N, nitrite as N, TKN, total nitrogen, orthophosphate as P, and total phosphorus. Data collected from this monitoring event and continuous flow monitoring will be used to address the following question:

*Are interim and final goals listed in the Carlsbad WQIP for nutrients in Upper San Marcos Creek*

*being met during wet weather?*

This question will be answered by conducting continuous flow monitoring in Upper San Marcos Creek during both wet and dry seasons and by collecting water samples for nutrient analyses during one wet weather event. Results of the nutrient analysis will be compared to the receiving water WQOs.

Results of flow monitoring and chemistry data will be utilized to calculate annual wet weather loads of total phosphorus and total nitrogen. Once generated, these loads can be compared against baseline loads to determine if interim wet weather goals are being met. The baseline total phosphorus wet weather load is equal to 6,867 pounds (lbs)/year, whereas the baseline total nitrogen wet weather load is equal to 88,904 lbs/year (MOE, 2021). Baseline wet weather loads listed in the WQIP were taken from the annual load calculations at station SM-TWAS in 2010-2011.

## **2.2 Dry Weather (MS4 Outfall Based)**

Data collected from the dry weather MS4 outfall monitoring programs will be used to answer the following question:

*Are interim and final goals listed in the Carlsbad WQIP for nutrients in Upper San Marcos Creek being met during dry weather?*

As discussed in Section 5.1, the WQIP provides multiple options for achievement of dry weather nutrient goals in the Upper San Marcos HA. Data from the dry weather MS4 outfall monitoring programs will be assessed to determine progress toward achieving these goals as provided in Table 3.

**Table 3. Dry Weather Program Data used for Assessment of Progress toward WQIP Goals**

Dry Weather MS4 Program	WQIP Dry Weather Nutrient Goal
Continuous Flow Special Studies	Effectively eliminate a percentage of dry weather flow from identified outfall(s).
Dry Weather Field Screening of Major MS4 Outfalls	Effectively eliminate two persistently flowing outfalls by 2023 (interim goal).
Monitoring of Highest Priority Persistently Flowing Outfalls	Discharge meets the nutrient water quality objective for the applicable water body segment

Additional information regarding the assessment of progress towards goals is provided in the Upper San Marcos Creek Monitoring Plan (WESTON, 2024).

### **2.3 Water Quality or Regulatory Criteria**

The San Diego Basin Plan (San Diego Water Board, 2021) contains a narrative objective for nitrogen and phosphorus that indicates concentrations shall be “maintained at levels below those which stimulate algae and emergent plant growth.” In addition, the Basin Plan includes numeric objectives for phosphorus concentrations for standing bodies of water (0.025 mg/L), in streams at the point of discharge into a standing body of water (0.05 mg/L), and in flowing waters (0.1 mg/L).

The Basin Plan does not contain similar numeric thresholds for nitrogen but indicates natural ratios of nitrogen to phosphorus should be determined and protected and in the absence of data, a ratio of N:P = 10:1 should be used.

## **3.0 PROJECT/TASK DESCRIPTION**

### **3.1 Work Statement and Produced Products**

The following sections provide the work statement for receiving water and dry weather MS4 outfall monitoring and data assessments.

WESTON will prepare a report per the schedule provided in Section 6.3. The County of San Diego, and City of San Marcos (or consultant) will provide WESTON with data collected via the dry weather MS4 outfall monitoring programs including the HPPF, field screening and special studies.

The report will include a summary of monitoring efforts as well as an assessment of the progress toward achieving the wet and dry weather interim and final WQIP goals for the Upper San Marcos HA.

### **3.2 Receiving Water Monitoring**

The following activities will be performed annually in the Upper San Marcos Creek HA to assess progress toward achieving Carlsbad WQIP wet weather goals for nutrient reduction:

- Continuous flow monitoring at SM-TWAS-1a-DS (or alternate location if needed) from May 1 – September 30,
- Continuous flow monitoring during the wet season (October – April) at SM-TWAS-1a or SM-TWAS-1b (or alternate location if needed),
- Collection of flow-weighted composite samples during one storm event at SM-TWAS-1a or SM-TWAS-1b (or alternate location if needed).

### **3.3 Dry Weather Outfall Monitoring**

The following activities will be performed annually in the Upper San Marcos Creek HA:

- HPPF MS4 outfall sampling by the City of San Marcos (or consultant) and the County of San Diego (WESTON),
- Major MS4 outfall field screening by the City of San Marcos (or consultant) and the County of San Diego (or consultant),
- Continuous flow monitoring special studies conducted by the County of San Diego (or consultant) and the City of San Marcos (or consultant).

### **3.4 Constituents to be Monitored and Measurement Techniques**

#### **3.4.1 Receiving Water**

One flow-weighted composite sample will be collected during one wet weather event annually at station SM-TWAS-1b, or SM-TWAS-1a (or alternate location). A wet weather event will be deemed appropriate for monitoring of a storm event if a minimum of 0.5 inch in a 24-hour period is predicted at least 24 hours in advance. The storm event must also be proceeded by a minimum of 72 hours of dry weather (< 0.1 in rainfall). Sampling methods are discussed in Section 7.

A YSI or similar water quality sonde will be used during the monitored wet weather event to collect water quality parameters of dissolved oxygen, pH, specific conductivity, water temperature and turbidity.

All samples will be collected, processed and analyzed in accordance with this QAPP. Analytes, suggested methods and target reporting limits are provided in Table 4. One field duplicate and one equipment rinse blank ([ERB], bottle/tubing rinse blank) will be collected annually.

**Table 4. Receiving Water Monitored Constituents**

Analyte	Potential Analytical Method	Target Reporting Limit	Units
<b>Field Parameters</b>			
Dissolved Oxygen	Meter	0.01	mg/L
pH	Meter	0.01	pH
Specific Conductivity	Meter	1	µS/cm
Temperature	Meter	0.1	°C
Turbidity	Meter	0.1	NTU
<b>General Chemistry</b>			
TSS	SM 2540D	5	mg/L
<b>Nutrients</b>			
Ammonia as N	USEPA 350.1	0.1	mg/L
Nitrate as N	USEPA 353.2	0.1	mg/L
Nitrite as N	USEPA 353.2	0.1	mg/L
Orthophosphate as P	USEPA 365.1	0.002	mg/L
TKN	USEPA 351.2	0.1	mg/L
Total Nitrogen	Calculated from TKN, Nitrate, and Nitrite	NA	NA
Total Phosphorus	USEPA 365.1	0.01	mg/L

USEPA – United States Environmental Protection Agency

SM – Standard Method

mg/L – milligrams per Liter

µS/cm – micro Siemens per centimeter

### **3.4.2 MS4 Outfall**

The Responsible Agencies conduct dry weather monitoring at outfalls in the Upper San Marcos HA as part of three monitoring approaches. These include the dry weather field screening of major storm drain outfalls in accordance with Permit Provision D.2.b(1); HPPF outfall monitoring in accordance with Permit Provision D.2.b.(2); and dry weather continuous flow monitoring special studies.

Details of the monitoring programs can be found in the Carlsbad WMA MS4 Outfall Monitoring Plan (Carlsbad WMA Responsible Agencies, 2024), and the Upper San Marcos Creek Monitoring Plan (WESTON, 2024) and are summarized below.

### **3.4.3 Field Screening**

The Permit requires Participating Agencies to conduct field screening of major MS4 outfalls during dry weather (Permit Provision D.2.b(1)). Field screening is conducted to determine the outfall flow status, identify non-stormwater and illicit discharges, and prioritize those discharges that will be investigated and eliminated. Each Responsible Agency performs field screening of major storm drain outfalls on an annual basis to maintain an up-to-date inventory of major outfalls and to initiate follow-up investigations that identify and mitigate the source(s).

During field screening, the Responsible Agencies recorded visual observations of outfall and flow characteristics including:

- flow conditions (flowing, ponded, dry, or tidal);
- whether flow reached the receiving water;
- whether there was a non-stormwater flow source;
- potential non-stormwater sources;
- whether the flow source was eliminated;
- evidence of obvious illicit connections or illicit discharges (IC/IDs);
- whether trash was present, and relative amount; and
- whether there was evidence of illegal dumping.

### **3.4.4 Highest Priority MS4 Outfalls with Persistent Flow**

Permit Provision D.2.b.(2) specifies requirements for dry weather monitoring of the highest priority MS4 outfalls with persistent flow. The purpose of this monitoring is to evaluate the potential impacts from MS4 outfall discharges on receiving water quality during dry weather conditions and to assess the ability of programs to effectively eliminate non-stormwater discharges to receiving waters.

Analytes, suggested methods and target reporting limits are provided in Table 5. Monitoring locations are provided in Section 6.1.1.

**Table 5. Highest Priority Persistently Flowing MS4 Outfall Monitored Constituents**

Analyte	Suggested Analytical Method*	Target Reporting Limit	Units
Conventional Parameters			
Dissolved Oxygen	Meter	0.01	mg/L
pH	Meter	0.01	pH
Specific Conductivity	Meter	1	µS/cm
Sulfates	USEPA 300.0	0.5	mg/L
Temperature	Meter	0.1	°C
Total Hardness	SM 2403B/USEPA 200.7	3.31	mg/L
Turbidity	Meter	0.1	NTU
Indicator Bacteria			
Enterococcus	SM 9230B	20	MPN/100mL

Analyte	Suggested Analytical Method*	Target Reporting Limit	Units
Fecal Coliform	SM 9221E	20	MPN/100mL
Total Coliform	SM 9221B	20	MPN/100mL
E. Coli <sup>1</sup>	SM 9223B	20	MPN/100mL
Inorganic Analytes			
Cadmium (Dissolved)	USEPA 200.8	0.0001	mg/L
Cadmium (Total)	USEPA 200.8	0.0001	mg/L
Chromium (Dissolved)	USEPA 200.8	0.0002	mg/L
Chromium (Total)	USEPA 200.8	0.0002	mg/L
Chromium III (Dissolved)	Calculated from Chromium and Chromium VI	NA	NA
Chromium III (Total)	Calculated from Chromium and Chromium VI	NA	NA
Chromium VI (Dissolved)	USEPA 218.6	0.0003	mg/L
Chromium VI (Total)	USEPA 218.6	0.0003	mg/L
Copper (Dissolved)	USEPA 200.8	0.0005	mg/L
Copper (Total)	USEPA 200.8	0.0005	mg/L
Iron (Dissolved)	USEPA 200.7	0.01	mg/L
Iron (Total)	USEPA 200.7	0.01	mg/L
Lead (Dissolved)	USEPA 200.8	0.0002	mg/L
Lead (Total)	USEPA 200.8	0.0002	mg/L
Manganese (Dissolved)	USEPA 200.8	0.0002	mg/L
Manganese (Total)	USEPA 200.8	0.0002	mg/L
Nickel (Dissolved)	USEPA 200.8	0.0008	mg/L
Nickel (Total)	USEPA 200.8	0.0008	mg/L
Selenium (Dissolved)	USEPA 200.8	0.0002	mg/L
Selenium (Total)	USEPA 200.8	0.0002	mg/L
Silver (Dissolved)	USEPA 200.8	0.0002	mg/L
Silver (Total)	USEPA 200.8	0.0002	mg/L
Zinc (Dissolved)	USEPA 200.8	0.005	mg/L
Zinc (Total)	USEPA 200.8	0.005	mg/L
Nutrients			
Ammonia	USEPA 350.1	0.1	mg/L
Nitrate	USEPA 353.2	0.1	mg/L
Nitrite	USEPA 353.2	0.1	mg/L
Orthophosphate	USEPA 365.1	0.002	mg/L
TKN	USEPA 351.2	0.1	mg/L

Analyte	Suggested Analytical Method*	Target Reporting Limit	Units
Total Nitrogen	Calculated from TKN, Nitrate, and Nitrite	NA	NA
Total Phosphorus	USEPA 365.1	0.01	mg/L
Solid Parameters			
TDS	SM 2540C	10	mg/L
TSS	SM 2540D	5	mg/L
Synthetic Organic Compounds			
Pyrethroids	EPA 625	Varies	ug/L
DDT/DDE	EPA 608 low level	5.0	ng/L
MBAS	SM 5540C	0.05	mg/L

\*The methods presented in the table are optional. Other equivalent EPA-approved methods may be substituted as long as the target reporting limits are met for the corresponding constituents.

<sup>1</sup>. Per Table D-7 of the Permit, E. Coli may be substituted for Fecal Coliform.

USEPA – United States Environmental

Protection Agency SM – Standard Method

mg/L – milligrams per Liter

µS/cm – micro Siemens per centimeter

Additional monitoring program details can be found in Section 2.3 of the Carlsbad WMA MS4 Outfall Monitoring Plan (Carlsbad Responsible Agencies, 2024).

### **3.4.1 Continuous Flow Monitoring**

The County of San Diego and City of San Marcos may conduct special studies in the Upper San Marcos HA to continuously monitor dry weather flows at several priority outfalls during the dry season. Outfalls selected for additional monitoring will be evaluated each year and may change based on reprioritization of efforts. Monitoring methods, including flow measurement methodology, may also differ each monitoring year and may include the use of continuous flow monitoring or instantaneous flow monitoring.

Continuous flow measurements may be conducted using sensors that measure level (stage) and/or area/velocity. Data will be downloaded periodically from the sensors/data loggers and checked for quality control and to prevent data gaps. Depending on the sites, it may be necessary to install weirs in order to completely submerge the sensors. Flow rates can then be calculated from the sensor measurements, channel/pipe dimensions, and weir equations specific to the type of weir (if any) installed.

Flow may also be measured using instantaneous measurement methods. Methods will be in accordance with the USEPA NPDES stormwater sampling guidance (USEPA, 1992).

## **3.5 Project Schedule**

Table 6 details the project schedule for monitoring and reporting for Upper San Marcos Creek Monitoring, including initiation and completion dates for major tasks, required deliverable(s), and the deliverable(s) due date. Receiving water wet season water monitoring will be conducted from October to April each year; and dry season receiving water flow monitoring will be conducted from May to September annually. This schedule assumes that monitoring collected for the MS4 outfall monitoring programs will be conducted by the Responsible Agencies during the dry season (May – September) and that data will be provided to WESTON from the Responsible Agencies for assessment of progress towards dry weather goals.

**Table 6. Project Schedule**

Task	Frequency	Anticipated Start Date	Anticipated End Date
<b>Project Planning</b>			
Monitoring Plan	As needed	January 1, 2024	January 20, 2024
Quality Assurance Project Plan (QAPP)	As needed	January 1, 2024	January 20, 2024
<b>Monitoring Activities</b>			
Flow Data Collection SM-TWAS-1aDS	Annually	May 1*	September 30*
Flow Data Collection SM-TWAS-1b	Annually	October 1*	April 30*
Wet weather event sampling (one event)	Annually	October 1	April 30
HPPF Monitoring	Annually	April 1	September 30
Dry Weather Field Screening	Annually	April 1	September 30
Special Studies	TBD	TBD	TBD

**Table 6. Project Schedule**

Task	Frequency	Anticipated Start Date	Anticipated End Date
<b>Reporting and Assessment Activities**</b>			
Draft Project Report	Annually	September 15	November 30
Review of Draft Report	Annually	November 30	December 15
Final Project Report	Annually	December 15	December 30
Data Submittal to CEDEN	Annually	December 1	January 31

CEDEN – California Environmental Data Exchange Network

\*Estimated date – actual date will depend upon site conditions

\*\* Schedule may be adjusted to align with WQIP Annual Reporting schedule

### 3.6 Geographical Setting

Upper San Marcos Creek is located in Northern San Diego County and drains an area of approximately 18,540 acres (DBSA, 2016) within the Carlsbad Watershed Management Area (WMA) and San Marcos Hydrologic Area (HA). The Creek originates in the Merriam Mountains in San Diego County (MOE, 2021) and receives flow from areas under the jurisdiction of the Cities of San Marcos and Escondido and unincorporated areas of the County of San Diego (San Diego Regional Water Quality Control Board [San Diego Water Board], 2019) before flowing into Lake San Marcos. Primary landuses with the Upper San Marcos Creek watershed include agricultural, urbanized, and open space (MOE, 2021).

Lake San Marcos separates the San Marcos HA into two distinctive areas, the Upper San Marcos HA and the Lower San Marcos HA (MOE, 2021). The Upper San Marcos HA includes portions of the County of San Diego and cities of Escondido and San Marcos as well as the Upper San Marcos Creek. The Lower San Marcos HA contains sections of the Cities of San Marcos, Carlsbad, Encinitas, and the County and ultimately drains into Batiquitos Lagoon before reaching the Pacific Ocean (MOE, 2021).

### 3.7 Constraints

Access to sites may be altered by natural or anthropogenic changes that may prevent physical or safe access to the site(s) and limit the ability to collect data. If this should occur, the Project Manager for the applicable Responsible Agency will be notified and an alternative monitoring location may be selected.

Due to the topography at SM-TWAS-1b, there is the potential for flooding to occur and it may be necessary to remove the equipment during large storm events. Should this occur, efforts will be made to minimize any data gaps. All monitoring equipment will be maintained throughout this project; however, equipment failures are possible which may require modeling of flow data.

In 2020, the City of San Marcos began work on the San Marcos Creek Project. The project is designed to add infrastructure such as new bridges on Via Vera Cruz and Bent Avenue to alleviate flooding issues and to preserve creek habitat. Project construction will affect access to established monitoring stations such as SM-TWAS-1b and will result in the need to move monitoring locations.

## 4.0 QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT OBJECTIVES

### 4.1 Measurement Quality Indicators

Measurement quality indicators for field measurements and laboratory analysis, including accuracy, precision, recovery, completeness, and representativeness, will be used to assess overall data quality for this monitoring program. These indicators and measurement quality objectives (MQOs) are used to determine the acceptable level of error in the data produced by the sampling program. Acceptance criteria will be based on the implementation of acceptable and recognized QA/QC procedures. Acceptable data must have been collected and analyzed using proper sample collection and handling methods, sample preparation and analytical procedures, holding times, stability issues, and QA protocols. The data quality indicators for both the field measurements and laboratory analyses are summarized in Table 7, followed by a brief discussion of the objectives of each indicator.

**Table 7. Measurement or Analysis Type and Applicable Measurement Quality Indicator**

Measurement or Analysis Type	Applicable Data Quality Objective
Laboratory Analyses	Accuracy, Precision, Completeness, Representativeness
Field Measurements	Accuracy, Precision, Completeness, Representativeness

#### 4.1.1 Accuracy

Accuracy (bias) is a measure of how closely the analytical result or field measurement represents the true quantity found in the sample. Evaluation of the accuracy of laboratory samples in this study will be achieved through the preparation and analysis of laboratory control samples (LCS) and matrix spikes (MS) with each analytical batch. The accuracy of the laboratory samples is quantified as percent recovery. For bacteria analysis precision is measured through positive or negative controls and field blanks.

#### 4.1.2 Precision

Precision is the measure of agreement among repeated measurements of the same property under identical or substantially similar conditions calculated as either the range or as the standard deviation. The precision of laboratory measurements will be controlled by comparison of the sample to either a laboratory duplicate or a laboratory matrix spike/matrix spike duplicate (MS/MSD). One laboratory duplicate or one MS/MSD will be performed per 20 samples or one per analytical batch, whichever is more frequent. Results of the duplicate analysis are evaluated by calculating the relative percent difference (RPD). For all constituents with the exception of fecal bacteria, the RPD will be calculated as follows:

$$RPD = (X_1 - X_2) / [(X_1 + X_2) / 2] * 100$$

Where:

$X_1$  = larger of two concentrations, and  $X_2$  = smaller of two concentrations

Laboratory batches with RPDs of less than 25% are considered acceptable data.

Precision in field duplicates is also evaluated using relative percent difference (RPD). RPDs of less than 25% are considered acceptable data.

Laboratory precision for fecal indicator bacteria will be measured per the Surface Water Ambient Monitoring Program (SWAMP) requirements for Indicator Bacteria in Fresh Water (revised March 2022). Lab replicates will be performed per 10 samples or per batch, whichever is more frequent. Results from the preceding 15 positive samples of a specific type (matrix) will be used to calculate a running mean. The calculation is summarized below:

*Step 1:*

*Record the results from duplicate analyses (these results are here designated as D<sub>1</sub> and D<sub>2</sub>).*

*Step 2:*

*Calculate the logarithm (here designated as L<sub>1</sub> and L<sub>2</sub>) of each duplicate result.*

*Note: If either of the values D<sub>1</sub> or D<sub>2</sub> are less than 1, add 1 to both values before calculating the logarithms.*

$$\begin{aligned}L_1 &= \log D_1 \\L_2 &= \log D_2\end{aligned}$$

*Step 3:*

*Calculate the range of logarithms (R<sub>log</sub>) for each pair of duplicates. R<sub>log</sub> is equal to the absolute value of the difference between the two numbers.*

$$R_{log} = | L_1 - L_2 |$$

*Step 4:*

*Calculate the mean of R<sub>log</sub> (R) for the duplicates analyzed*

$$\bar{R} = \frac{\sum R_{log}}{n}$$

*where:*

*$\sum R_{log}$  = the sum of the ranges of logarithms calculated for each pair of duplicates*

*n = the number of pairs of duplicates (in this case, n = 15)*

*Step 5:*

*Assess the precision of the duplicate analyses. In order for the laboratory to demonstrate an acceptable level of precision, the range of logarithms for a particular duplicate must be less than the mean of the range of logarithms multiplied by 3.27:*

$$R_{log} \leq 3.27 \times \bar{R}$$

Field duplicates are not a current SWAMP requirement for bacteria.

#### **4.1.3 Representativeness**

Representativeness is a qualitative term that describes how characteristic a sample is of the actual environmental condition from which it was collected. Determining appropriate sampling locations, sampling frequency, and use of approved/documentated SOPs and analytical methods will control to the greatest extent possible that the measurement data represent the conditions at the monitoring

site.

#### 4.1.4 Completeness

Completeness is a measure of the percentage of sample results that are collected and analyzed and determined to be valid. Field personnel and the analytical laboratory will strive for 90% data completeness, which accounts for unexpected field conditions, equipment problems, and laboratory error.

#### 4.2 Measurement Quality Objectives

Table 8 provides the MQOs for field and laboratory measurements. All laboratory blanks, LCS, MS, MSD, and laboratory duplicates must be analyzed at a frequency of one per 20 samples or one per analytical batch, whichever is more frequent. For bacteria samples laboratory duplicates must be analyzed at a frequency of one per 10 samples or per analytical batch, whichever is more frequent.

Field duplicates and field blanks (or ERBs) will be collected to account for at least 5% of samples for each program.

**Table 8. Measurement Quality Objectives for Field and Laboratory Measurements**

Group	Parameter	Accuracy	Precision	Completeness
Fecal Indicator Bacteria	Enterococcus E. coli Fecal coliform Total coliform	Field Blank: No growth on filter  Laboratory Controls:  Positive control and reference material = Growth on filter  Negative control = No growth on filter	Lab Replicate Rlog ≤ 3.27 x R	90%
General Constituents	Total Suspended Solids, Total Dissolved Solids	Laboratory Control Spike 80- 120% or Matrix Spike 80%-120%	Laboratory Duplicate or Matrix Spike Duplicate (RPD<25%)	90%
Organic Constituents	DDE, MBAS	Laboratory Control Spike 50-150% or Matrix Spike 50%-150%	Laboratory Duplicate or Matrix Spike Duplicate (RPD<25%)	90%
Nutrients	Ammonia, Nitrate as N, Nitrite as N, Orthophosphate as P, Total Phosphorus, TKN	Laboratory Control Spike 90-110% or Matrix Spike 80%-120%	Laboratory Duplicate or Matrix Spike Duplicate (RPD<25%)	90%
Metals	Total and dissolved metals	Laboratory Control Spike 75- 125% or Matrix Spike 75%-125%	Laboratory Duplicate or Matrix Spike Duplicate (RPD<25%)	90%
Field Measurements	pH	±0.2	±2	90%
	Specific Conductivity	±2	±2 or ±10%	90%
	Dissolved Oxygen	±0.5	±0.5 or ±10%	90%

Group	Parameter	Accuracy	Precision	Completeness
	Water Temperature	±0.2	±1 or ±10%	90%
	Turbidity	±1	±1 or ±10%	90%

% - percent

Dichlorodiphenyldichloroethylene

MBAS – methylene blue active substances

TKN – Total Kjeldahl Nitrogen

#### **4.3 Project Action Limits for Parameters of Interest**

Receiving water sample results will be compared to applicable water quality objectives in the San Diego Basin Plan (San Diego Water Board, 2021) and USEPA criteria (Table 9).

**Table 9 Water Quality Objectives**

Analyte	Units	Water Quality Objective	Reference
Dissolved Oxygen	mg/L	5 mg/L	Basin Plan
pH	pH	6.5-8.5	Basin Plan
Turbidity	NTU	20	Basin Plan
Ammonia as N	mg/L	calculation	U.S. EPA, 2013 Aquatic Life Ambient Water Quality Criteria for Ammonia - Freshwater, EPA-822-R-13-001, April 2013.
Total Nitrogen	NA	1 (a)	Basin Plan
Total Phosphorus	mg/L	0.1 (b)	Basin Plan

(a) Based upon Basin Plan suggested ratio of 10:1 for nitrogen to phosphorus.

(b) Basin Plan objective for flowing waters.

## **5.0 SPECIAL TRAINING NEEDS/CERTIFICATIONS**

Field personnel will have current and relevant experience in the aspects of standard field monitoring, including use of relevant field monitoring equipment, experience in the collection and handling/storage of samples, and chain-of-custody (COC) procedures. Training in techniques for proper field sampling and sample-handling will be reviewed prior to the sampling event, and only those staff with proficiency will be permitted to conduct field work.

All laboratory analysts will be proficient in the use of analytical equipment, conducting analytical protocols, and other general laboratory processes. The QA Officer is responsible for distributing the most up-to-date QAPP for this monitoring project to the respective laboratory staff and ensuring that the staff understand and follow all SOPs and the QAPP for the duration of this study.

### **5.1 Training and Certification Documentation**

Personnel are responsible for complying with QA/QC requirements that pertain to their organizational/technical function. Technical staff members must have a combination of experience and education to adequately demonstrate a specific knowledge of their particular function and a general knowledge of laboratory operations, test methods, QA/QC procedures, and records management. The Laboratory's QA officer will ensure that all laboratory staff is proficient at analyses applicable to this project. Training and certification documents for laboratory staff will be maintained by the Laboratory's QA officer, or their designee.

### **5.2 Training Personnel**

The Project Manager and/or Field Sampling Lead will provide training for field personnel in proper field sampling techniques prior to work initiation to ensure consistent and appropriate sampling, sample handling/storage, and COC procedures. The Laboratory's QA officer will ensure that training is provided to the laboratories' personnel for implementing standard laboratory procedures and maintaining proper documentation.

## **6.0 DOCUMENTS AND RECORDS**

The applicable consultant will document and track the aspects of the sample collection process, including generating field logs at each site and COC forms for the samples collected. COC forms will accompany samples to the laboratory. The laboratory will document and track the aspects of receipt and storage, analyses, and reporting related to the samples.

The applicable consultant will maintain a database of information collected during this project. The database will include field observations, data sheets, COC records, and analytical results. The original data sheets and reports produced will be accumulated into project-specific files maintained in file cabinets at the consultant's office after the report has been submitted. Data from outside contractors are kept exactly as received. Records will be maintained for at least five years or transferred according to agreement between the company and the client.

The consultant's Project Manager will be responsible for maintaining records for this project. The applicable Project Manager will oversee the operations of the project, will maintain the sample collection, sample transport, COC, field analysis forms, and laboratory data. The Project Manager will also arbitrate any issues relative to records retention and any decisions to discard records.

Copies of this QAPP will be distributed to the parties identified previously in Element 3. Updates to this QAPP will be distributed in like manner, and previous versions will be discarded from the project file. WESTON's Project Manager (Ms. Mattson) under the direction, supervision, and review of WESTON's QA Officer (Ms. Yonemasu), will be responsible for distributing an updated version of the QAPP.

Copies of the final report(s), including laboratory results and field records, will be maintained for a minimum of five years after project completion.

## GROUP B: DATA GENERATION AND ACQUISITION

## 6.0 SAMPLE PROCESS DESIGN

### 6.1 Station Locations

#### 6.1.1 Receiving Water

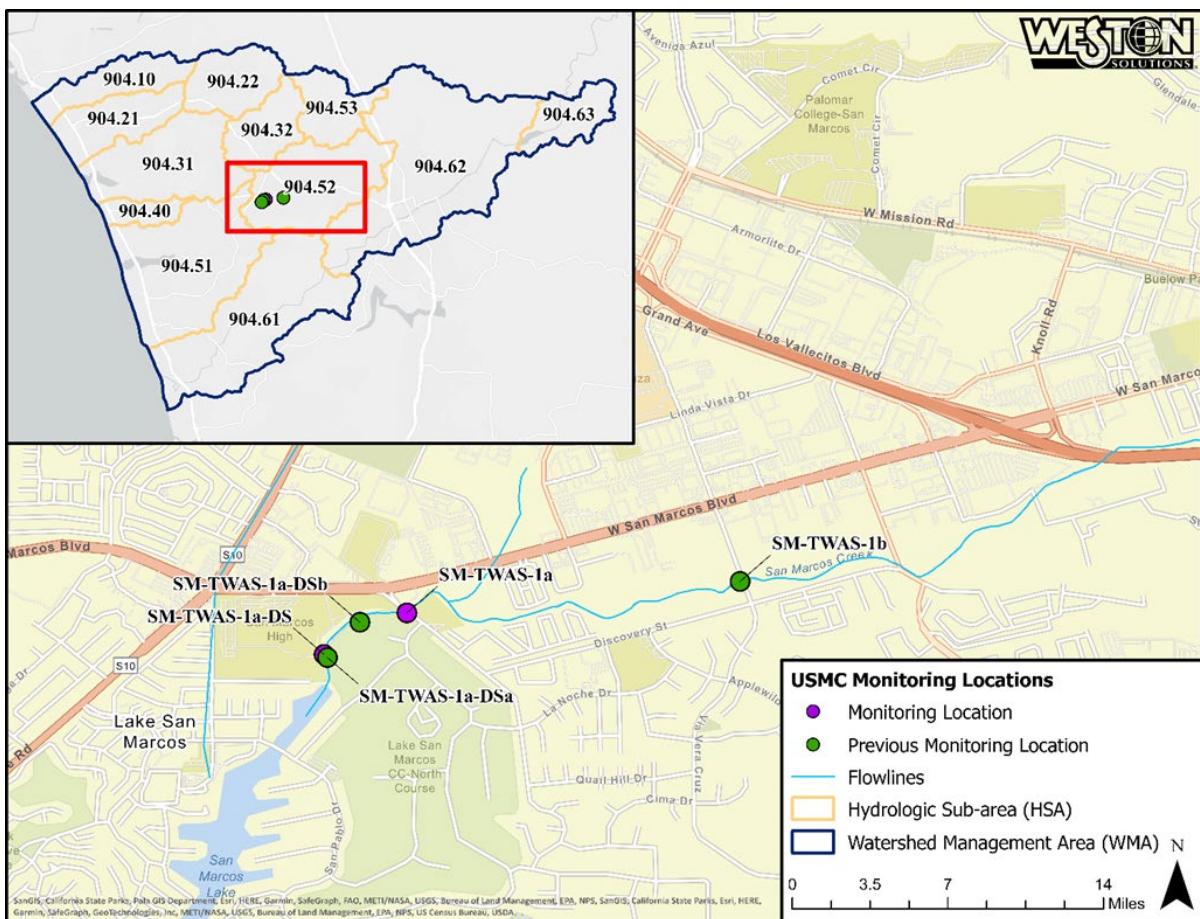
Stations selected for continuous flow measurement along San Marcos Creek are summarized in Table 10, and shown in Figure 10-1. The uppermost station (SM-TWAS-1b), located on San Marcos Creek at Via Vera Cruz, has been monitored regularly since 2008 and will continue to be used to monitor flow and nutrient levels during the wet season (approximately October - April) (Figure 10). The downstream station, SM-TWAS-1a-DS, will be monitored during the dry season (approximately May through September), and will capture all inputs to San Marcos Creek downstream of the Via Vera Cruz station and upstream of Lake San Marcos (Figure 10-1). This station is a relocation of a historically monitored station at Discovery Street. A weir will be installed at station SM-TWAS-1a-DS to facilitate accurate flow measurements during dry weather conditions.

One flow-weighted composite sample will be collected during one wet weather event at SM-TWAS-1b.

Due to ongoing construction preventing access to SM-TWAS-1b, a second location was chosen to monitor flow and nutrient levels during the wet season (approximately October – April) during the time period of construction, approximately 2021 – 2024.

**Table 10. Receiving Water Monitoring Station Locations**

Station ID	Station Name	Latitude	Longitude	Location Description
SM-TWAS-1a	2022-2023 wet weather monitoring location	33.130386	-117.200407	San Marcos Creek upstream of Discovery Street Bridge
SM-TWAS-1b	Via Vera Cruz	33.13166	-117.1869	San Marcos Creek at Via Vera Cruz
SM-TWAS-1a-DS	Downstream of Discovery Street	33.12864	-117.2039	San Marcos Creek downstream of Discovery Street Bridge
SM-TWAS-1a-DSb	2022 dry weather monitoring location	33.130007	-117.20231	San Marcos Creek downstream of Discovery Street Bridge



**Figure 2. Station Locations along Upper San Marcos Creek**

### 6.1.2 MS4 Outfall

#### 6.1.2.1 Field Screening

Each Responsible Agency performs field screening of major storm drain outfalls on an annual basis to maintain an up-to-date inventory of major outfalls. Major MS4 Outfalls located in the Upper San Marcos HA are provided in Figure 3.

#### 6.1.2.2 Highest Priority MS4 Outfalls with Persistent Flow

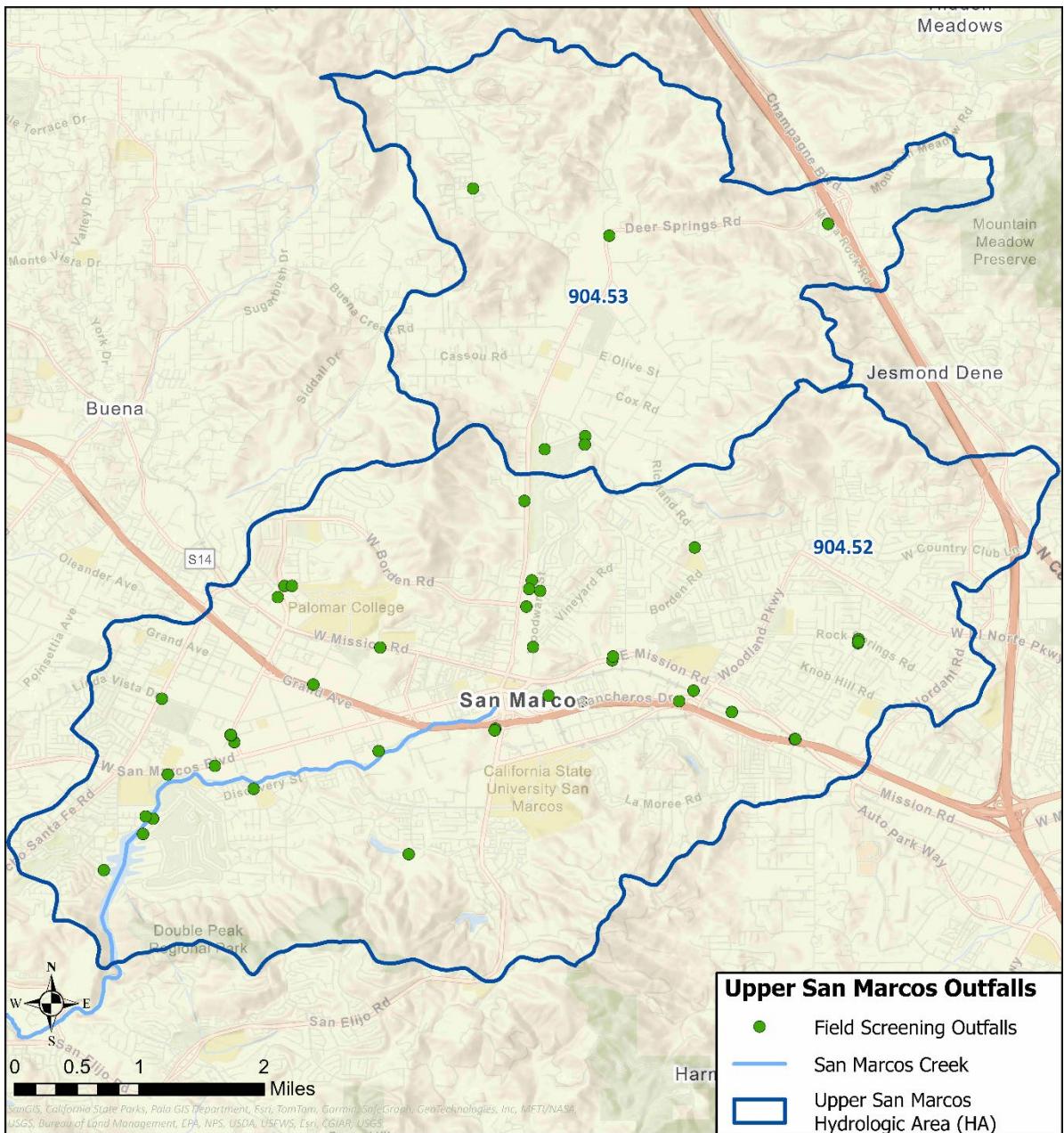
Permit Provision D.2.b.(2) specifies requirements for dry weather monitoring of the highest priority MS4 outfalls with persistent flow. The purpose of this monitoring is to evaluate the potential impacts from MS4 outfall discharges on receiving water quality during dry weather conditions and to assess the ability of programs to effectively eliminate non-stormwater discharges to receiving waters.

All five of the City of San Marcos' highest priority persistently flowing outfalls in the Carlsbad WMA are located within the Upper San Marcos HA as are three of the County of San Diego's highest priority outfalls (Table 11).

Additional monitoring program details can be found in Section 2.3 of the Carlsbad WMA MS4 Outfall Monitoring Plan (Carlsbad Responsible Agencies, 2024).

**Table 11. Highest Priority Outfalls Located in the Upper San Marcos HA**

Outfall	Latitude	Longitude
<b>County of San Diego</b>		
MS4-CAR-069	33.12606	-117.2042
MS4-CAR-070	33.12631	-117.20506
MS4-CAR-072	33.12007	-117.20991
<b>City of San Marcos</b>		
INL11196	33.14152	-117.18557
OUT026	33.140360	-117.143040
OUT053	33.13117	-117.20248
OUT10236	33.134930	-117.194780
OUT10330	33.13843	-117.13703



**Figure 3. Dry Weather MS4 Outfall Monitoring Locations**

### **6.1.2.3 Continuous Flow Monitoring**

The County of San Diego and City of San Marcos may also conduct special studies in the Upper San Marcos HA to continuously monitor dry weather flows at priority outfalls during the dry season.

The County of San Diego has conducted dry season continuous flow monitoring within the Carlsbad WMA since 2016, including sites within the Upper San Marcos HA (Table 12.). The City of San Marcos has also conducted continuous flow monitoring at the several highest priority major outfalls in the Upper San Marcos HA within their jurisdiction. Additional information on these studies can be found in the CAR WMA WQIP Annual Reports. Outfalls selected for continuous flow monitoring will be re-evaluated each year and may change based on reprioritization of efforts. Monitoring methods, including flow measurement methodology, may also differ each monitoring year and may include the use of continuous flow monitoring or instantaneous flow monitoring.

**Table 12. San Marcos HA Continuous Flow Monitoring Outfalls Summary – County of San Diego**

Location Type	Station Name	Jurisdiction	Years with Continuous Monitoring
Highest priority persistently flowing Outfall	MS4-CAR-069	County	2017-2018
	MS4-CAR-070		2015-2016, 2016-2017, 2017-2018, 2018-2019
	MS4-CAR-072		2015-2016, 2016-2017, 2017-2018, 2018-2019
	OUT002	City of San Marcos	2016-2017, 2017-2018, 2018-2019
	OUT023		2016-2017, 2017-2018, 2018-2019
	OUT053		2016-2017, 2017-2018, 2018-2019
	OUT10237		2016-2017, 2017-2018, 2018-2019
	OUT10330		2016-2017, 2017-2018, 2018-2019
Outfalls located upstream of a highest priority persistently flowing outfall	MS4-CAR-072O	County	2017-2018, 2018-2019
	MS4-CAR-072B		2018-2019

## **6.2 Variability and Bias**

Natural variability may occur within a given sampling location. Proper sampling procedures will help minimize variability. Field personnel will follow USEPA guidance for collecting composite samples and field measurements. A field duplicates will also be collected to assess variability.

Bias is defined as the systematic or persistent distortion of a measurement process that causes errors in one direction. Bias, with regard to sample collection, will be controlled using best professional judgment to obtain representative samples that reflect field conditions. Equipment rinse blanks or field blanks will also be used to measure potential contamination introduced during sample collection.

## **7.0 SAMPLING METHODS**

### **7.1 Receiving Water**

#### ***7.1.1 Wet Season Monitoring***

Flow at SM-TWAS-1b, SM-TWAS-1a, or another monitoring location will be continuously monitored throughout the wet season. Flow rates will be monitored using American Sigma flowmeters with an ultrasonic sensor, bubbler, or submerged pressure transducer as the primary measuring device. The primary sensor will continuously measure the creek's stage (i.e., water level) and relay that information to the flowmeter. The flowmeter will continually calculate flow rates by inserting the stage information into the preprogrammed discharge equation. Continuous flow data will be downloaded from the monitoring station every two weeks to provide a better understanding of flow estimates for constituent loading information and to verify equipment functionality.

A flow-weighted composite sample will be collected during one storm event at SM-TWAS-1b, SM-TWAS-1a, or another monitoring location using an auto-sampler. The flow-weighted composite sample will be collected during representative flow conditions and will be comprised of a minimum of three sample aliquots, spaced at least 15 minutes apart. A forecast of greater than or equal to 0.5 inch of rain in a 24-hour period will be required to trigger the mobilization of WESTON field staff. The storm event must be preceded by a minimum of 72 hours of dry weather (< 0.1 in rainfall).

During the wet weather sampling event, the field team will record all pertinent sample information, such as sample time, date, weather conditions, water appearance, presence of trash, etc. on designated field data sheets (Appendix A).

#### ***7.1.2 Dry Season Monitoring***

Dry season flow monitoring will be conducted at station SM-TWAS-1a-DS, SM-TWAS-1a-DSb, or another monitoring location, located downstream of Discovery Street. Flow will be continuously monitored at the SM-TWAS-1a-DS, SM-TWAS-1a-DSb, or another monitoring station throughout the dry season (approximately May– September) using a HOBO level logger or similar device. The sensor will continuously measure stage (i.e., stream height). Level data will be downloaded from the monitoring station frequently to verify equipment functionality and minimize data gaps. Monitoring equipment at this location will be maintained throughout the project to ensure it is in proper working order.

### **7.2 MS4 Outfall**

#### ***7.2.1 Field Screening***

Samples are not collected for analysis during field screening activities. Observations of site conditions are recorded, as described in Section 6.2.2.1 during dry weather conditions (<0.1 inch of precipitation in previous 72 hours).

#### ***7.2.2 Highest Priority Outfalls with Persistent Flow***

HPPF monitoring is conducted during dry weather conditions (<0.1 inch of precipitation in previous 72 hours). During the monitoring events, field observations (as described in Section 6.2.2.1) are recorded at each of the identified outfalls. Flow rates and volumes are measured or estimated in accordance with the USEPA Storm Water Sampling Guidance Document (EPA-833-B-92-001).

Field measurements (Section 3.4.3) will be collected using a YSI 6600 or similar device. When sufficient flowing or ponded water (for the County of San Diego sites) grab samples will be collected

and submitted for analysis to an analytical laboratory(ies). Grab samples will be collected in accordance with SWAMP protocols and will follow strict chain of custody (COC) procedures (Section 12.2).

### ***7.2.3 Continuous Flow Monitoring***

Samples are not collected for analysis during continuous flow monitoring activities. Water level measurements are logged at 5-minute increments as described in Section 3.4.5.

## 8.0 SAMPLE HANDLING CUSTODY

### 8.1 Sample Collection

Samples will be uniquely identified with sample labels in indelible ink. All sample containers will be identified with the project title, appropriate identification number, date and time of sample collection, and preservation method. Upon collection, samples will be stored on ice until delivery to the applicable laboratory. All samples will be delivered to the applicable laboratory for analysis within the required holding times (Table 13).

**Table 13. List of Analytes with Sample Volume, Container Type, Holding Time, and Preservation Method**

Analyte	Volume/Container	Holding Time	Preservation
<b>Fecal Indicator Bacteria</b>			
E. coli	100 mL/HDPE	8 hours	None
Enterococcus	100 mL/HDPE	8 hours	None
Fecal Coliform	100 mL/HDPE	8 hours	None
Total Coliform	100 mL/HDPE	8 hours	None
<b>Conventional Parameters</b>			
Total Dissolved Solids	2L/Poly	7 days	None
Total Suspended Solids	2L/Poly	7 days	None
<b>Nutrients</b>			
Ammonia as N	250 mL/Poly	28 days	H <sub>2</sub> SO <sub>4</sub>
Nitrate as N	250 mL/Poly	48 hours	None
Nitrite as N	250 mL/Poly	48 hours	None
Orthophosphate as P	250 mL/Poly	48 hours	None (field filter)
Total Kjeldahl Nitrogen	250 mL/Poly	28 days	H <sub>2</sub> SO <sub>4</sub>
Total Phosphorus	250 mL/Poly	28 days	H <sub>2</sub> SO <sub>4</sub>
<b>Metals</b>			
Cadmium (Dissolved)	250 mL/Poly	6 months	None
Cadmium (Total)	250 mL/Poly	6 months	HNO <sub>3</sub>
Chromium (Dissolved)	250 mL/Poly	6 months	None
Chromium (Total)	250 mL/Poly	6 months	HNO <sub>3</sub>
Chromium III (Dissolved)	250 mL/Poly	6 months	None
Chromium III (Total)	250 mL/Poly	6 months	(NH <sub>4</sub> ) <sub>2</sub> SO <sub>4</sub> buffer
Chromium VI (Dissolved)	250 mL/Poly	28 days	None
Chromium VI (Total)	250 mL/Poly	28 days	HNO <sub>3</sub>
Copper (Dissolved)	250 mL/Poly	6 months	None
Copper (Total)	250 mL/Poly	6 months	HNO <sub>3</sub>
Iron (Dissolved)	250 mL/Poly	6 months	None

**Table 14. List of Analytes with Sample Volume, Container Type, Holding Time, and Preservation Method**

Analyte	Volume/Container	Holding Time	Preservation
Iron (Total)	250 mL/Poly	6 months	HNO <sub>3</sub>
Lead (Dissolved)	250 mL/Poly	6 months	None
Lead (Total)	250 mL/Poly	6 months	HNO <sub>3</sub>
Manganese (Dissolved)	250 mL/Poly	6 months	None
Manganese (Total)	250 mL/Poly	6 months	HNO <sub>3</sub>
Nickel (Dissolved)	250 mL/Poly	6 months	None
Nickel (Total)	250 mL/Poly	6 months	HNO <sub>3</sub>
Selenium (Dissolved)	250 mL/Poly	6 months	None
Selenium (Total)	250 mL/Poly	6 months	HNO <sub>3</sub>
Silver (Dissolved)	250 mL/Poly	6 months	None
Silver (Total)	250 mL/Poly	6 months	HNO <sub>3</sub>
Zinc (Dissolved)	250 mL/Poly	6 months	None
Zinc (Total)	250 mL/Poly	6 months	HNO <sub>3</sub>
Organics			
Methylene Blue Active Substances (MBAS)	500 mL/Poly	48 hours	None
DDE	2 x 1L Amber Glass	48 hours	None
Pyrethroid Pesticides			
Pyrethroids	2x 1L Amber Glass	7 days	None
Bifenthrin	2x 1x Amber Glass	7 days	None

Poly – polyethylene  
Dichlorodiphenyldichloroethylene

## 8.2 Chain-of-Custody Procedures

Samples will be considered to be in custody if they are retained as follows (1) in the custodian's possession or view, (2) retained in a secured place (under lock) with restricted access, or (3) placed in a container and secured with an official seal such that the sample could not be reached without breaking the seal. The principal documents used to identify samples and to document possession will be chain-of-custody (COC) records (example COC form in Attachment A), field logbooks, and field tracking forms. COC procedures will be used for samples throughout the collection, transport, and analytical process.

COC procedures will be initiated during sample collection. A COC record will be provided with each sample or group of samples. Each person who will have custody of the samples will sign the form and ensure the samples will not be left unattended unless properly secured. Documentation of sample handling and custody includes the following:

- Sample identifier.
- Sample collection date and time.
- Any special notations on sample characteristics or analysis.

- Initials of the person collecting the sample.
- Date the sample was sent to the analytical laboratory.
- Shipping company and waybill information.

Completed COC forms will be placed in a plastic envelope and kept inside the cooler containing the samples. Once delivered to the analytical laboratory, the COC form will be signed by the person receiving the samples. The condition of the samples will be noted and recorded by the receiver. COC records will be included in the final reports prepared by the analytical laboratories and are considered an integral part of the report.

### **8.3 Sampling Transport, Shipping, and Storage Procedures**

All samples collected will be delivered on ice inside coolers to the contract laboratory for analysis. Transport of the samples will be coordinated by the Field Sampling Lead to ensure that all samples are sent within appropriate laboratory holding times. Prior to transport, COC forms will be filled out and the original signed COC forms will be inserted in a sealable plastic bag and placed inside the coolers. The contract laboratory will properly and safely dispose of the samples after the analyses are complete and analytical QA/QC procedures have been reviewed and accepted. Table 15 below contains the laboratory contact information.

**Table 15. Analytical Laboratory, Point of Contact, and Shipping Information**

Laboratory	Point of Contact	Shipping Information
Weck Laboratories, Inc.	Kim Tu (626) 336-2139 x102	Weck Laboratories, Inc. 14859 East Clark Avenue City of Industry, CA 91745

## 9.0 ANALYTICAL METHODS

The specific analyses and target reporting limits are outlined in Table 16 for all water samples. All analytical methods utilized will follow USEPA or Standard Methods for the Examination of Water and Wastewater (SM; American Public Health Association [APHA], 2012). All samples will be analyzed by an Environmental Laboratory Accreditation Program (ELAP)-certified laboratory.

**Table 16. Analytes, Analytical Methods, and Target Reporting Limits**

Analyte	Method	Target RL	Units
<b>Conventional Parameters</b>			
Total Hardness	SM 2403B/USEPA 200.7	3.31	mg/L
TDS	SM 2540C	10	mg/L
TSS	SM 2540D	5	mg/L
<b>Indicator Bacteria</b>			
E. Coli	SM 9223B	20	MPN/100mL
Enterococcus	SM 9230C	20	MPN/100mL
Fecal Coliform	SM 9221E	20	MPN/100mL
Total Coliform	SM 9221B	20	MPN/100mL
<b>Inorganic Analytes</b>			
Cadmium (Dissolved)	USEPA 200.8	0.0002	mg/L
Cadmium (Total)	USEPA 200.8	0.0002	mg/L
Chromium (Dissolved)	USEPA 200.8	0.0002	mg/L
Chromium (Total)	USEPA 200.8	0.0002	mg/L
Chromium III (Dissolved)	Calculated from Chromium and Chromium VI	NA	mg/L
Chromium III (Total)	Calculated from Chromium and Chromium VI	NA	mg/L
Chromium VI (Dissolved)	USEPA 218.6	0.0002	mg/L
Chromium VI (Total)	USEPA 218.6	0.0002	mg/L
Copper (Dissolved)	USEPA 200.8	0.0005	mg/L
Copper (Total)	USEPA 200.8	0.0005	mg/L
Iron (Dissolved)	USEPA 200.7	0.03	mg/L
Iron (Total)	USEPA 200.7	0.03	mg/L
Lead (Dissolved)	USEPA 200.8	0.0002	mg/L
Lead (Total)	USEPA 200.8	0.0002	mg/L
Manganese (Dissolved)	USEPA 200.8	0.001	mg/L
Manganese (Total)	USEPA 200.8	0.001	mg/L
Nickel (Dissolved)	USEPA 200.8	0.002	mg/L
Nickel (Total)	USEPA 200.8	0.002	mg/L
Selenium (Dissolved)	USEPA 200.8	0.0004	mg/L
Selenium (Total)	USEPA 200.8	0.0004	mg/L

**Table 17. Analytes, Analytical Methods, and Target Reporting Limits**

Analyte	Method	Target RL	Units
Silver (Dissolved)	USEPA 200.8	0.0002	mg/L
Silver (Total)	USEPA 200.8	0.0002	mg/L
Zinc (Dissolved)	USEPA 200.8	0.01	mg/L
Zinc (Total)	USEPA 200.8	0.01	mg/L
<b>Nutrients</b>			
Ammonia	USEPA 350.1	0.1	mg/L
Nitrate	USEPA 353.2	0.2	mg/L
Nitrite	USEPA 353.2	0.1	mg/L
Orthophosphate	USEPA 365.3	0.010	mg/L
TKN	USEPA 351.2	0.1	mg/L
Total Nitrogen	Calculated from TKN, Nitrate, and Nitrite	NA	mg/L
Total Phosphorus	USEPA 365.1/EPA 200.7	0.05	mg/L
<b>Organic Compounds</b>			
DDE	USEPA 608 low level	5	ng/L
MBAS	SM 5540C	0.05	mg/L
<b>Pyrethroid Pesticides</b>			
Pyrethroids	USEPA 625.1	Varies	ug/L
Bifenthrin	USEPA 625.1	0.002	ug/L

SM – Standard Method

USEPA- United States Environmental Protection Agency

Dichlorodiphenyldichloroethylene

MBAS – methylene blue active substances

## **10.0 QUALITY CONTROL**

### **10.1 Water Sampling**

Quality control for sampling processes will include proper collection of the samples to minimize the possibility of contamination. All samples will be collected in laboratory-supplied, laboratory-certified, contaminant-free sample bottles. Field staff will wear powder-free nitrile or similar gloves at all times during sample collection and handling.

Water samples will be collected in appropriate laboratory-certified containers, immediately placed on ice in coolers, along with completed COCs for transfer to the applicable laboratory. The field crew will ensure that sampling containers are being filled properly and the requirement to avoid contamination of samples at all times is met. A field log will be completed at the site. QC samples, such as blanks and duplicate samples, will be collected and analyzed in sufficient numbers to meet SWAMP requirements (SWRCB, 2022).

### **10.2 Laboratory Analyses**

Laboratory quality control of the collected samples will be performed under the guidelines of this QAPP and the laboratories SOPs (Attachment B). Quality control samples, frequency, and control limits specific to this project are discussed in Element 7 and listed in Table 7-1 and Table 7-2. Laboratory quality control checks may include the use of blanks, laboratory control spikes, matrix spikes and duplicate samples. These checks are performed to identify possible contamination problem(s), and to facilitate the ability to duplicate results. If control limits are exceeded, the laboratory QA Officer will perform corrective actions to determine the cause of the exceedance. Analytical procedures based on laboratory SOPs will be reviewed with appropriate laboratory staff; and errors will be identified, documented, corrected, and reported. Samples will be re-analyzed, if available and within their respective holding times, and deemed necessary.

## **10.3 INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE**

### **10.3.1 Field Equipment**

Prior to conducting field sampling, the Field Lead will be responsible for preparing sampling kits that include field logs, project-specific instructions, COC forms, sample labels, sampling containers, and monitoring equipment. Spare equipment, such as extra bottles, labels, etc., will be included in the field sampling kits in the event that the sampling equipment becomes lost, contaminated, or otherwise needs to be replaced or supplemented. The Field will also verify the water quality sonde has been calibrated per manufacturer's recommendations.

### **10.3.2 Analytical Laboratory**

The contract laboratory is responsible for maintaining their equipment in accordance with their SOPs, which include those specified by the manufacturer and those specified by the method (See Attachment B). Laboratory analysts are responsible for equipment testing, inspection, and maintenance. Corrective actions will be taken to repair equipment, document the issue, and reanalyze the sample if necessary. The Laboratory QA Officer will notify the applicable consultant's Project Manager of any equipment deficiencies impacting sample results or timing or result availability.

### **10.3.3 INSTRUMENT/EQUIPMENT CALIBRATION AND FREQUENCY**

The laboratory equipment used at the contract laboratories will be operated and calibrated according to manufacturer recommendations as well as by criteria defined in individual SOPs. Operation and calibration will be performed by properly trained personnel. Documentation of calibration information will be recorded in appropriate logbooks. If calibration is unsuccessful, then the equipment will be cleaned and parts replaced until a successful calibration can occur. If the equipment fails to calibrate after several attempts, then the Project Manager will be notified that analyses have stopped until functional equipment is available. Affected data will be flagged with appropriate qualifiers. Once equipment is functioning again, the samples will be reanalyzed. Issues with an instrument will be documented and corrective actions will be recorded by the laboratory. The Project Manager will be notified if data are affected by the documented issue.

Calibration of flow monitoring and sampling equipment will be conducted immediately prior to its deployment or use and will be field verified during field visit or sampling event.

Field measurements for pH, specific conductance, dissolved oxygen, turbidity, and temperature will be made using a YSI data sonde or similar device according to the manufacturer's specifications. The data sonde will be calibrated per manufacturer's recommended guidelines.

## **10.5 INSPECTION/ACCEPTANCE OF SUPPLIES AND CONSUMABLES**

It is the duty of each staff member responsible for equipment ordering to inspect equipment and materials for quality and report any equipment or materials that do not meet acceptance criteria to the appropriate Laboratory Manager and/or QA Officer. Upon receipt of materials or equipment, a designated employee will receive and sign for the materials. The items will be reviewed to ensure the shipment is complete, then they will be delivered to the proper storage location. Chemicals will be dated upon receipt. Supplies will be stored appropriately and discarded on the expiration date. The equipment and supplies purchased for use in field sampling activities will be inspected for damage as they are received.

Sample containers will be provided by the contract laboratories. They will be shipped to and stored at the consultant's facility prior to use in the field. Confirmation that sample bottles are laboratory-certified clean will be made when received from the laboratory. The Field Sampling Lead will oversee this element.

## **10.6 NON-DIRECT MEASUREMENTS**

Precipitation data from the San Diego County Rainfall and Stream Level Information System will be used in performance of this monitoring program. Data will be reviewed prior to sampling events in order to ensure that antecedent dry weather requirements have been met prior to sampling. The National Oceanographic and Atmospheric Agency's precipitation forecasts will be used to inform mobilization decisions.

## **10.7 DATA MANAGEMENT**

The applicable consultant will document and track the aspects of the sample collection process, including generating field logs at each site and COC forms for the samples collected. COC forms will accompany samples to the laboratory for analysis.

The laboratory(ies) will document and track the aspects of sample receipt and storage, analyses, and reporting pertaining to all laboratory analyses. Laboratory results will be stored in a database system at their office and will be provided to the applicable consultant both electronically and in hard copy. Further details of the laboratories' data management protocols can be found in their Quality Assurance Manual (Attachment B).

The consultant's Project Managers and QA officers will maintain and control the data and documents collected during this project. All data records, including field-generated data and laboratory data, will be accumulated into project-specific files that are maintained at the consultant's office. Records will be maintained for at least five years or transferred according to agreement between the consultant and the Responsible Agencies.

## **GROUP C: ASSESSMENT AND OVERSIGHT**

## **11.0 ASSESSMENTS AND RESPONSE ACTIONS**

Data collected and analyzed for this monitoring program need to be consistently assessed and documented throughout the project to determine whether the project objectives are being met. Field staff will review sampling procedures prior to conducting samples to ensure that all methods of collection are understood and that equipment/instruments used for sample collection and analysis are functioning and ready for use. Field data sheets will be reviewed prior to leaving the sample location to ensure that all samples were collected and field observations were documented. If the field staff encounters any issues related to sample collection or equipment failure that cannot be immediately corrected at the sample site, they will notify the consultant's Project Manager. Either re-sampling will occur on another day or errors will be noted on field data sheets and reported in the final report.

The laboratory technicians are responsible for following the procedures and operating analytical equipment, including conducting instrument maintenance, calibration of equipment/instruments, and performing laboratory QC sample analyses at the required frequency stated in this QAPP. The laboratory QA Officer is responsible for reviewing the associated QC results that are reported with all of the sample results to evaluate the analytical process performance, verifying that the performance criteria of this QAPP were met, recommending or approving proposed corrective actions, and verifying that corrective actions have been completed.

The need for corrective action comes from several sources, including equipment malfunction, failure of internal QA/QC checks, failure to follow-up on performance or system audit findings, and noncompliance with QA requirements. When measurement equipment or analytical methods fail QA/QC requirements, the problem(s) will be brought immediately to the attention of the laboratory supervisor and QA Officer. Corrective measures will depend entirely on the type of analysis, the extent of the error, and whether or not the error is determinant. Final approval of what the corrective measure will be is the responsibility of the Laboratory's QA Officer. If failure is due to equipment malfunction, the equipment will not be used until repaired. Precision and accuracy will be reassessed, and the analysis will be rerun. Attempts will be made to reanalyze the affected parts of the analysis so that in the end, the product is not affected by failure of QC requirements. When a result in a performance audit is unacceptable, the laboratory will identify the problem(s) and implement corrective actions immediately. A step-by-step analysis and investigation to determine the cause of the problem will take place as part of the corrective action program. If the problem cannot be controlled, the laboratory will analyze the impact on data. Clients will be notified if their data are affected.

## **11.1 REPORTS TO MANAGEMENT**

The applicable consultant's Project Manager is responsible for preparation and submittal of all project deliverables. The applicable Laboratory's QA Officer is responsible for the preparation of all data packages and laboratory reports originating from their laboratory.

WESTON will prepare a Draft Assessment Report for submittal to the Responsible Agencies by October 15 of each year and will include data collected through September. The brief report will include the following elements:

- Project Overview
- Receiving Water Analytical Results
- Receiving Water Nutrient Wet Weather Event Loads
- Appendices with Receiving Water Laboratory Reports and EDDs in CEDEN-compatible format (appendix), flow data, field data sheets and COCs
- Summary of Dry Weather flow data collected by County of San Diego and City of San Marcos including field screening, highest priority persistently flowing outfall monitoring, and continuous flow monitoring studies
- Assessment of progress toward WQIP numeric goals for both dry and wet weather

Flow data collected by consultants other than WESTON will not be provided as part of this report but will be provided through separate scope of works with the applicable Responsible Agency and the consultant. Flow data collected by WESTON during the project will be submitted in MS Excel format and will include flow data and hydrographs for dry and wet weather illustrating when rain events occurred. Calculations of annual loads and dry weather loads are not included in this report. The report is expected to be finalized by November 30 of each year, pending review by the County and other Responsible Agencies.

Receiving water data will be submitted to CEDEN by January 31 of each year for the previous monitoring year. Consultant's Quality Assurance Officer will be responsible for the final review of the receiving water data generated in the field and laboratory.

**Table 18. Management Report Schedule**

Type of Report	Frequency	Projected Delivery Dates(s)	Person(s) Responsible for Report Preparation	Report Recipients
Monitoring Plan	Once	1/20/2020	WESTON Project Manager (Michelle Mattson)	County of San Diego Project Manager (Neil Searing)
Quality Assurance Project Plan (QAPP)	Once	1/20/2020		
Draft Report	Annually	October 15		
Final Report	Annually	November 30		
Proof of Data Submittal to CEDEN	Annually	January 30		

## GROUP D: VALIDATION AND USABILITY

## **12.0 DATA REVIEW, VERIFICATION, AND VALIDATION REQUIREMENTS**

All data generated by this project's activities will be reviewed against the DQOs presented in Element 7 of this QAPP. The field and laboratory personnel, including QA Officers, will be responsible for verifying that the sample collection, handling, and analytical procedures were in accordance with the approved QAPP. The Field Sampling Leads will review all COC forms to ensure adherence to collection, transport to analytical laboratory, and receipt requirements are completed within appropriate holding times.

Laboratory technicians generating the data have the prime responsibility for the accuracy and completeness of data. The laboratory supervisor and QA Officer are responsible for reviewing laboratory data forms and sample logs to ensure that all requirements for sample preservation, sample integrity, data quality assessments, and equipment calibration have been met. Data that do not meet these requirements will be reanalyzed, not reported, or will be reported with qualifiers which provide adequate explanations for the data discrepancies. If data cannot be reported, then consultant's Project Manager will be notified.

## **12.1 VERIFICATION AND VALIDATION METHODS**

After sampling, the field data sheets will be removed from the field logbooks, and sheets will be checked for completeness and accuracy (including sample location, sample date and time, and sample type) by the consultant's Field Sampling Lead. Any field changes or discrepancies will be noted on the field sheets. Copies of the COC forms with signatures from laboratory personnel showing that the laboratory has received the samples will be kept with field data sheets in a designated folder. If there are any questions, clarification from the Field Sampling Lead will be obtained as soon as possible.

Verification and validation of the laboratory data are the responsibility of the laboratory. All sample preparation and analytical activities will be documented in bound laboratory notebooks or on bench sheets. The laboratory technician generating the data has the prime responsibility for the accuracy and completeness of the data. Laboratory technicians and the laboratory QA Officer will review the analytical data to ensure that the sample description information, analysis information, instrument calibration, and analytical results are correct and documentation is complete, and that QC samples meet performance criteria. The laboratory supervisor will maintain analytical reports and QA/QC documentation for this project in a database format. All corrective actions required during the analytical process that may affect sample results will be recorded by the laboratory's QA Officer and reported to the consultant's Project Manager and QA Officer.

In addition to the laboratory performing verification and validation of laboratory data, the consultant's Project Manager or QA Officer will review all laboratory analytical reports and EDDs when they are received from the laboratory to ensure that the data provided are complete and DQOs in this QAPP have been met. Laboratory reports/EDDs that do not meet the consultant's QC check will be returned to the laboratory with requests for correction.

The applicable consultant's Project Manager will be responsible for final review of data analysis and drafts of annual reports prior to submission to the Responsible Agency for their review.

## **12.2 RECONCILIATION WITH USER REQUIREMENTS**

### **12.2.1 Receiving Water**

The goal of the receiving water monitoring program is to determine nutrient wet weather event loads and wet weather annual loads in Upper San Marcos Creek. Data collected in this monitoring program will assist the County in addressing the management question outlined in Element 5.2:

*Are interim goals listed in the Carlsbad WQIP for nutrients in Upper San Marcos Creek being met during the wet weather season?*

In order to answer the question, flow monitoring data will be collected year-round along Upper San Marcos Creek and one wet weather event will be sampled annually to assess nutrient levels. Nutrient loads will be calculated for the event and the concentrations from the event will be used in conjunction with the flow data from non-monitored storm events to estimate the annual wet weather loads in the Creek. Once generated, these loads can be compared against baseline loads to determine if interim wet weather goals are being met.

The QA officer will review the data to determine if data quality objectives have been met. If data do not meet the project's specifications, the QA officer will review the errors and determine if the problem is due to calibration/maintenance, sample techniques, or other factors and they will suggest corrective action. It is expected that the problem would be corrected by retraining, revision of techniques, or replacement of supplies/equipment. If not, then the measurement quality objectives will be reviewed for feasibility. If specific measurement quality objectives are not achievable, the QA officer will recommend appropriate modifications. Any revisions need approval by the WESTON Project Manager and the County of San Diego Project Manager.

### **12.2.2 MS4 Outfall**

Data collected from the multiple dry weather MS4 outfall monitoring programs will be used to answer the following question:

*Are interim and final goals listed in the Carlsbad WQIP for nutrients in Upper San Marcos Creek being met during dry weather?*

As discussed in Section 5.1, the WQIP provides multiple options for achievement of dry weather nutrient goals in the Upper San Marcos HA. Data from the dry weather MS4 outfall monitoring programs will be assessed to determine progress toward achieving these goals.

The applicable consultant's QA officer or Project Manager will review the data to determine if data quality objectives have been met. If data do not meet the project's specifications, the QA officer will review the errors and determine if the problem is due to calibration/maintenance, sample techniques, or other factors and they will suggest corrective action. It is expected that the problem would be corrected by retraining, revision of techniques, or replacement of supplies/equipment. If not, then the measurement quality objectives will be reviewed for feasibility. If specific measurement quality objectives are not achievable, the QA officer or Project Manager will recommend appropriate modifications.

## 13.0 REFERENCES

- Carlsbad WMA Responsible Agencies. 2019. *Carlsbad WMA MS4 Monitoring Plan*. Prepared by Wood Environmental. Revised January 2019. Revised January 2024.
- DBSA (D. B. Stephens & Associates). 2016. *Remedial Investigation/Feasibility Study Report, Upper San Marcos Creek Watershed and Lake San Marcos*. Prepared for Citizens Development Corporation and Public Agency Defendants. September 30, 2016.
- MOE (Mikhail Ogawa Engineering). 2016. *Carlsbad Watershed Management Area Water Quality Improvement Plan*. Prepared and submitted by the Carlsbad Watershed Management Area Responsible Agencies. June 2016 updated May 2018. Updated December 2021.
- San Diego Water Board (San Diego Regional Water Quality Control Board). 2013. Order No. R9-2013-0001, as Amended by Order Nos. R9-2015-0001 and R9-2015-0100. NPDES No. CAS0109266. National Pollutant Discharge Elimination System (NPDES) Permit and Waste Discharge Requirements for Discharges from the Municipal Separate Storm Sewer Systems (MS4s) Draining the Watersheds Within the San Diego Region. November 18, 2015.
- San Diego Water Board (San Diego Water Quality Control Board). 2016. *Water Quality Control Plan for the San Diego Basin (Basin Plan)*. August, 2016. Updated September 2021.
- San Diego Water Board (San Diego Regional Water Quality Control Board). 2019. [http://geotracker.waterboards.ca.gov/regulators/deliverable\\_documents/4515219449/LSM%20Fact%20Sheet%20October%202019.pdf](http://geotracker.waterboards.ca.gov/regulators/deliverable_documents/4515219449/LSM%20Fact%20Sheet%20October%202019.pdf)
- SWRCB (State Water Resources Control Board). 2017. *SWAMP Quality Assurance Program Plan, Surface Water Ambient Monitoring Program*. May 2017. Revised January 2022.
- United States Environmental Protection Agency (USEPA). 1992. NPDES Storm Water Sampling Guidance Document Storm Water Sampling Guidance Document (EPA-833-B-92-001). July, 1992. Available online at: <http://www.epa.gov/npdes/pubs/owm0093.pdf>.
- WESTON (Weston Solutions, Inc.). 2019. *Upper San Marcos Creek Monitoring Plan*. Prepared for the County of San Diego. October 2019. Revised January 2021, January 2022, January 2023, and January 2024.

**Appendix A – Chain of Custody Form**

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- 5817 Dryden Place, Ste 101 • Carlsbad, CA 92008 • (760) 795-6900, FAX 931-1580
- 1340 Treat Blvd, Ste 210 • Walnut Creek, CA 94597 • (925) 948-2600, FAX 948-2601

# CHAIN OF CUSTODY

39630

DATE PAGE OF

## **Appendix B – Laboratory QA/QC Manual**

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Weck Laboratories, Inc.

Analytical Laboratory Service - Since 1964

# Quality Assurance Manual (QAM)

Rev 20.9 – Effective Date 05/02/2023  
Updated 05/02/2023



Weck Laboratories, Inc.

Analytical Laboratory Services - Since 1964



# QUALITY ASSURANCE MANUAL

For  
Weck Laboratories, Inc.

14859 Clark Avenue  
City of Industry, CA 91745  
Telephone 626-336-2139 Fax 626-336-2634  
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Agustin Pierri	Technical Director	626-336-2139 Ext. 128		05/01/2023

Revision Number:	20.9	Effective Date:	05/02/2023
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## Section 3

### INTRODUCTION AND SCOPE

(TNI V1:M2 – Sections 1,2,3)

The purpose of this *Quality Assurance Manual* (QM) is to outline the management system for Weck Laboratories, Inc. The QM defines the policies, procedures, and documentation that assure analytical services continually meet a defined standard of quality that is designed to provide clients with data of known and documented quality and, where applicable, demonstrate regulatory compliance.

The *Quality Manual* sets the standard under which all laboratory operations are performed, including the laboratory's organization, objectives, and operating philosophy. The *Quality Assurance Manual* has been prepared to assure compliance with the 2016 TNI Environmental Laboratory Sector Standard – Volume 1 – Management and Technical Requirements for Laboratories Performing Environmental Analysis (EL-V1-M1 through M7) as well as the DoD Quality Systems Manual for Environmental Laboratories, Version 5.4, 2021. It also covers all applicable requirements, regulations, guidance, and technical standards from the USEPA and State regulatory agencies. This Standard is consistent with ISO/IEC 17025:2017 requirements that are relevant to the scope of environmental testing services and thus, the laboratory operates a quality system in conformance with ISO/IEC 17025:2017(E). In addition, the policies and procedures outlined are compliant with the various accreditation and certification programs listed in Appendix F.

#### 3.1 Scope of Testing

The services provided by this facility include Organic Chemical Analyses, Inorganic Chemical Analyses, Trace Metal analyses, Microbiological Analysis, Physical Analyses and Field services (sampling and simple field determinations).

The laboratory's scope of analytical testing services includes those listed in Appendix E (list of Standard Operating Procedures) and also in the certifications presented in Appendix F.

#### 3.2 Table of Contents, References and Appendices

The Table of Contents is in Section 2 and Appendices are in Section 29.

This *Quality Manual* uses the references included in Modules 1-7 in the 2016 TNI Environmental Laboratory Sector Standard – Volume 1 – Management and Technical Requirements for Laboratories Performing Environmental Analysis.

Other references used in this QM include the following in addition to SW-846, Standard Methods, EPA methods for drinking water and wastewater, ASTM and other recognized sources of analytical methods and guidance documents:

- a) *Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans, QAMS-005/80, December 29, 1980, Office of Monitoring Systems and Quality Assurance, ORD, USEPA, Washington, DC 20460*
- b) *RCRA QAPP Instructions, USEPA Region 5, Revision: April 1998*

- c) *ASTM D-5283-92. Generation of Environmental Data Related to Waste Management Activities: Quality Assurance and Quality Control Planning and Implementation.*
- d) *American National Standards Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs (ANSI/ASQC E-4), 1994.*
- e) *EPA 2185 – Good Automated Laboratory Practices, 1995*
- f) *ISO/IEC Guide 25: 1990. General Requirements for the Competence of Calibration and Testing Laboratories.*
- g) *QA/R-2: EPA Requirements for Quality Management Plans, August 1994.*
- h) *QA/G-4: Guidance for the Data Quality Objectives Process EPA/600/R-96/055, September 1994.*
- i) *A/R-5: EPA Requirements for Quality Assurance Project Plans Draft – November 1997*
- j) *QA/G-5: Guidance on Quality Assurance Project Plans EPA/600/R-98/018, February 1998.*
- k) *A/G-6: Guidance for the Preparation of Standard Operating Procedures for Quality Related Operations EPA/600/R-96/027, November 1995.*
- l) *A/G-9: Guidance for the Data Quality Assessment: Practical Methods for Data Analysis EPA/600/R-96/084, January 1998.*
- m) *Manual for the Certification of Laboratories Analyzing Drinking Water EPA/570/9-90/008.*
- n) *ISO. 2017. General requirements for the competence of testing and calibration laboratories. ISO 17025*
- o) *DoD Quality Systems Manual for Environmental Laboratories, Version 5.4, 2021.*

### 3.3 Glossary and Acronyms Used

Quality control terms are generally defined within the Section that describes the activity.

#### 3.3.1 Glossary

The *Terms and Definitions* Section of Modules 1-7 in the 2016 TNI Environmental Laboratory Sector Standard – Volume 1 – Management and Technical Requirements for Laboratories Performing Environmental Analysis.

Other Terms and Definitions used in the laboratory are the following:

**Accreditation body** - Authoritative body that performs accreditation.

**Aliquot** - A discrete, measured, representative portion of a sample taken for analysis.

**Analyte** - The specific chemicals or components for which a sample is analyzed; it may be a group of chemicals that belong to the same chemical family, and which are analyzed together.

**Assessment** - The evaluation process used to measure the performance of effectiveness of a system and its elements against specific criteria. It includes any of the following: audit, performance evaluation, peer review, inspection, or surveillance.

**Atomization** - A process in which a sample is converted to free atoms.

**Audit** - A documented investigative evaluation used to determine the degree of compliance with established procedures and guidelines, applied to specific analytical processes.

**Calibration Range** - The range of values (concentrations) between the lowest and highest calibration standards of a multi-level calibration curve. For metals analysis with a single-point calibration, the low-level calibration check standard and the high standard establish the linear calibration range, which lies within the linear dynamic range.

**Chain of Custody** - An unbroken trail of accountability that verifies the physical security of samples, data and records.

**Client** - Any individual or organization for whom items or services are furnished or work performed in response to defined requirements and expectations.

**Congener** - A member of a class of related chemical compounds (e.g., PCBs, PCDDs).

**Consensus Standard** - A standard established by a group representing a cross-section of a particular industry or trade, or a part thereof.

**Continuing calibration verification (CCV)** - The verification of the initial calibration that is required during the course of analysis at periodic intervals. Continuing calibration verification applies to both external standard and internal standard calibration techniques, as well as to linear and non-linear calibration models.

**Definitive Data** - Analytical data of known quality, concentration, and level of uncertainty. The levels of quality and uncertainty of the analytical data are consistent with the requirements for the decision to be made. Suitable for final decision-making.

**Detection Limit (DL)** - The lowest concentration or amount of the target analyte that can be identified, measured, and reported with confidence that the analyte concentration is not a false positive value. The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration at the 99% level of confidence. At the DL, the false positive rate (Type I error) is 1%.

**Digestion** - A process in which a sample is treated (usually in conjunction with heat) to convert the sample to a more easily measured form.

**Dissolved** - The concentration of analyte in an aqueous sample that will pass through a 0.45 µm membrane filter assembly prior to sample acidification.

**Duplicate** - The analysis or measurement of the variable of interest performed identically on two subsamples of the same sample. The results of duplicate analysis are used to evaluate analytical or measurement precision but not the precision of sampling, preservation or storage internal to the laboratory.

**Eluent** - A solvent used to carry the components of a mixture through a stationary phase.

**Elute** - To extract; specifically, to remove (adsorbed material) from an adsorbent by means of a solvent.

**Elution** - A process in which solutes are washed through a stationary phase by a movement of a mobile phase.

**Environmental Data** - Any measurement or information that describe environmental processes, locations, or conditions; ecological or health effects and consequences; or the performance of environmental technology.

**Environmental Monitoring** - The process of measuring or collecting environmental data.

**False Negative** - An analyte incorrectly reported as absent from the sample, resulting in potential risks from their presence.

**False Positive** - An item incorrectly identified as present in the sample, resulting in a high reporting value for the analyte of concern.

**Finding** - An assessment conclusion referenced to a TNI Standard and supported by objective evidence that identifies a deviation from a TNI requirement. An assessment conclusion that identifies a condition having a significant effect on an item or activity. An assessment finding may be positive or negative and is normally accompanied by specific examples of the observed condition and may be linked to a specific requirement.

**Holding Times** - The maximum times that samples may be held prior to analysis and still be considered valid or not compromised. The time elapsed from the time of sampling to the time of extraction or analysis, or from extraction to analysis, as appropriate.

**Homologue** - One in a series of organic compounds in which each successive member has one more chemical group in its molecule than the next preceding member. For instance, CH<sub>3</sub>OH (methanol), C<sub>2</sub>H<sub>5</sub>OH (ethanol), C<sub>3</sub>H<sub>7</sub>OH (propanol), C<sub>4</sub>H<sub>9</sub>OH (butanol), etc., form a homologous series.

**Interference, spectral** - Occurs when particulate matter from the atomization scatters the incident radiation from the source or when the absorption or emission of an interfering species either overlaps or is so close to the analyte wavelength that resolution becomes impossible.

**Instrument Performance Check Solution (IPC)** - A solution of the method analyte, used to evaluate the performance of the instrument system with respect to a defined set of method criteria.

**Isomer** - One of two or more compounds, radicals, or ions that contain the same number of atoms of the same elements but differ in structural arrangement and properties. For example, hexane (C<sub>6</sub>H<sub>14</sub>) could be n-hexane, 2-methylpentane, 3-methylpentane, 2,3-dimethylbutane, 2,2-dimethylbutane.

**Limit of Detection (LOD)** - An estimate of the minimum amount of a substance that an analytical process can reliably detect. An LOD is analyte and matrix-specific and may be laboratory-dependent. The smallest amount or concentration of a substance that must be present in a sample in order to be detected at a high level of confidence (99%). At the LOD, the false negative rate (Type II error) is 1%.

**Limits of Quantitation (LOQ)** - The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence. The lowest concentration that produces a quantitative result within specified limits of precision and bias. The LOQ is set at or above the concentration of the lowest initial calibration standard. Also known as Practical Quantitation Limit or PQL and Method Reporting Limit or MRL.

**Laboratory Reagent Blank** - An aliquot of reagent water or other blank matrices that are treated exactly as a sample including exposure to all glassware, equipment, solvents, reagents, and internal standards that are used with other samples. The LRB is used to determine if the method analyte or other interferences are present in the laboratory environment, reagents, or apparatus.

**Management** - Those individuals directly responsible and accountable for planning, implementing, and assessing work.

**Management System** - System to establish policy and objectives and to achieve those objectives.

**Matrix Spike (MS)** - Also known as spiked sample or fortified sample, it is a sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is

available. Matrix spikes are used, for example, to determine the effect of the matrix on a method's recovery efficiency.

**Matrix Spike Duplicate (MSD)** - Also known as fortified sample duplicate, a second replicate matrix spike prepared in the laboratory and analyzed to obtain a measure of the precision of the recovery for each analyte.

**Method Detection Limit** - One way to establish a Limit of Detection, defined as the minimum concentration of a substance (an analyte) that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte.

**Method of Standard Additions (MSA)** - A set of procedures adding one or more increments of a standard solution to sample aliquots of the same size in order to overcome inherent matrix effects. The procedures encompass the extrapolation back to obtain the sample concentration. (This process is often called spiking the sample.)

**Nonconformance** - An indication or judgment that a product or service has not met the requirement of the relevant specifications, contract, or regulation; also the state of failing to meet the requirements.

**Quality Assurance Project Plan (QAPP)** - A formal document describing the detailed quality control procedures by which the quality requirements defined for the data and decisions pertaining to a specific project are to be achieved.

**Quality Control Sample (QCS)** - A solution of the method analyte of known concentration, which is used to fortify an aliquot of LRB or sample matrix. The QCS is obtained from a source external to the laboratory and different from the source of the calibration standards. It is used to check either laboratory or instrument performance.

**Quantitation Range** - The range of values in a calibration curve between the LOQ and the highest successfully analyzed initial calibration standard. The quantitation range lies within the calibration range.

**Reporting Limit (RL)** - A client-specified lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.

**Retention Time (RT)** - The time between sample injection and the appearance of a solute peak at the detector.

**Sample** - Portion of material collected for analysis, identified by a single, unique alphanumeric code. A sample may consist of portions in multiple containers, if a single sample is submitted for multiple or repetitive analysis.

**Sampling and Analysis Plan (SAP)** - See Quality Assurance Project Plan.

**Second-source calibration verification (ICV)** - A standard obtained or prepared from a source independent of the source of standards for the initial calibration. Its concentration should be at or near the middle of the calibration range. It is done after the initial calibration.

**Signal to Noise Ratio** - The signal carries information about the analyte, while noise is made up of extraneous information that is unwanted because it degrades the accuracy and precision of an analysis and also places a lower limit on the amount of analyte that can be detected. In most measurements, the average strength of the noise is constant and independent of the magnitude of the signal. Thus, the effect of noise on the relative error of a measurement becomes greater and greater as the quantity being measured (producing the signal) decreases in magnitude.

**Standard** - Standard samples are comprised of a known amount of standard reference material in the matrix undergoing analysis. A standard reference material is a certified reference material produced by the US National Institute of Standards

and Technology (NIST) and characterized for absolute content, independent of analytical test method.

**Target Analytes** - Analytes specifically named by a client (also called project-specific analytes).

**Tuning** - A check and/or adjustment of instrument performance for mass spectrometry as required by the method.

**Work Cell** - A well-defined group of analysts that together perform the method analysis. The members of the group and their specific functions within the work cell must be fully documented.

**3.3.1.1     *The TNI Standard: Modules 1-7 in the 2016 TNI Environmental Laboratory Sector Standard – Volume 1 – Management and Technical Requirements for Laboratories Performing Environmental Analysis (EL-V1, M1 through M7).***

**3.3.2     Acronyms**

A list of acronyms used in this document and their definitions are:

AA	- Atomic Absorption Spectrometry
AB	- Accrediting Body
ANSI	- American National Standards Institute
ASQC	- American Society for Quality Control
ASTM	- American Society for Testing and Materials
BFB	- Bromofluorobenzene
Blk	- Blank
BNA	- Base, Neutral and Acid Extractables
BOD	- Biochemical Oxygen Demand
BS	- Blank Spike, equivalent to LCS and LFB
°C	- degrees Celsius
cal	- calibration, Calibration Standard (CAL)
CAR	- Corrective Action Report
CAS	- Chemical Abstract Service
CCV	- Continuing calibration verification
CCC	- Continuing Calibration Check, equivalent to CCV
CFR	- Code of Federal Regulations
CI	- Chemical Ionization
CLP	- Contract Laboratory Program
COC	- Chain of custody
COD	- Chemical Oxygen Demand
CRDL	- Contract Required Detection Limit
CV	- Coefficient of Variation
CVAA	- Cold Vapor Atomic Absorption
DBP	- Disinfection by Product
DFTPP	- Decafluorotriphenylphosphine
DLR	- Detection Limit for Reporting Purposes (established by California)
DO	- Dissolved oxygen
DOC	- Demonstration of Capability
DOD	- Department of Defense
DOE	- Department of Energy

DOT	-	Department of Transportation
DQO	-	Data Quality Objectives
DQI	-	Data Quality Indicators
DRO	-	Diesel-range Organics
ECD	-	Electron Capture Detector
EDD	-	Electronic Data Deliverable
EI	-	Electron Impact Ionization
ELAP	-	Environmental Laboratory Accreditation Program
EPA	-	Environmental Protection Agency
FIA	-	Flow Injection Analysis
FID	-	Flame Ionization Detector
g/L	-	Grams per liter
GC/MS	-	Gas chromatography/mass spectrometry
GC/MS/MS-	-	Gas chromatography Tandem Mass Spectrometry
GPC	-	Gel Permeation Chromatography
GRO	-	Gasoline Range Organics
HAA	-	Haloacetic acids
HDPE	-	High Density Polyethylene
HPLC	-	High Performance Liquid Chromatography
HRMS	-	High Resolution Mass Spectrometry
IC	-	Ion Chromatography
IC/MS/MS-	-	Ion Chromatography Tandem Mass Spectrometry
ICP	-	Inductively coupled Optical Emission Spectrometry (ICP-OES)
ICP-MS	-	Inductively coupled plasma-mass spectrometry
ICV	-	Initial calibration verification
ICS	-	Interference Check Sample
ICS	-	Interference Check Sample
IDL	-	Instrument Detection Limit
IEC	-	Interelement Correction Factor
ISE	-	Ion Selective Electrode
ISO/IEC	-	International Organization for Standardization/International Electrochemical Commission
lb/in <sup>2</sup>	-	Pound per square inch
LC/MS/MS-	-	Liquid chromatography Tandem Mass Spectrometry
LCL	-	Lower Control limit
LCS	-	Laboratory control sample, equivalent to LFB and BS
LD	-	Laboratory Duplicates (LD1 and LD2)
LDR	-	Linear Dynamic Range
LFB	-	Laboratory fortified blank
LFM	-	Laboratory Fortified Matrix, equivalent to Matrix Spike (MS)
LFMD	-	Laboratory fortified Matrix Duplicate, equivalent to MSD
LIMS	-	Laboratory Information Management System
LLE	-	Liquid-Liquid Extraction
LOD	-	Limit of Detection
LOQ	-	Limit of Quantitation
LRB	-	Laboratory Reagent Blank
LWL	-	Lower Warning Limit
MDL	-	Method detection limit
MRL	-	Method Reporting Limit or Level, equivalent to RL
MRM	-	Multiple reaction monitoring
mg/Kg	-	Milligrams per kilogram

ug/Kg	-	Microgram per kilogram
mg/L	-	Milligrams per liter
ug/L	-	Microgram per liter
ng/L	-	Nanogram per liter
MS	-	Matrix spike, equivalent to LFM
MSD	-	Matrix spike duplicate, equivalent to LFMD
MSDS	-	Material Safety Data Sheet
NELAC	-	National Environmental Laboratory Accreditation Conference
NELAP	-	National Environmental Laboratory Accreditation Program
NIOSH	-	National Institute for Occupational Safety and Health
NIST	-	National Institute of Standards and Technology
NPD	-	Nitrogen-Phosphorus Detector
NPDES	-	National Pollutant Discharge Elimination System
OCP	-	Organochlorine Pesticides
OPP	-	Organophosphorus Pesticides
OSHA	-	Occupational Safety and health Administration
PAH	-	Polynuclear Aromatic Hydrocarbons
PBMS	-	Performance based Measurement System
PCBs	-	Polychlorinated Biphenyls
PCDD	-	Polychlorinated dibenzo-p-dioxins
PCDF	-	Polychlorinated dibenzofurans
PID	-	Photoionization Detector
PQL	-	Practical Quantitation Limit
PT	-	Proficiency Test(ing)
PTP	-	Proficiency Testing Provider
PTPA	-	Proficiency Testing Provider Accreditor
QA	-	Quality Assurance
QAP	-	Quality Assurance Program
QAPP	-	Quality Assurance Project Plan
QC	-	Quality Control
QCS	-	Quality Control Sample
QM	-	<i>Quality Manual</i>
RF	-	Response Factor
RL	-	Reporting level
RPD	-	Relative percent difference
RSD	-	Relative standard deviation
RT	-	Retention Time
SCAQMD	-	Southern California Air Quality Management District
SI	-	International System of Units
SIM	-	Selected Ion Monitoring
SOC	-	Synthetic Organic chemical
SOPs	-	Standard operating procedures
SPCC	-	System Performance Check Compounds
SPE	-	solid Phase Extraction
SPME	-	Solid Phase Microextraction
spk	-	Spike
SRM	-	Standard Reference Material
std	-	standard
SUR	-	Surrogate compound
SVOA	-	Semivolatile Organic Analysis
TCD	-	Thermal conductivity Detector

TCLP	- Toxic Characteristics leaching Procedure
TDS	- Total Dissolved Solids
TEM	- Transmission Electron Microscope
TIC	- Tentatively Identified Compound
TKN	- Total Kjeldahl Nitrogen
TNI	- The NELAC Institute
TOC	- Total Organic Carbon
TOX	- Total Organic Halogens
TPH	- Total Petroleum Hydrocarbons
TRPH	- Total Recoverable Petroleum Hydrocarbons
TSS	- Total Suspended solids (Non-filterable residue)
UCL	- Upper control limit
UCMR	- Unregulated Contaminant Monitoring Rule
ug/L	- micrograms per liter
UV-Vis	- Ultraviolet visible light
UWL	- Upper Warning Limit
VOA	- Volatile organic analysis
VOC	- Volatile organic compound
WET	- Whole effluent toxicity
WET	- Waste Extraction Test (California leaching test for hazardous waste)
ZHE	- Zero Headspace extraction

### **3.4 Management of the Quality Manual**

The Quality Assurance Manager is responsible for maintaining the currency of the *Quality Manual*.

The *Quality Manual* is reviewed and revised when necessary and whenever the activity described changes significantly to ensure their contents are suitable and in compliance with the current quality system requirements and current operations. The QAM is reviewed at least every 3 years by the Quality Manager and laboratory personnel to ensure it still reflects current practices and meets the requirements of any applicable regulations or client specifications. Sections of the manual are updated by making a change to the Section and then increasing the revision number by one if revised with major changes (e.g. requirements, procedures, etc), and by 1/10 (e.g. Rev. 20.1) if updated with minor changes (e.g. editorial, personnel, etc). The cover sheet of the *Quality Manual* (Section 1) must be re-signed and the Table of Contents (Section 2) is updated whenever a Section is updated.

The *Quality Manual* is considered confidential within Weck Laboratories, Inc. and may not be altered in anyway except by approval of the Laboratory Director and Quality Manager. If it is distributed to external users, it is for the purpose of reviewing Weck Labs' management system and may not be used for any other purpose without written permission.

## Section 4

# ORGANIZATI ON

(TNI V1:M2 – Section 4.1)

The laboratory is a legally identifiable organization. The laboratory is responsible for carrying out testing activities that meet the requirements of the TNI Standard, the ISO/EIC 17025 Standard, and that meet the needs of the client. Through application of the policies and procedures outlined in this Section and throughout the *Quality Manual*:

- *The laboratory assures that it is impartial and that personnel are free from undue commercial, financial, or other undue pressures that might influence their technical judgment.*
- *Management and technical personnel have the authority and resources to carry out their duties and have procedures to identify and correct departures from the laboratory's management system.*
- *Personnel understand the relevance and importance of their duties as related to the maintenance of the laboratory's management system.*
- *Ethics and data integrity procedures (see Appendix A, Section 5 – "Management" and Section 19 – "Data Integrity Investigations") ensure personnel do not engage in activities that diminish confidence in the laboratory's capabilities.*
- *Confidentiality is maintained.*

### 4.1 Organization

The laboratory is a commercial enterprise organized as a California corporation under the legal name Weck Analytical Environmental Services, Inc, DBA Weck Laboratories Inc. The Tax ID number is available upon request, if applicable.

The laboratory operates in the City of Industry, Los Angeles County, California.

The laboratory's organization chart can be found in Appendix B. Additional information regarding responsibilities, authority and interrelationship of personnel who manage, perform or verify testing is included in Section 5 – "Management" and Section 20 – "Personnel". These Sections also include information on supervision, training, technical management, job descriptions, quality personnel, and appointment of deputies for key managerial personnel.

The laboratory has the resources and authority to operate a management system that is capable of identifying departures from that system and from procedures during testing, and initiates actions to minimize or prevent departures.

### 4.2 Conflict of Interest and Undue Pressure



The organizational structure indicated above minimizes the potential for conflicting or undue interests that might influence the technical judgment of analytical personnel. In addition, procedures are in place to prevent outside pressures or involvement in activities that may affect competence, impartiality, judgment, operational integrity, or the quality of the work performed at the laboratory.

In order to assist the laboratory technical personnel in performing their duties without detrimental influences, it is the policy of the Company that the laboratory be impartial and that it and its personnel are free from any undue commercial, financial and other pressures which might influence or adversely affect their normal performance having an impact on the quality of the work they produce or their technical judgment. By this policy all laboratory personnel dedicated to technical activities should not be influenced by, or involved in any financial or commercial matter while performing laboratory work. If any employee feels that he or she might be under any kind of pressure as described above, the Laboratory Director must be notified immediately. Additionally, the Laboratory will not engage in any activities that may endanger the trust in its independence of judgment and integrity in relation to its environmental testing.

## Section 5

### MANAGEME

### NT

*(TNI V1:M2 – Section 4.2)*

The laboratory maintains a management system that is appropriate to the scope of its activities.

#### **5.1 Management Requirements**

Top management includes the CEO/President, Laboratory Technical Director, Laboratory Manager, Supervisors/Team Leaders and Customer Service/Project Managers and the Quality Assurance Director.

Management's commitment to good professional practice and to the quality of its products is defined in the Quality Policy statement, Section 5.3

Management has overall responsibility for the technical operations and the authority needed to generate the required quality of laboratory operations. Management ensures communication within the organization to maintain an effective management system and to communicate the importance of meeting customer, statutory, and regulatory requirements. Management assures that the system documentation is known and available so that appropriate personnel can implement their part. When changes to the management system occur or are planned, managers ensure that the integrity of the system is maintained.

Management is committed to impartiality and responsible for the impartiality of the laboratory activities and will not allow commercial, financial or other pressures to compromise impartiality. The laboratory will identify risks to its impartiality on an ongoing basis and will take proper corrective action immediately to eliminate or minimize such risk. Regular educational seminars are conducted in the laboratory to safeguard impartiality.

Management is responsible for carrying out testing activities that meet the requirements of the TNI Standard, the ISO/IEC 17025 Standard, and that meet the needs of the client in relation to other Federal and State requirements, such as DoD.

Managers implement, maintain, and improve the management system, and identify noncompliance with the management system of procedures. Managers initiate actions to prevent or minimize noncompliance.

Management ensures technical competence of personnel operating equipment, performing tests, evaluating results, or signing reports, and limits authority to perform laboratory functions to those appropriately trained and/or supervised. This is done by requiring minimum level of education for each position as specified in the corresponding job descriptions, receiving training from senior chemists or lab managers and as described in Section 20 of this QM.

Management is responsible for defining the minimal level of education, qualifications, experience, and skills necessary for all positions in the laboratory and assuring that technical staff have demonstrated capabilities in their tasks.

Training is kept up to date as described in Section 20 – "Personnel" by periodic review of training records and through employee performance review.

Management bears specific responsibility for maintenance of the management system. This includes defining roles and responsibilities to personnel, approving documents, providing required training, providing a procedure for confidential reporting of data integrity issues, and periodically reviewing data, procedures, and documentation. The assignment of responsibilities, authorities, and interrelationships of the personnel who manage, perform, or verify work affecting the quality of environmental tests is documented in Job Descriptions documentation.

Management ensures that audit findings and corrective actions are completed within required time frames. The implementation and effectiveness of the corrective action should be verified by the management within six month of the completion of the corrective action report (CAR).

Designated deputies are appointed by management during the absence of the CEO/President, Laboratory Manager, Laboratory Technical Director or the Quality Assurance Director if the absence is more than 15 days.

## **5.2 Management Roles and Responsibilities**

### **5.2.1 CEO/President**

The CEO/President is responsible for the overall quality, safety, financial, technical, human resource and service performance of the laboratory. The CEO/President provides the resources necessary to implement and maintain an effective quality and data integrity program.

#### **5.2.1.1 *Responsibilities***

The CEO/President is responsible for:

- a. *Ensuring that personnel are free from any commercial, financial, and other undue pressures that might adversely affect the quality of their work*
- b. *Ensuring that the laboratory has the appropriate resources and facilities to perform requested work.*
- c. *Nominating deputies when the Technical Director or QA Director are absent for a prolonged period of time.*
- d. *Developing and implementing a proactive program for prevention and detection of improper, unethical or illegal actions and operating in accordance with the Laboratory's documented ethics policy.*

- e. Ensuring that only those outside support services and supplies that are of adequate quality to sustain confidence in the laboratory's tests are used.
- f. Commitment to meet customer requirements and whenever possible exceed their expectations.
- g. Commitment to operate in accordance with statutory and regulatory requirements.
- h. As much as possible, operate the company in sustainable manner, making efforts to conserve resources, reduce waste and minimize the impact on the environment.
- i. Create a working environment in which every person is treated with respect and have their concerns addressed by management.

### 5.2.2 Quality Assurance Director (QA Director)

The QA Director (or designee) is responsible for the oversight and review of quality control data, but is independent from laboratory operations. The QA Director reports directly to the Officers of the Corporation as indicated in the Organizational chart (Appendix B). The QA Director's training and proof of experience in QA/QC procedures, knowledge of analytical methods, and the laboratory's management system are available in the personnel records.

#### 5.2.2.1 *Responsibilities*

The Quality Director is responsible for:

- a. serving as a focal point for QA/QC;
- b. arranging or conducting annual internal audits without outside (e.g., managerial) influence;
- c. notifying management of deficiencies, and monitoring corrective actions;
- d. oversight and review of quality control data;
- e. arranging or conducting internal audits annually;
- f. monitoring corrective actions;
- g. ensuring that the management system related to quality is implemented and followed at all times;
- h. have a general knowledge of the analytical test methods for which data review is performed;
- i. Ensuring communications take place within the laboratory regarding the effectiveness of the quality system;
- j. Evaluating the effectiveness of training; and
- k. Using available tools, such as audit and surveillance results, control charts, proficiency testing results, data analysis, corrective and preventive actions, customer feedback, and management reviews in efforts to monitor trends and continually improve the quality system;
- l. Stop work as deemed necessary in the event of serious QA/QC issues;
- m. monitoring and maintaining laboratory certifications; and
- n. keeping this Quality Manual current.

### 5.2.3 Lab Technical Director

The Technical Director (or designee) is a full-time laboratory staff member and supervises laboratory operations and data reporting. The Technical Director's proof of experience in the fields of accreditation may be found in the personnel records.

If the Technical Director is absent for fifteen (15) calendar days or more, a deputy (see Table 5-1 below) with appropriate qualifications will perform the Technical Directors' duties. Beyond a thirty-five (35) calendar day absence, management will notify the primary accreditation body in writing of the absence of the Technical Director and the appointment of the deputy.

#### 5.2.3.1 *Responsibilities*

The Technical Director is responsible for:

- a. *meeting the general and education requirements and qualifications found in Sections 4.1.7.2 and 5.2.6.1 of the TNI Standard - EL-V1M2- 2016;*
- b. *monitoring performance data and the validity of the analyses for the laboratory;*
- c. *Ensuring that sufficient number of qualified personnel are employed to supervise and perform the work of the laboratory;*
- d. *Provide educational direction to laboratory staff;*
- e. *Ensuring that all analysts and supervisors have the appropriate education, skills and training to properly carry out the duties assigned to them and ensures that this training has been documented.*
- f. *Ensuring that appropriate corrective actions are taken to address analyses identified as requiring such actions by internal and external performance or procedural audits.  
Procedures that do not meet the standards set forth in the Quality Manual, laboratory SOPs or laboratory policies may be temporarily suspended by the Laboratory Director.*
- g. *Reviews and approves all SOPs and policies prior to their implementation and ensures all approved SOPs and policies are provided to laboratory personnel and are adhered to.*
- h. *Documenting all relevant analytical and operational activities that might adversely affect the quality of their work*
- i. *Supervising all personnel*
- j. *Performing with the other management staff an annual Management System Review*
- k. *Research and develop new methods, review and fine tune existing methods for optimal operation.*

### 5.2.4 Lab General Manager

The Lab manager is a full-time employee that work under the direction of the Technical Directors and are responsible managing the lab overall operation. Training records and educational background can be found in the personnel records.

If the General Manager is absent for fifteen (15) calendar days or more, a deputy (see Table 5-1 below) with appropriate qualifications will perform the General Managers' duties.

#### **5.2.4.1 Responsibilities**

The Lab General Manager is responsible for:

- a. *Ensuring that personnel are free from any commercial, financial, and other undue pressures.*
- b. *Ensuring that the laboratory has the appropriate resources and facilities to perform requested work.*
- c. *Ensuring that only those outside support services and supplies that are of adequate quality to sustain confidence in the laboratory's tests are used.*
- d. *Commitment to meet customer requirements and whenever possible exceed their expectations.*
- e. *Ensuring that sufficient number of qualified personnel are employed to supervise and perform the work of the laboratory.*
- f. *Ensuring that all analysts and supervisors have the appropriate education, skills and training to properly carry out the duties assigned to them and ensures that this training has been documented.*
- g. *Supervising all personnel.*
- h. *Performing with the other management staff an annual Management System Review.*

#### **5.2.5 Lab Supervisors/Team Leaders**

The Lab supervisors are full time employees that work under the direction of the Technical Directors and are responsible in managing the group or section. Training records and educational background can be found in the personnel records.

#### **5.2.5.1 Responsibilities**

The Lab Supervisor/Team leader is responsible for:

- a. *Reviewing section workload and distribute work among available chemists;*
- b. *Perform secondary data review of data packages;*
- c. *ensuring analytical instruments are performing correctly;*
- d. *Provide educational direction to laboratory staff;*
- e. *Assist the Technical Director in performing day-to-day supervision of laboratory operations for the corresponding department*

#### **5.2.6 Customer Service/Project Managers (PM)**

The PMs are full time or part-time employees that work under the direction of the Laboratory Director and are responsible for the relationship between the laboratory and the external clients. Training records and educational background can be found in the personnel records.

#### **5.2.6.1 *Responsibilities***

The PMs are responsible for:

- a. *Reviewing final reports for completeness and accuracy prior to be submitted to clients;*
- b. *Maintain projects and bids in LIMS accurate and updated;*
- c. *Maintain good communications with customers in all aspects related with their projects;*
- d. *Make the necessary arrangements for sampling supplies delivery and samples pick up;*
- e. *Answer customer technical questions or relate to appropriate lab personnel when needed;*
- f. *Ensure data deliverables including hard copy reports, EDDs and invoices are accurate and delivered on time.*

#### **5.2.7 Business Development Director**

The business development director is full time or part-time employees that work under the direction of the Laboratory Director and are responsible for the relationship between the laboratory and the external clients. Training records and educational background can be found in the personnel records.

#### **5.2.7.1 *Responsibilities***

The business development director is responsible for:

- a. *Market development for the laboratory business*
- b. *Reviewing and prepare proposals and bid.*
- c. *Make necessary visit to existing and potential clients.*
- d. *Maintain good communication with clients as well as laboratory.*
- e. *Answer customer technical and business question relate to appropriate lab personnel as needed.*
- f. *Participate and attend industrial and professional conferences and exhibits related to lab business.*

#### **5.2.8 IT/LIMS Manager**

The IT/LIMS manager is full time or part-time employees that work under the direction of the Laboratory Director and is responsible for the maintaining and creating IT/LIMS related hardware and software. Training records and educational background can be found in the personnel records.

#### **5.2.8.1 *Responsibilities***

The IT/LIMS manager is responsible for:

- a. *Maintain backup and archive plan.*
- b. *Secure and maintain the health of the network, desktop, server, database, and application systems for proper operation*
- c. *Train and enforce users on good computer related practices and systems*
- d. *Troubleshoot all computer hardware and software related issues Research, develop, and deploy new technologies.*

#### 5.2.9 Purchasing Manager

The purchasing managers are full-time or part-time employees that work under the direction of the Laboratory Technical Director and are responsible for the purchase of lab chemicals, reagents, consumables and lab supplies as needed. Training records and educational background can be found in the personnel records.

##### 5.2.8.1 *Responsibilities*

The purchasing manager is responsible for:

- a. *Search and order chemicals, reagents and consumables to ensure lab normal operation.*
- b. *Search and test for new materials to ensure the quality to meet lab specific requirement.*
- c. *Keep track of lab inventory to ensure steady supply for lab operation.*
- d. *Evaluate suppliers in terms of quality, service and price.*

#### 5.2.10 Laboratory Key Personnel Deputies

The following table defines who assumes the responsibilities of key personnel in their absence:

Table 5-1 Key Personnel Deputies	
Key Personnel	Deputy
Laboratory Technical Director	Laboratory Manager
QA Director	Laboratory Technical Director
Laboratory General Manager	Laboratory Technical Director
Marketing Director	Customer Service Manager
Customer Service Manager	Marketing Director
IT/LIMS Manager	Laboratory Technical Director
Project Manager	Other Project Manager

Note: The designees or deputies are for temporary absence only; for prolonged absence, a new person should be appointed to the position on a permanent basis.

## 5.3 Quality Policy

Management's commitment to quality and to the management system is stated in the Quality Policy below, which is upheld through the application of related policies and procedures described in the laboratory's *Quality Manual*, SOPs and policies.

Weck Laboratories provides qualitative and quantitative data for use in critical decisions relating to the protection of the public and the environment. The data used for such purposes must be scientifically valid, defensible and of known and documented quality. All environmental testing activities are carried out in such a way as to meet the requirements of the current TNI Standard and to satisfy the needs of the client, the regulatory authorities or organizations providing recognition.

It is our goal to provide our clients with the best possible services, in terms of quality of laboratory work, honesty in our procedures and reporting, efficiency in our turnaround time and reasonable prices for our services and at the same time satisfy the needs of the regulatory authorities and organizations providing recognition.

The management of the laboratory is totally committed to the attainment of the best possible quality of data and instructs and educates the staff on this company policy.

All the necessary resources and materials shall be provided to the personnel of the laboratory in order to meet and/or improve the quality requirements of TNI and consequently of ISO 17025, of the analytical methods performed at the lab and any special requirements from clients.

Our policy is to use good professional practices, to maintain quality, to uphold the highest quality of service, and to comply with the TNI Standard. The laboratory ensures that personnel are free from any commercial, financial, and other undue pressures, which might adversely affect the quality of work. This policy is implemented and enforced through the unequivocal commitment of management, at all levels, to the Quality Assurance (QA) principles and practices outlined in this manual. However, the primary responsibility for quality rests with each individual within the laboratory organization. Every laboratory employee must ensure that the generation and reporting of quality analytical data is a fundamental priority. Every laboratory employee is required to familiarize themselves with the quality documentation and to implement the policies and procedures in their work. All employees are trained annually on ethical principles and procedures surrounding the data that is generated. The laboratory maintains a strict policy of client confidentiality.

The objective of the Quality Assurance Program is to monitor the reliability of the analytical data produced by the Laboratory and to implement effectively the quality control procedures and operations defined for each analysis. The purposes of this program are:

- a. *Provide data that is scientifically valid, defensible, and of known and documented quality in accordance with standards developed by TNI and any applicable state or EPA regulations or requirements;*
- b. *Ensure that analytical results fall between acceptable control limits;*
- c. *Provide mechanisms for corrective action when necessary;*

- d. Establish standardized practices to provide consistency in the generation of data;
- e. Define the quality of each analytical system in terms of accuracy, precision and sensitivity;
- f. Identify in the early stages possible problems that may affect data quality;
- g. Ensure that all personnel involved with testing and calibration are familiar with the quality documentation;
- h. Ensure that all policies and procedures are implemented;
- i. Commitment that management will comply with the standard and will continually improve the effectiveness of the management system.

## 5.4 Ethics and Data Integrity System

The laboratory has developed an Ethics and Data Integrity policy for prevention and detection of improper, unethical or illegal actions that is included in Appendix A. The laboratory's Ethics and Data Integrity program, training and investigations are discussed in Section 19 – "Data Integrity Investigations".

A main component of this program is the periodic training and communications that the employees receive from management about the ethics policy and the utmost importance of an honest and ethical behavior in all activities performed at the laboratory.

Proper ethical conduct in the laboratory is strictly enforced. The Company's Code of Ethics is presented to current and prospective employees in both the QA manual and the Employee Handbook.

The Data Integrity Plan, which includes the description of the data integrity procedures, serves to combine the elements currently in place and document further procedures to ensure our compliance with requirements in the TNI standard and from other regulatory agencies.

These procedures include the following elements:

- a. *data Integrity training*
- b. *signed data integrity documentation for all laboratory employees*
- c. *in-depth, periodic monitoring of data integrity*
- d. *data integrity procedure documentation.*

The data integrity procedures are signed and dated by senior management. These procedures and the associated implementation records are properly maintained and made available for assessor review. The data integrity procedures are annually reviewed and updated if necessary by management.

The Data Integrity Plan also provides a mechanism for confidential reporting of data integrity issues in the laboratory. A primary element of the mechanism is to assure confidentiality and a receptive environment in which all employees may privately discuss ethical issues or report items of ethical concern. In instances of ethical

concern, the mechanism also includes a process whereby laboratory management is to be informed of the need for any further detailed investigation.

Each employee is required to understand and sign a Data Integrity Agreement, contained in the Data Integrity Plan document. The Laboratory Ethics seminar that is presented as a refresher to current employees on an annual basis and as part of the hiring process for new employees include elements describing examples of improper and illegal actions, how to identify appropriate and inappropriate laboratory and instrument manipulation practices, guidance for manual integration practices and consequences of unethical or improper behavior.

Punishment for improper, illegal or unethical activities range from suspension to termination, depending on the degree and nature of the unethical activity.

Employees are required and encouraged to bring up to management any improper activities they detect or are suspicious of. Any incident reported is immediately investigated by the management and the person or persons involved are subject to disciplinary actions.

The Management shall also monitor the program for detecting improper, unethical or illegal action by performing internal proficiency testing (single or double blind), reviewing of analytical data post-analysis, performing electronic data audits using special software if available and providing an open-door policy for employees to report any suspicious activity without fears.

In order to assist the laboratory technical personnel in performing their duties without detrimental influences, it is the policy of the Company that the laboratory be impartial and that it and its personnel are free from any undue commercial, financial and other pressures which might influence or adversely affect their normal performance having an impact on the quality of the work they produce or their technical judgment. By this policy all laboratory personnel dedicated to technical activities should not be influenced by, or involved in any financial or commercial matter while performing laboratory work. If any employee feels that he or she might be under any kind of pressure as described above, the Laboratory Director must be notified immediately. Additionally, the Laboratory will not engage in any activities that may endanger the trust in its independence of judgment and integrity in relation to its environmental testing.

## **5.5 Documentation of Management/Quality System**

The management system is defined through the policies and procedures provided in this *Quality Manual* and written laboratory Standard Operating Procedures (SOPs) and policies.

### **5.5.1 Quality Manual**

The *Quality Manual* contains the following required items:

5.5.1.1 *document title*;

5.5.1.2 *laboratory's full name and address*;

- 5.5.1.3 *name, address (if different from above), and telephone number of individual(s) responsible for the laboratory;*
- 5.5.1.4 *identification of all major organizational units which are to be covered by this quality manual and the effective date of the version;*
- 5.5.1.5 *identification of the laboratory's approved signatories;*
- 5.5.1.6 *the signed and dated concurrence (with appropriate names and titles), of all responsible parties including the quality assurance manager, technical directors, and the agent who is in charge of all laboratory activities, such as the Laboratory Manager and/or Operation Manager;*
- 5.5.1.7 *the objectives of the management system and contain or reference the laboratory's policies and procedures;*
- 5.5.1.8 *the laboratory's official quality policy statement, which shall include management system objectives and management's commitment to ethical laboratory practices and to upholding the requirements of this Standard; and*
- 5.5.1.9 *a table of contents, and applicable lists of references, glossaries and appendices.*

This *Quality Manual* contains or references all required elements as defined by the TNI Standard - V1:M2, Section 4.2.8.4.

## 5.5.2 Standard Operating Procedures (SOPs)

Standard operating procedures (SOPs) represent all phases of current laboratory operations (they include an effective date, revision number, and signature of the approving authorities which are the Technical Director of the section involved or the Laboratory Director and QA Manager and are available to all personnel. They contain sufficient detail such that someone with similar qualifications could perform the procedures. There are two types of SOPs used in the laboratory: 1) test method SOPs, which have specific requirements as outlined below, and 2) general use or administrative SOPs which document general procedures.

A list of the SOPs currently in use at the laboratory can be found in Appendix E.

Each accredited analyte or method has an SOP. Sometimes an SOP is a copy of a method, and any additions are clearly described. The laboratory's test method SOPs include the following topics, where applicable, as indicated in the SOP MIS048:

- i. *identification of the method;*
- ii. *applicable matrix or matrices;*
- iii. *limits of detection and quantitation;*
- iv. *scope and application, including parameters to be analyzed;*
- v. *summary of the method;*
- vi. *definitions;*
- vii. *interferences;*
- viii. *safety;*
- ix. *equipment and supplies;*
- x. *reagents and standards;*

- xi. *sample collection, preservation, shipment and storage;*
- xii. *quality control;*
- xiii. *calibration and standardization;*
- xiv. *procedure;*
- xv. *data analysis and calculations;*
- xvi. *method performance;*
- xvii. *pollution prevention;*
- xviii. *data assessment and acceptance criteria for quality control measures;*
- xix. *corrective actions for out-of-control data;*
- xx. *contingencies for handling out-of-control or unacceptable data;*
- xxi. *waste management;*
- xxii. *references; and*
- xxiii. *any tables, diagrams, flowcharts and validation data.*

#### **5.5.3 Order of Precedence**

In the event of a conflict or discrepancy between policies, the order of precedence is as follows unless otherwise noted:

1. *Mandated Methods or Regulations (whichever are more stringent)*
2. *SOPs and Policies*
3. *Quality Manual*
4. *Others (Work Instructions (WI), memos, flow charts, etc.)*

If there is a Quality assurance Project Plan (QAPP) for a particular project, this will take precedence over the above item just for that particular project.

## Section 6

# DOCUMENT CONTROL

(TNI V1:M2 – Section 4.3)

This Section describes how the laboratory establishes and maintains a process for document management. Procedures for document management include controlling, distributing, reviewing, and accepting modifications. The purpose of document management is to preclude the use of invalid and/or obsolete documents.

Documents can be SOPs, policy statements, specifications, calibration tables, charts, textbooks, posters, notices, memoranda, software, drawings, plans, etc. These may be on various media, whether hard copy or electronic, and they may be digital, analog, photographic or written.

The laboratory manages three types of documents: 1) controlled, 2) approved, and 3) obsolete.

A controlled document is one that is uniquely identified, issued, tracked, and kept current as part of the management system. Controlled documents may be internal documents or external documents.

An approved document means it has been reviewed and either signed and dated, or acknowledged in writing or by secure electronic means by the issuing authority(ies).

Obsolete documents are documents that have been superseded by more recent versions or are no longer needed.

### 6.1 Controlled Documents

Documents will be reviewed, revised (as appropriate) and approved for use by appropriate management personnel prior to issue. SOPs are approved by both the Technical Director and the QA Director. Policies and other similar documents are approved by the Technical Director alone. The QA Manual is approved by top management personnel (CEO/President, Lab Technical Director, Lab Manager and QA Director).

Documents are reviewed and revised when necessary and whenever the activity described changes significantly to ensure their contents are suitable and in compliance with the current management systems requirements, and accurately describe current operations. These documents are reviewed at least every 3 years, with the exception of the QA Manual and SOPs associated with drinking water and DoD project, which are reviewed annually.

Approved copies of documents are available to staff at all locations where operations are essential to the effective functions of the laboratory.

The procedure for document control and distribution of documents is detailed in SOP MIS045.

SOPs and other controlled documents are accessible to all analysts electronically as PDF documents located in the laboratory computer network. Each analysis in LIMS has a link to the corresponding SOP for that method.

The QA Manager or Laboratory Director will update the controlled documents by keeping in the active folder the current documents and moving to the "Archive" folder the documents that have been replaced. The new document will have the date it is effective and the revision number while the old document with a prior revision number will be considered obsolete starting with the date the new revision becomes effective.

Controlled internal documents are uniquely identified with 1) a unique name or number identification 2) date of issue, 3) revision identification, 4) page number, 5) the total number of pages (or a mark to indicate the end of the document), and 6) the signatures of the issuing authority (i.e. management) that approve documents after reviewing for accuracy.

A master list of controlled internal documents is maintained that includes distribution, location, and revision dates. A master list of controlled external documents is also maintained that includes title, author, copyright date, and date of publication, and location. The controlled document list is maintained electronically by the QA Manager and is updated as needed and reviewed annually for accuracy.

### **6.1.1 Document Changes to Controlled Documents**

#### **6.1.1.1 *Paper Document Changes***

Document changes are approved by the original approving authority.

The document management process allows for handwritten modifications to documents if the modifications are not substantial. The date and approval is documented with the modifications and these changes are tracked by the QA Manager who will redistribute the modified document to its users.

All document modifications are approved. Changes that are not process modifications but clarifications may be performed without revision. Approval is required. The modified document is then copied and distributed, and obsolete documents are removed according to the master list of controlled documents.

Amendments/modifications to documents are incorporated into a new revision and reissued when the document is reviewed and updated on or before its scheduled review cycle.

A reason for the modification or change is provided as historical information in the revised document as an appendix.

#### **6.1.1.2 *Electronic Document Changes***

Suggested revisions to electronic documents are presented to the QA Manager or Laboratory Director for review and approval. Changes to

electronic documents are approved through electronic means such as an email notification for interested parties.

Where practical, the altered text or new text in the draft is identified during the revision or review process to provide for easy identification of the modifications.

## **6.2 Obsolete Documents**

All invalid or obsolete documents are removed from general distribution, or otherwise prevented from unintended use.

Obsolete documents retained for legal use or historical knowledge preservation are appropriately marked and retained. Obsolete documents are identified as being obsolete by management. All copies of the obsolete document are collected from employees according to the master distribution list and destroyed; the original copy or a remaining copy is clearly marked "Old" or "Obsolete" on the front cover and kept in a folder properly identified as containing old or obsolete documents. They are retained for 10 years or as required by regulations or clients from the date they became obsolete in the area designated for document storage.

Electronic documents that have been identified obsolete or old are also moved to a computer directory or folder clearly identified as such.

## Section 7

### REVIEW OF REQUESTS, TENDERS AND CONTRACTS

(*TNI V1:M2 – Section 4.4*)

The review of all new work assures that oversight is provided so that requirements are clearly defined, the laboratory has adequate resources and capability, and the test method is applicable to the customer's needs. This process assures that all work will be given adequate attention without shortcuts that may compromise data quality.

Contracts for new work may be formal bids, signed documents, verbal, or electronic. The client's requirements, including the methods to be used, must be clearly defined, documented and understood. Requirements might include target analyte lists, project specific reporting limits (if any), project specific quality control requirements (if any), turnaround time, and requirements for data deliverables. The review must also cover any work that will be subcontracted by the laboratory.

#### Procedure for the Review of Work Requests

The Client Service Manager in conjunction with the Technical Directors or Laboratory Director determines if the laboratory has the necessary accreditations, physical, personnel and information resources, including schedule, equipment and deliverables to meet the work request. The purpose of this review of capability is to establish that the laboratory's personnel have the skills and expertise necessary for the performance of the tests in question. The review may encompass results of earlier participation in interlaboratory comparisons or proficiency testing and/or the running of trial environmental test or calibration programs using samples or items of known value in order to determine uncertainties of measurement, detection limits of confidence limits, or other essential quality control requirements. The current accreditation status of the laboratory is also reviewed. The laboratory then informs the client of the results of this review if it indicates any potential conflict, deficiency, lack of appropriate accreditation status, or inability on the laboratory's part to complete the client's work.

Other aspects to be evaluated and reviewed include whether or not the appropriate test method is selected and capability of meeting the clients' requirements, contractual obligations, bonding issues and payment terms, method capabilities, analyte lists, reporting limits, quality control limits turnaround time feasibility, QA/QC issues, formal laboratory quote, final report formatting, electronic deliverable documents, time required to keep sample in house and final sample disposal requirements.

The Client Services Manager or designated staff will discuss and resolve any differences between the request or tender and the contract before any work commences in order to assure that each contract is acceptable both to the laboratory and the client. A contract may be any written or oral agreement to provide a client with environmental testing or other laboratory services.

Records of reviews, including any significant changes, shall be maintained either as written documents in the project/client folder, in forms of emails received and sent or in other electronic documentation such as electronic files in the client computer folders or LIMS. Records shall also be maintained of pertinent discussions with a client relating to the client's requirements or the results of the work during the period of execution of the contract.

For review of routine and other simple tasks, the date and the identification (e. g. the initials) of the person in the laboratory responsible for carrying out the contracted work are considered adequate.

For repetitive routine tasks, the review need be made only at the initial enquiry stage or on granting of the contract for on-going routine work performed under a general agreement with the client, provided that the client's requirements remain unchanged. For new, complex or advanced environmental testing, a more comprehensive record should be maintained.

The review shall also cover any work that is subcontracted by the laboratory.

The client shall be informed of any deviation from the contract. If a contract needs to be amended after work has commenced, the same contract review process shall be repeated and any amendments shall be communicated to all affected personnel.

If there is any suspension of accreditation, revocation of accreditation, or voluntary withdrawal of accreditation during the time the contract is in effect, this must be reported to the client

Waivers from DoD QSM requirements must be requested in writing from the appropriate DoD Chemist or Contractor Project Chemist (however named) on a project-specific basis and shall include technical justification relating to the specific project for the waiver. Documentation of approval for the waiver must be maintained by the laboratory and readily available for review.

The review process is repeated when there are amendments to the original contract by the client. The participating personnel are given copies of the amendments. The amendments are maintained electronically in the project information area of LIMS.

## **Documentation of Review**

Records are maintained for every contract or work request, when appropriate. This includes pertinent discussions with a client relating to the client's requirements or the results of the work during the period of execution of the contract. The information if in the form of hard copies, is maintained in folders kept by the assigned Project Manager, this will also include phone logs, communications and faxes. Electronic records, such as emails, PDF files, word processing documents, spreadsheets and charts are kept electronically in the "F:/PM/Clients" section of the file server under the client's folder and project subfolder.



## **Section 8 SUBCONTRACTING OF ENVIRONMENTAL TESTS**

*(TNI V1:M2 – Section 4.5)*

A subcontract laboratory is defined as a laboratory external to this laboratory, or at a different location than the address indicated on the front cover of this manual, that performs analyses for this laboratory.

A subcontracted laboratory will be used only if Weck Laboratories does not have the capability of performing the requested test, because of unforeseen reasons (e. g. workload, need for further expertise or temporary incapacity) or if the client specifically requests a particular analysis to be subcontracted.

For DoD related work, only subcontracted laboratories accredited by DoD or its designated representatives will be used. Subcontracted laboratories must receive project-specific approval from the DoD client before any samples are analyzed.

When subcontracting analytical services, the laboratory assures work requiring accreditation is placed with an appropriately accredited laboratory or one that meets applicable statutory and regulatory requirements for performing the tests.

The laboratory will ensure that the subcontract laboratory understands the requirements and will meet the same commitments made to the client by the primary laboratory.

### **Procedure**

The Client Service Manager maintains a list of subcontractors.

A register for all subcontractors that are routinely used by the laboratory is kept on file including copies of the certifications and analyte list among other documents. This information is maintained by the Client Services Manager and is kept at the main office and electronically in the "Marketing-Sales" folder of the file server under subcontractor information.

The certificate and analyte list are reviewed by the Client Services Manager to ensure the subcontracting laboratory has the appropriate accreditation to do the work.

The Client Services Manager or the Project Manager involved notifies the client of the intent to subcontract the work in writing or by verbal communications. When possible, the laboratory gains the approval of the client to subcontract their work prior to implementation, preferably in writing.

The laboratory performing the subcontracted work is identified in the final report and a copy of the subcontractor's report is kept in file in case the client requests it at a later time.



The laboratory assumes responsibility to the client for the subcontractor's work, except in the case where a client or a regulating authority specified which subcontractor is to be used.

More detailed procedures for subcontracting laboratory work are in SOP MIS041.

## Section 9

### PURCHASING SERVICES AND SUPPLIES

(TNI V1:M2 – Section 4.6)

The laboratory ensures that purchased supplies and services that affect the quality of environmental tests are of the required or specified quality, by using approved suppliers and products.

The laboratory has procedures for purchasing, receiving, and storage of supplies that affect the quality of environmental tests.

Weck Laboratories, Inc. only uses those outside support services and supplies that are of adequate quality to sustain confidence in the laboratory's tests. Services and supplies that may affect the quality of environmental tests include, but are not limited to, balance calibration, solvents, standards, and sample containers; their records include the following, where applicable:

- *Date of receipt;*
- *Expiration date;*
- *Source;*
- *Lot or serial number;*
- *Calibration and verification records*
- *Certifications.*

#### Procedure

The section Supervisors or Lab Manager review and approve the supplier of services and supplies and approves technical content of purchasing documents prior to ordering.

Specific procedures to evaluate, select and monitor suppliers of materials and services as well as required documentation are detailed in the corresponding SOP (MIS042).

Evaluation of suppliers is accomplished by ensuring the supplier ships the product or material ordered and that the material is of the appropriate quality by signing packing slips or other supply receipt documents. The purchasing documents contain the data that adequately describes the services and supplies ordered. The description may include type, class, grade, identification, specifications or other technical information.

The supplies received are inspected for breakage, leaks or any other damage. The supplies and chemicals are checked for Expiration date, concentration, grade and other relevant information. The supplies received are stored according to manufacturer's recommendations, laboratory SOPs or test method specifications.

Any documents received with the supplies and services including specifications, certificates of analyses, warranties, maintenance records, calibration records etc are kept on file as follows:

- *Certificates of standards are scanned and stored in the LIMS as a "Certificate Image" of the standard record.*
- *Records for instrument repair services are kept with each instrument maintenance records by the main analyst assigned to the instrument*
- *Records for balance calibration services, thermometers and other equipment requiring periodic calibration are kept in binders or electronically in the QA department by the QA Director.*

The purchased supplies and reagents that affect the quality of the tests are not used until they are inspected or otherwise verified as complying with requirements defined in the test method.

## Approval of Suppliers

The QA Director maintains a list of approved suppliers, which are evaluated annually and approved by the QA Director.

The evaluation procedure for approving vendors is described in the SOP MIS042.

## Section 10 SERVICE TO THE CLIENT

(TNI V1:M2 – Section 4.7)

The laboratory collaborates with clients and/or their representatives in clarifying their requests and in monitoring laboratory performance related to their work. Each request is reviewed to determine the nature of the request and the laboratory's ability to comply with the request within the confines of prevailing statutes and/or regulations without risk to the confidentiality of other clients.

### Client Confidentiality

The laboratory confidentiality policy is to not divulge or release any information to a third party without proper authorization. Third party requests for data and information are referred to the client. Data and records identified as proprietary, privileged, or confidential are exempt from disclosure.

All electronic data (storage or transmissions) are kept confidential, based on technology and laboratory limitations, as required by client or regulation.

The client is the person or entity who requested the analyses. Any information or data is only released to third parties with written permission from a properly authorized representative of the client. This information includes, but is not limited to COCs, Certificates of Analysis, raw data, bench sheets, electronic information and sample results.

In addition, no information pertaining to clients is posted in public areas where the access is not restricted.

Access to laboratory records and LIMS data is limited to authorized laboratory personnel except with the permission of the QA Director or Laboratory Technical Director. Records are also made available to authorized accrediting authority personnel.

### Client Support

Communication with the client, or their representative, is maintained to provide proper instruction and modification for testing. Technical staff is available to discuss any technical questions or concerns the client may have.

The client, or their representative, may be provided reasonable access to laboratory areas for witnessing testing, provided that the laboratory ensures confidentiality to other clients.

Delays or major deviations to the testing are communicated to the client immediately. Communications are verbal, via telephone or in writing via email, fax or

letter and are performed normally by the Project Manager assigned to that client or in some cases by the Client Services Manager or Laboratory Director.

The laboratory will provide the client with all requested information pertaining to the analysis of their samples. An additional charge may apply for additional data/information that was not requested prior to the time of sample analysis or previously agreed upon.

## Client Feedback

The laboratory seeks both negative and positive feedback following the completion of projects and periodically for ongoing projects. Feedback provides acknowledgement, corrective actions where necessary, and opportunities for continuous improvement.

Negative customer feedback is documented as a customer complaint (see Section 11 – "Complaints").

The following are specific situations for which immediate clarification or feedback is required from the client:

- *The client has specified incorrect, obsolete, or improper methods;*
- *Methods require modification to ensure achievement of project-specific objectives contained in planning documents (e.g., difficult matrix, poor-performing analyte);*
- *Project-planning documents (e.g., Quality Assurance Project Plan (QAPP) or Sampling and Analysis Plan (SAP)) are missing or requirements in the documents (e.g., action levels, detection and quantification capabilities) require clarification; or*
- *The laboratory has encountered problems with sampling or analysis that may impact results (e.g., improper preservation of sample).*

Customer feedback are obtained by Project Managers that maintain regular communication with the clients, by the Client Services Manager, who contacts different client to ask about the development of each project and by survey conducted by external agencies such as ACIL Seal of Excellence in which the Laboratory participates on regular basis.

## Client Notification of Results over the MCL or Trigger Limits

The laboratory will notify the client immediately after completed the analysis if any results for total coliform shows a positive result for potable water samples. The notification is made by contacting a live individual at the water system; if a voice mail, e-mail or fax is used to leave a message the laboratory will follow up contacts until a live individual of the water system is reached. This notification is documented on the coliform notification log, located in the Project Management office, and on the sample worksheet. In the case a live individual at the water system cannot be contacted within 24 hours, the Division of Drinking Water (DDW) of the state water resources control board is contacted and notified of the positive bacteriological results.

Maximum Contaminant Levels (MCLs) exceedances of regulated parameters in drinking water are also notified to the water utility within 24 hours of analysis completed; in some cases there are not established MCLs for certain parameters but the client has set trigger limits that also require notification, in this case the same procedure is used. The parameters that require MCL or trigger limits notification are the parameters listed in <http://water.epa.gov/drink/contaminants/index.cfm#List>

The Laboratory will request from each client subject to notification a list of individuals with their contact information (phone, email, fax number) and the priority of who should be contacted first, including the assigned state engineer. This list must be updated on regular basis by the Laboratory Project Manager assigned to the client. The form of contact can be established between the Laboratory PM and the Client but for positive coliform and high nitrate results the notification must include a phone call to a live person and if the Client contact(s) cannot be reached within 24 hours, the laboratory will contact Division of Drinking Water (DDW) of the state water resources control board. More detailed procedures for exceedance notification system are in SOP MIS060.

## Section 11 COMPLAINTS

*(TNI V1:M2 – Section 4.8)*

The purpose of this Section is to ensure that customer complaints are addressed and corrected. This includes requests to verify results or analytical data. Complaints provide the laboratory with an opportunity to improve laboratory operation and client satisfaction.

Complaints by customers or other parties are reviewed by management and appropriate action is determined. All customer complaints are documented by the person receiving the complaint and addressed to the responsible manager.

If it is determined that the complaint has merit, the procedures outlined in Section 14 – Corrective Action are utilized. If it is determined that a complaint is without merit, it is documented, and the client is contacted by the person who received the complaint or the Client Services Manager.

A complaint such as a concern that data is repeatedly late should be reviewed for preventive action (see Section 15 – “Preventive Action”) to minimize a future occurrence.

## Section 12

# CONTROL OF NON-CONFORMING ENVIRONMENTAL TESTING WORK

(TNI V1:M2 – Section 4.9)

Non-conforming work is work that does not meet acceptance criteria or requirements. Nonconformances can include departures from standard operating procedures or test methods or unacceptable quality control results (see Section 27 – “Quality Assurance for Environmental Testing”). Identification of non-conforming work can come through customer complaints, quality control, instrument calibration, evaluating consumable materials, staff observation, final report review, management reviews and internal and external audits.

### Exceptionally Permitting Departures from Documented Policies and Procedures

Requests for departures from laboratory procedures are approved by the QA Manager in agreement with the Laboratory Director and documented. The specific procedures are described in SOP MIS044. Planned departures from procedures or policies do not require audits or investigations.

### Non-Conforming Work

The lab policy for control of non-conforming work is to identify the non-conformance, determine if it will be permitted, and take appropriate action. All employees have the authority to stop work on samples when any aspect of the process does not conform to laboratory requirements.

The responsibilities and authorities for the management of non-conforming work are detailed in SOP MIS044. The procedure for investigating and taking appropriate corrective actions of non-conforming work are described in Section 14 – “Corrective Actions”. Section 14.3 describes procedures for Technical Corrective Actions. Formal corrective action procedures must be followed for non-conforming work that could reoccur (beyond expected random QC failures) or where there is doubt about the laboratory’s compliance to its own policies and procedures.

The investigation and associated corrective actions of non-conforming work involving alleged violations of the company’s Ethics and Data Integrity policies must follow the procedures outlined in Section 19 – “Data Integrity Investigations”.

The laboratory evaluates the significance of the non-conforming work, and takes corrective action immediately. The customer is notified if their data has been impacted. The laboratory allows the release of non-conforming data only with approval by the QA Manager or appropriate Technical Director or their designee on a case-by-case basis. Non-conforming data is clearly identified in the final report (see Section 28 – “Reporting the Results”).

The discovery of a nonconformance for results that have already been reported to the customer must be immediately evaluated for significance of the nonconformance,



its acceptability to the customer, and determination of the appropriate corrective action.

Corrective action for routine, non-recurring exceedances can be documented on raw data worksheets, logbooks, e-mail, a database or other documents. More serious corrective actions (non-conforming work that could reoccur or where there is doubt that the laboratory is in compliance with its own policies and procedures) will require a more formal corrective action process that usually includes the use of a corrective action report.

## Stop Work Procedures

In some cases, it might be necessary to stop work until the issue is corrected; the procedure to stop work and to evaluate when this is necessary is detailed in SOP MIS044.

Resumption of work after work has been stopped is authorized by the QA Director in consultation with the Laboratory Technical Director.

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## Section 13 IMPROVEMENT

(TNI V1:M2 – Section 4.10)

Improvement in the overall effectiveness of the laboratory management system is a result of the implementation of the various aspects of the laboratory's management system: quality policy and objectives (Section 5 – "Management"); internal auditing practices (Section 17 – "Internal Audits"); the review and analysis of data (Section 27 – "Quality Assurance for Environmental Testing"); the corrective action (Section 14 – "Corrective Action") and preventive action (Section 15 – "Preventive Action") process; and the annual management review of the quality management system (Section 18 – "Management Reviews") where the various aspects of the management/quality system are summarized, and evaluated and plans for improvement are developed.

During the Management review other aspects of the laboratory operation are evaluated; these include On Time Delivery, PT performance, re-issuing reports, numbers and types of corrective actions, Audit performance, complaints, control charting, customer feedback, etc.

## Section 14 CORRECTIVE ACTION

(TNI V1:M2 – Section 4.11)

Corrective action is the action taken to eliminate the causes of an existing non-conformity, defect, or other undesirable situation in order to prevent recurrence.

Deficiencies cited in external assessments, internal quality audits, data reviews, customer feedback/complaints, control of nonconforming work or managerial reviews are documented and require corrective action. Corrective actions taken are appropriate for the magnitude of the problem and the degree of risk.

### General Procedure

The laboratory uses forms to document and track corrective actions. The form used to document corrective as well as the procedures involved are in SOP MIS016.

The SOPs specify conditions during and after analysis that may automatically trigger corrective action or optional procedures. These conditions may include dilution of samples, additional sample extract cleanup, and automatic reinjection/reanalysis when certain QC criteria are not met.

Any QC sample result outside of acceptance limits requires corrective action, which may be document in worksheets, LIMS, etc. and not necessarily in the corrective action form. Once the problem has been identified and addressed, corrective action may include the reanalysis of samples, or appropriately qualifying the results.

The data reviewers or supervisors will identify the need for corrective action and are responsible for initiating corrective action on routine data reviews where a nonconformance is found that could reoccur (beyond expected random QC failures) or where there is doubt about the compliance of the laboratory to its own policies and procedures. The Technical Director will approve the required corrective action to be implemented by the laboratory staff. The QA Director will ensure implementation and recording of the corrective action.

All deficiencies are investigated and a corrective action plan is developed and implemented if determined necessary. The implementation is monitored for effectiveness.

#### 14.1.1 Cause Analysis

When failures due to systematic errors have been identified, the first step of the corrective action process starts with the initial investigation and determination of root cause(s) of the problem. Records are maintained in the corrective action binder and the corrective action reports computer folder where electronic copies of the Corrective Action Reports are kept of

nonconformances requiring corrective action to show that the root cause(s) was investigated and includes the results of the investigation. Where there may be non-systematic errors and as such the initial cause is readily identifiable or expected random failures (e.g. failed quality control), a formal root cause analysis is not performed and the process begins with selection and implementation of corrective action (also see Section 14.3 "Technical Corrective Actions").

**14.1.2 Selection and Implementation of Corrective Actions**

Where uncertainty arises regarding the best approach for analysis of the cause of exceedances that require corrective action, appropriate personnel will recommend corrective actions that are appropriate to the magnitude and risk of the problem and that will most likely eliminate the problem and prevent recurrence

The QA Director, the Technical Director or their designee ensure that corrective actions are discharged within the agreed time frame.

**14.1.3 Monitoring of Corrective Action**

The QA Director will monitor implementation and documentation of the corrective action to assure that the corrective actions were effective. The procedures for the implementation of corrective action are detailed in SOP MIS016.

## **Additional Audits**

Where the identification of nonconformances or departures from normal lab procedures cast doubt on the laboratory's compliance with its own policies and procedures, or on its compliance with the TNI Standard, the laboratory ensures that the appropriate areas of activity are audited in accordance with Section 17 – "Internal Audits" as soon as possible.

In many cases, the additional audits are follow-ups after the corrective action has been implemented to ensure it is effective. These are done when a serious issue or risk to the laboratory have been identified.

## **Technical Corrective Action**

Sample data associated with a failed quality control are evaluated for the need to be reanalyzed or qualified. Unacceptable quality control results are documented, and if the evaluation requires cause analysis, the cause and solution are recorded (also see Section 12 – "Control of Nonconforming Environmental Testing Work"). Analysts routinely implement corrective actions for data with unacceptable QC measures. First level correction may include re-analysis without further assessment. If the test method SOP addresses the specific actions to take, they are followed. Otherwise, corrective actions start with assessment of the cause of the problem.

Corrective action for non-systematic errors or expected random failures is documented in as specified in SOP MIS016. Corrective actions for nonconformances that may reoccur (beyond expected random QC failures) or where there is concern that the laboratory is not in compliance with its own policies and procedures require that a corrective action report be completed (see Section 14.1) and may trigger an Internal Audit to be performed on that area of the laboratory.

The Technical Directors and/or QA Director review corrective action reports and suggest improvements, alternative approaches, and procedures where needed.

If the data reported are affected adversely by the nonconformance, the affected data is clearly identified in the report and the customer is notified.

## Section 15 PREVENTIVE ACTION

(TNI V1:M2 – Section 4.12)

Preventive action is a pro-active process to identify opportunities for improvement rather than a reaction to the identification of problems or complaints.

Preventive action includes but not limited to: review of QC data to identify quality trends, regularly scheduled staff quality meetings to ensure staff is knowledgeable in quality procedures, review of client feedback to look for improvement opportunities, review of proficiency testing data to look for analytes that were nearly missed, annual managerial reviews, scheduled instrument maintenance and other actions taken to prevent problems.

When improvement opportunities are identified or if preventive action is required, action plans are developed, implemented and monitored to reduce the likelihood of the occurrence of nonconformities.

Procedures for preventive actions include the initiation of such actions and subsequent monitoring to ensure that they are effective.

All personnel have the authority to offer suggestions for improvements and to recommend preventive actions, however management is responsible for implementing preventive action.

The laboratory has also implemented a Management of Change process. This process is designed to formally review any changes that are planned for the laboratory and look for potential issues that might arise. Issues are minimized through the development of preventive measures. Changes that are considered under this type of process include the installation of a new LIMS, key personnel changes, building renovations, addition/deletion of an accreditation, addition of a new technology that requires new instrumentation, etc. The process is evaluated by all Management personnel that will be affected in any way with the change and they take a decision on the convenience or not of implementing the change. The opinions of other laboratory personnel involved are also requested and evaluated.

## Section 16 CONTROL OF RECORDS

(TNI V1:M2 – Section 4.13)

Records are a subset of documents, usually data recordings that include annotations, such as daily refrigerator temperatures posted to a laboratory form, lists, spreadsheets, or analyst notes on a chromatogram. Records may be on any form of media, including electronic and hard copy. Records allow for the historical reconstruction of laboratory activities related to sample-handling and analysis.

The laboratory maintains a record system appropriate to its needs, records all laboratory activities, and complies with applicable standards or regulations as required. Records of original observations and derived data are retained to establish an audit trail. Records help establish factors affecting the uncertainty of the test and enable test repeatability under conditions as close as possible to the original.

### Records Maintained

Records of all procedures to which a sample is subjected while in the possession of the laboratory are kept. The laboratory retains all original observations, calculations, and derived data (with sufficient information to produce an audit trail), calibration records, personnel records and a copy of the test report for a minimum of five years from generation of the last entry in the records. At a minimum, the following records are maintained by the laboratory to provide the information needed for historical reconstruction:

- i) *all raw data, whether hard copy or electronic, for calibrations, samples and quality control measures, including analysts' worksheets and data output records (chromatograms, strip charts, and other instrument response readout records);*
- ii) *a written description or reference to the specific method(s) used, which includes a description of the specific computational steps used to translate parametric observations into a reportable analytical value (a copy of all pertinent Standard Operating Procedures);*
- iii) *laboratory sample ID code;*
- iv) *date of analysis;*
- v) *time of analysis is required if the holding time is seventy-two (72) hours or less, or when time critical steps are included in the analysis (e.g., extractions and incubations);*
- vi) *instrumentation identification and instrument operating conditions/parameters (or reference to such data);*

- vii) *all manual calculations (including manual integrations);*
- viii) *analyst's or operator's initials/signature or electronic identification;*
- ix) *sample preparation, including cleanup, separation protocols, incubation periods or subculture, ID codes, volumes, weights, instrument printouts, meter readings, calculations, reagents;*
- x) *test results (including a copy of the final report);*
- xi) *standard and reagent origin, receipt, preparation, and use;*
- xii) *calibration criteria, frequency and acceptance criteria;*
- xiii) *data and statistical calculations, review, confirmation, interpretation, assessment and reporting conventions;*
- xiv) *quality control protocols and assessment;*
- xv) *electronic data security, software documentation and verification, software and hardware audits, backups, and records of any changes to automated data entries;*
- xvi) *method performance criteria including expected quality control requirements;*
- xvii) *proficiency test results;*
- xviii) *records of demonstration of capability for each analyst;*
- xix) *a record of names, initials, and signatures for all individuals who are responsible for signing or initialing any laboratory record, digital signature can be applied in addition to manual one, the digital signature policy (IT001) should be followed.*
- xx) *correspondence relating to laboratory activities for a specific project;*
- xxi) *corrective action reports;*
- xxii) *preventive action records;*
- xxiii) *copies of internal and external audits including audit responses;*
- xxiv) *copies of all current and historical laboratory SOPs, policies and Quality Manuals;*
- xxv) *sample receiving records (including information on any interlaboratory transfers);*
- xxvi) *sample storage records;*

- xxvii) *data review and verification records;*
- xxviii) *personnel qualification, experience and training records;*
- xxix) *archive records; and*
- xxxiv) management reviews.

## Records Management and Storage

The laboratory maintains a record management system for control of laboratory notebooks, instrument logbooks, and records for data reduction, validation, storage, and reporting. Most records are maintained electronically as computer files, others are kept in appropriate binders. Data is recorded immediately and legibly in permanent ink (data generated by automated data collections systems is recorded electronically.) Corrections are initialed and dated with the reason noted for corrections other than transcription errors. A single line strikeout is used to make corrections so that the original record is not obliterated. Correction on electronic records is made by the addition of notes or by audit trails.

Electronic records are kept according to the procedures described in SOP MIS045. Data backups are routinely performed according to SOP MIS003. Records, including electronic records, are easy to retrieve, legible, and protected from deterioration or damage; held secure and in confidence; and are available to accrediting bodies for a minimum of five years or as required by regulation or contract. Records that are stored only on electronic media are supported by the hardware and software necessary for their retrieval. Access to protected records is limited to the QA Director or Laboratory Technical Director and the personnel they authorize to prevent unauthorized access or amendment.

Additional information regarding control of data is included in Section 22.5 – “Control of Data”.

Procedures for identification, collection, indexing, access, filing, storage, maintenance and disposal of quality and technical records are found in SOP MIS045.

A document control system is used to ensure that all personnel have access to current policies and procedures at all times. Documents, which are managed by this system, include this Quality Manual, reports from internal audits and management reviews as well as records of corrective and preventive actions, all SOPs, policy statements, procedures, specifications, calibration tables, charts, textbooks, posters, notices, memoranda, software, drawings, plans, etc. The system consists of a document review, revision and approval system, and document control and distribution. The documents may be on various media, whether hard copy or electronic, and they may be digital, analog, photographic or written.

All quality documents (this manual, SOPs, policies, etc.) are reviewed and approved by the QA Director and the Technical Directors. Such documents are reviewed and revised when necessary and whenever the activity described changes significantly. These documents are reviewed at least every 3 years, with the

exception of the QA Manual and SOPs associated with drinking water program and DoD projects, which are reviewed annually.

More detailed procedures related to Document Control are specified in the corresponding SOP (MIS045).

If records are archived electronically as PDF files through scanning of hardcopy records and both are kept, the electronic copy is used for long term storage of vital records. The accuracy of the scanning procedure is verified upon the scan is completed to make sure all pages were properly copied and are legible. Storage of vital records is maintained by the IT manager to allow minimal access only to authorized personnel.

Archived information and access logs are protected against fire, theft, loss, environmental deterioration, vermin, and in the case of electronic records, electronic or magnetic sources. Archived records have limited access and are checked out through an access log. Records are archived on site.

In the event that the laboratory transfers ownership or goes out of business, records are maintained or transferred according to client instructions. Appropriate regulatory and state legal requirements concerning laboratory records shall be followed.

### **Legal Chain of Custody Records**

Evidentiary sample data is used as legal evidence. Procedures for evidentiary samples can be found in SOP MIS038.

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## Section 17 AUDITS

(TNI V1:M2 – Section 4.14)

Audits measure laboratory performance and verify compliance with accreditation/certification and project requirements. Audits specifically provide management with an ongoing assessment of the management system. They are also instrumental in identifying areas where improvement in the management/quality system will increase the reliability of data. Audits are of four main types: internal, external, performance, and system. Section 17.5 discusses the handling of audit findings.

### Internal Audits

Annually, the laboratory prepares a schedule of internal audits to be performed during the year. These audits verify compliance with the requirements of the management/quality system, including analytical methods, SOPs, the *Quality Assurance Manual*, ethics policies, data integrity, other laboratory policies, and the TNI Standard.

The internal audit program shall address all elements of the quality system, including all of the environmental testing activities.

The internal system audits include an examination of laboratory documentation and records on sample receiving, sample log-in, sample storage, chain-of-custody procedures, sample preparation and analysis, instrument operating records, etc. Specific records that are subject to review are detailed in the corresponding SOP for performing audits and data review (SOP MIS014).

It is the responsibility of the QA Director to plan and organize audits as required by the schedule and requested by management. These audits are carried out by trained and qualified personnel who are, wherever resources permit, independent of the activity to be audited.

The auditor should not be the person responsible for the work being audited or be the supervisor of the person responsible for the work. The auditor should have the necessary qualifications to review the area being audited and use a checklist approved by the Quality Manager.

In addition to the scheduled internal audits, it may sometimes be necessary to conduct special audits as a follow-up to corrective actions, PT results, complaints, regulatory audits or alleged data integrity issues. These audits address specific issues.

The area audited, the audit findings, and corrective actions are recorded. Audits are reviewed after completion to assure that corrective actions were implemented and effective. This review may occur during the next scheduled audit unless

findings are observed that cast doubt on the validity of data. Corrective actions that warrant sooner review cannot wait for the next scheduled audit.

## External Audits

It is the laboratory's policy to cooperate and assist with all external audits, whether performed by clients or an accrediting body. Management ensures that all areas of the laboratory are accessible to auditors as applicable and that appropriate personnel are available to assist in conducting the audit.

### 17.1.1 Confidential Business Information (CBI) Considerations

During on-site audits, on-site auditors may come into possession of information claimed as business confidential. A business confidentiality claim is defined as "a claim or allegation that business information is entitled to confidential treatment for reasons of business confidentiality or a request for a determination that such information is entitled to such treatment." When information is claimed as business confidential, the laboratory must place on (or attach to) the information at the time it is submitted to the auditor, a cover sheet, stamped or typed legend or other suitable form of notice, employing language such as "trade secret", "proprietary" or "company confidential". Confidential portions of documents otherwise non-confidential must be clearly identified. CBI may be purged of references to client identity by the responsible laboratory official at the time of removal from the laboratory. However, sample identifiers may not be obscured from the information.

## Performance Audits

Performance audits may be Proficiency Test Samples, internal single-blind samples, double-blind samples through a provider or client, or anything that tests the performance of the analyst and method.

Proficiency Test Samples are discussed in Section 27 – "Quality Assurance for Environmental Testing".

## System Audits

The Laboratory's management system is audited through annual management reviews. Refer to Section 18 – "Management Reviews" for further discussion of management reviews.

## Handling Audit Findings

Internal or external audit findings are responded to within the time frame agreed to at the time of the audit. The response may include action plans that could not be completed within the response time frame. A completion date is established by management for each action item and included in the response.

The responsibility for developing and implementing corrective actions to findings is the responsibility of the Lab supervisor corresponding to the particular section of the lab. Corrective actions are documented through the corrective action process described in Section 14 – “Corrective Actions”.

Audit findings that cast doubt on the effectiveness of the laboratory operation to produce data of known and documented quality or that question the correctness or validity of sample results must be investigated. Corrective action procedures described in Section 14 – “Corrective Action” must be followed. Clients must be notified in writing if the investigation shows the laboratory results have been negatively affected and the clients’ requirements have not been met. The client must be notified within 30 days after the laboratory discovers the issue. Laboratory management will ensure that this notification is carried out within the specified time frame.

All investigations that result in findings of inappropriate activity are documented and include any disciplinary actions involved, corrective actions taken, and all appropriate notifications of clients. See Section 19 (Data Integrity Investigation) for additional procedures for handling inappropriate activity.

## Section 18 MANAGEMENT REVIEWS

(TNI V1:M2 – Section 4.15)

At least once per year, laboratory executive management (top management) conducts a review of the quality system and environmental testing activities to ensure its continuing suitability and effectiveness and to introduce any necessary changes or improvements in the quality system and laboratory operations. The management review is a separate activity from the internal audit and records of review findings and actions are maintained.

### Management Review Topics

The following are reviewed to ensure their suitability and effectiveness:

- *the suitability of policies and procedures;*
- *reports from managerial and supervisory personnel;*
- *the outcome of recent internal audits;*
- *corrective and preventive actions;*
- *assessments by external bodies;*
- *the results of interlaboratory comparisons or proficiency tests;*
- *changes in the volume and type of the work;*
- *customer feedback;*
- *complaints;*
- *recommendations for improvement;*
- *other relevant factors, such as quality control activities, resources, and staff training.*

### Procedure

The procedure on how to conduct the managerial review is described in SOP MIS030.

Findings and follow-up actions from management reviews are recorded. Management will determine appropriate completion dates for action items and ensure they are completed within the agreed upon time frame.

## Section 19

# DATA INTEGRITY INVESTIGATIONS

(TNI V1:M2 – Section 4.16)

In addition to covering data integrity investigations, this Section covers all topics related to ethics and data integrity policies, procedures and training.

Weck Laboratories, Inc. is committed to ensuring the integrity of its data and providing valid data of known and documented quality to its clients. The elements in Weck Laboratories' Ethics and Data Integrity program include:

- *Documented data integrity procedures signed and dated by top management.*
- *An Ethics and Data Integrity Policy signed by all management and staff at the time of employment (see Appendix A). This policy is signed, dated and distributed by the President of the Company*
- *Annual data integrity training.*
- *Procedures for confidential reporting of alleged data integrity issues.*
- *An audit program that monitors data integrity (see Section 17 – “Audits”) and procedures for handling data integrity investigations and client notifications.*

Proper ethical conduct in the laboratory is strictly enforced. The Company's Code of Ethics (Appendix A) is presented to current and prospective employees in both the QA manual and the Employee Handbook.

In order to assist the laboratory technical personnel in performing their duties without detrimental influences, it is the policy of the Company that the laboratory be impartial and that it and its personnel are free from any undue commercial, financial and other pressures which might influence or adversely affect their normal performance having an impact on the quality of the work they produce or their technical judgment. By this policy all laboratory personnel dedicated to technical activities should not be influenced by, or involved in any financial or commercial matter while performing laboratory work. If any employee feels that he or she might be under any kind of pressure as described above, the Laboratory Technical Director must be notified immediately. Additionally, the Laboratory will not engage in any activities that may endanger the trust in its independence of judgment and integrity in relation to its environmental testing.

## Ethics and Data Integrity Procedures

The Ethics and Data Integrity Policy provides an over view of the program. Written procedures that are considered part of the Ethics and Data Integrity program include:

- *Ethics and Data Integrity Policy (see Appendix A)*
- *Manual integration procedures (SOP MIS039)*
- *Implementation of Business Ethics and Data Integrity Policy (SOP MIS043)*

- *Corrective action procedures (SOP MIS016 and Section 14 of this QAM)*

Management reviews data integrity procedures yearly and updates these procedures as needed.

## Training

Data integrity training is provided as a formal part of new employee orientation and a refresher is given annually for all employees. Employees are required to understand that any infractions of the laboratory data integrity procedures shall result in a detailed investigation that could lead to very serious consequences including immediate termination, debarment or civil/criminal prosecution. This is discussed in the Ethics and Data Integrity Policy that every employee is required to sign upon commencement of employment. Attendance for required training is monitored through a signature attendance sheet or a training completion certificate generated through Paylocity.

An agenda is provided to each trainee prior to the training class. Data integrity training emphasizes the importance of proper written narration on the part of the analyst with respect to those cases where analytical data may be useful, but are in one sense or another partially deficient. The following topics and activities are covered:

- *organizational mission and its relationship to the critical need for honesty and full disclosure in all analytical reporting;*
- *how and when to report data integrity issues;*
- *record keeping;*
- *training, including discussion regarding all data integrity procedures;*
- *data integrity training documentation;*
- *in-depth data monitoring and data integrity procedure documentation; and*
- *specific examples of breaches of ethical behavior such as improper data manipulations, adjustments of instrument time clocks, and inappropriate changes in concentrations of standards.*
- *guidelines for manual integration practices*
- *consequence of unethical or improper behavior*

When contracted technical or support personnel are used, the QA Director or Laboratory Technical Director are responsible for ensuring that they are trained to the laboratory's management system and data integrity procedures, competent to perform the assigned tasks, and appropriately supervised.

Topics covered are provided in writing and provided to all trainees.

## Confidential Reporting of Ethics and Data Integrity Issues

The Data Integrity Plan also provides a mechanism for confidential reporting of data integrity issues in the laboratory. A primary element of the mechanism is to assure confidentiality and a receptive environment in which all employees may privately discuss ethical issues or report items of ethical concern. In instances of ethical concern, the mechanism also includes a process whereby laboratory management is to be informed of the need for any further detailed investigation.

Employees are required and encouraged to bring up to management any improper activities they detect or are suspicious of. Any incident reported is immediately investigated by the management and the person or persons involved are subject to disciplinary actions

## **Investigations**

All investigations resulting from data integrity issues are conducted confidentially. They are documented and notifications are made to clients who received any negatively affected data that did not meet the client's data quality requirements. Procedures for investigation are included in SOP MIS043.

The Management shall also monitor the program for detecting improper, unethical or illegal action by performing internal proficiency testing (single or double blind), reviewing of analytical data post-analysis, performing electronic data audits using special software if available and providing an open door policy for employees to report any suspicious activity without fears.

The procedures for investigations are described in SOP MIS043.



## Section 20 PERSONNEL

(TNI V1:M2 – Section 5.2)

Weck Laboratories, Inc. employs competent personnel based on education, training, experience and demonstrated skills as required. The laboratory's organization chart can be found in Appendix B.

### Overview

All personnel are responsible for complying with all quality and data integrity policies and procedures that are relevant to their area of responsibility.

All personnel who are involved in activities related to sample analysis, evaluation of results or who sign test reports, must demonstrate competence in their area of responsibility. Appropriate supervision is given to any personnel in training and the trainer is accountable for the quality of the trainee's work. Personnel are qualified to perform the tasks they are responsible for based on education, training, experience and demonstrated skills as required for their area of responsibility.

The laboratory provides goals with respect to education, training and skills of laboratory staff. These goals are outlined in the Job Descriptions for each laboratory position. Training needs are identified at the time of employment and when personnel are moved to a new position or new responsibilities are added to their job responsibilities. Ongoing training, as needed, is also provided to personnel in their current jobs. The effectiveness of the training must be evaluated before the training is considered complete.

Contracted personnel, when used, must meet the same competency standards and follow the same policies and procedures that laboratory employees must meet.

### Job Descriptions

Job descriptions are available for all positions that manage, perform, or verify work affecting data quality, and are located in the Personnel binder and also under personnel records in the file server as electronic files. An overview of top management's responsibilities is included in Section 5 – "Management".

Job descriptions include the specific tasks, minimum education and qualifications, skills, and experience required for each position.

### Training

All personnel are appropriately trained and competent in their assigned tasks before they contribute to functions that can affect data quality. It is management's

responsibility to assure personnel are trained. Training records are used to document management's approval of personnel competency. The date on which authorization and/or competence is confirmed is included.

Training records are maintained by the QA Director and include evidence of acknowledgement that each employee has read, understood, and is committed to follow the current versions of the established Standard Operating Procedures and Analytical Method Protocols, which relates to his/her job responsibilities. The Training records show evidence of the revisions of the SOPs the employees have reviewed. Each employee demonstrates initial proficiency and demonstrates continued proficiency on a yearly basis by acceptable performance on Laboratory Control Samples (LCS), successful analysis of blind samples or by analyzing in parallel a sample analyzed by a trained or re-trained analyst. The training records of the analysts are organized by analyst and kept with personnel files. They include initial and continuing training, continuing education, participation in technical conferences or seminars and internal training activities.

#### **20.1.1 Training for New Staff**

Initial training for new employees is performed by experienced personnel with management guidance and includes the observation of the QC procedures described in this manual.

New staff members are given the New Employee Training as specified in SOP MIS035.

#### **20.1.2 Ongoing Training**

Staff members are given the following ongoing training:

All staff members are given refresher data integrity training and are required to sign off on the Ethics and Data Integrity Policy if they have not done so previously. The training is documented on a training attendance sheet that outlines what was covered during the training.

Ongoing training consists of:

- *The employee attests, through annual ethics, data integrity and quality system training, that they agree to perform the latest version of the Quality Assurance Manual and any SOPs or policies that the analyst is responsible for following.*
- *Annually, the analyst shows continued proficiency in each method they perform by obtaining acceptable performance on Laboratory Control Samples (LCS), successful analysis of blind samples or by analyzing in parallel a sample analyzed by a trained or re-trained analyst.*
- *Attending training related to job function as applicable.*
- *Maintaining training documentation in the employees training record*

The company has a policy that encourages all technical personnel to participate in technical seminars, conferences and scientific meetings involving innovative analytical technologies, new instrumentation and software applied to



environmental testing. Records of this participation are maintained in the personnel files. The management of the laboratory shall formulate the goals with respect to the education, training and skills of the laboratory personnel.

## Section 21

### ACCOMODATIONS AND ENVIRONMENTAL CONDITIONS (TNI V1:M2 – Section 5.3)

#### Environmental

The laboratory facility is designed and organized to facilitate testing of environmental samples. Environmental conditions are monitored to ensure that conditions do not invalidate results or adversely affect the required quality of any measurement. Such environmental conditions include physical space, energy sources, lighting, temperature, workbenches, ventilation, utilities, access and entryways to the laboratory, sample receipt area(s), sample storage area(s), chemical and waste storage area(s); data handling and storage area(s), humidity, biological sterility, dust, sound and vibration levels.

The laboratory has backup power supplies to keep operating the most critical areas of the lab such as computer systems, telephones, sample storage and some laboratory equipment for short holding time samples.

If the laboratory environment is required to be controlled by a method or regulation, the adherence is monitored, controlled and recorded as per SOPs, such as is the recording of temperature during TCLP extraction and monitoring biological sterility and other environmental effects, as appropriate to the technical activities concerned.

Environmental tests are stopped when the environmental conditions jeopardize the results.

#### Work Areas

Work areas may include access and entryways to the laboratory, sample receipt area, sample storage area, sample process area, instrumental analysis area, chemical and waste storage area and data handling and storage area.

Access to, and use of, areas affecting the quality of the environmental tests is controlled by restriction of areas to authorized personnel only. See Section 21.4 below.

The laboratory work spaces are adequate for their use, and appropriately clean to support environmental testing and ensure an unencumbered work area.

The Laboratory is segregated into different areas for operations that are not compatible with each other. This separation prevents contamination of low levels of common laboratory solvents in the volatile organics analyses and maintains culture handling or incubation areas segregated from other areas. The access to the volatile organics laboratory, which is isolated from other areas of the laboratories and has a separate air system and microbiology laboratory is restricted to

appropriate personnel only; signs to that effect are posted on the entry doors of these areas. Electronic balances are located away from drafts and doorways, and mounted on marble slabs or special tables in areas where their use is not affected by vibration. Biological sterility is monitored using air blanks for plate counts or density plates according to the SOPs for bacteriological test methods. Biological work areas are cleaned and sterilized between uses.

For microbiology, floors and work surfaces are non-absorbent and easy to clean and disinfect. Work surfaces are adequately sealed and are cleaned periodically in order to be free from dust accumulation. Plants, food, and drink are prohibited from the laboratory work area. The company will procure to improve the condition of the facilities whenever possible and make plans for future expansions or improvements.

In order to prevent cross-contamination, samples suspected of containing high concentrations of target analytes shall be isolated from other samples. Samples or extracts designated for volatile organics analysis are stored in separate refrigerators located in volatile organics area, completely segregated from all other samples and extracts. Samples suspected of containing high concentrations of volatile organics are further isolated from other volatile organics samples and samples for volatile organic analysis in potable water are kept in designated refrigerator.

When the project requires it, travel blanks, used as storage blanks, are kept with the samples until the moment of analysis to determine whether or not cross-contamination occurred. The procedures for evaluation of storage blanks, as well as other considerations for incompatible activities as detailed in the SOP MIS036.

Adequate measures are taken to ensure good housekeeping in the laboratory and to ensure that any contamination does not adversely affect data quality.

## Floor Plan

A floor plan can be found in Appendix C.

## Building Security

The laboratory is kept secure during off hours with an alarm, locked doors and locked entry gate.

A Visitor's Logbook is maintained for every visitor to sign in and out. Visitors must be accompanied by laboratory personnel when in secure areas.

Signs are used to designate secure areas.

Segregated areas are only accessible to authorized personnel, with signs posted, such as the volatile organics laboratory and clean rooms.



The Laboratory is equipped with surveillance cameras both inside and outside the buildings that can be monitored remotely.

## Section 22

### ENVIRONMENTAL METHODS AND METHOD VALIDATION

*(TNI V1:M2 – Section 5.4 and Sections 1.4, 1.5 and 1.6 of Technical Modules TNI V1:M 3-7)*

Methods and/or procedures are available for all activities associated with the analysis of the sample including preparation and testing. For purposes of this Section, “method” refers to both the sample preparation and determinative methods.

Before being put into use, a test method is confirmed by a demonstration of capability or method validation process.

All methods are published or documented. Deviations from the methods are allowed only if the deviation is documented, technically justified, authorized by management and accepted by the customer

The methods and procedures used at the laboratory are the appropriate ones for all environmental tests within its scope. These include sampling, handling, transport, storage and preparation of samples, and, where appropriate, an estimation of the measurement uncertainty as well as statistical techniques for analysis of environmental test and/or calibration data.

The methods used at the laboratory, including methods for sampling, must meet the needs of the client and are appropriate for the environmental tests it undertakes. These analytical procedures currently in use are based on the methodology approved by the regulatory agencies, such as EPA and State Agencies.

The Laboratory maintains Standard Operating Procedures (e.g., SOPs, Laboratory Method Manual) that accurately reflect all phases of current laboratory activities such as assessing data integrity, corrective actions, handling customer complaints, and all test methods. The SOPs provide all information needed to perform the different analytical tasks in accordance with regulatory requirements and in a consistent and controlled manner following the guidelines described in this QAP manual. All technical SOPs (e.g., sample preparation, analytical procedures, sample storage, sample receipt, etc.) are reviewed for accuracy and adequacy every three years except for drinking water methods reviewed annually and whenever method procedures change and updated as appropriate. Copies of all SOPs, both electronic and paper, are accessible to all personnel. Each SOP has an alphanumeric code that indicates the section it belongs, the number that identifies it, the revision number, the effective date and the signature of the QA Director and the Laboratory Director.

If other documents besides laboratory generated SOPs (i.e. equipment manuals, copies of published methods, etc.) are used as Standard Operating Procedures, they must be written in a way that they can be used as written and any changes, including the use of a selected option must be documented and included in the laboratory's SOP manual. For DoD related work, where published methods are specified as required for a project, requirements

contained within that method shall be followed and any modifications to existing method requirements will require project-specific approval by DoD personnel.

SOPs are written in a standardized format and with standardized contents, as indicated in SOP MIS048.

A current list of the Standard Operating Procedures in use is in Appendix E.

## Method Selection

A reference method is a method issued by an organization generally recognized as competent to do so. (When ISO refers to a standard method, that term is equivalent to reference method.) When a laboratory is required to analyze a parameter by a specified method due to a regulatory requirement, the parameter/method combination is recognized as a reference method.

The laboratory will use methods that meet the needs of the customer. Such methods will be based on the latest edition of the method unless it does not meet the needs of the customer or regulatory agencies.

The laboratory selects methods that are appropriate to the customer needs. When the regulatory authority mandates or promulgates methods for a specific purpose, only those methods will be used.

If a method proposed by a customer is considered to be inappropriate or out-of-date, the customer is informed and the issue resolved before proceeding with analysis of any samples (see Section 7 – Review of Requests, Tenders and Contracts).

The analytical procedures currently in use are based on the methodology approved by the EPA, the California State Water Resources Control Board, the AIHA, DoD and other regulatory agencies.

When a method is not specified by the customer, or the proposed method is inappropriate, the laboratory will select a method that is appropriate to the end use of the data:

- *If the data are to be submitted to a regulatory authority, the method(s) specified by the regulatory authority will be used.*
- *For drinking water compliance, a method will be selected from those specified in 40 CFR Part 141, or the applicable state regulations.*
- *For NPDES permits, the method will be selected from those specified in 40 CFR Part 136.*
- *If the end use of the data is not regulatory or if the regulatory authority does not specify a method, the laboratory will determine the customer needs in terms of reporting level (e.g., LOD, LOQ), bias (e.g., screening versus quantitative) and the laboratory capabilities and capacity. Based on these*

criteria, the laboratory will select an appropriate method based on the following hierarchy:

- *Resources from published in regional, national or international standards*
- *Methods published by other technical organizations such as ASTM, Standard Methods or AOAC*
- *Methods develop by the instrument manufacturer*
- *Laboratory-developed methods.*

In some cases, Weck Laboratories can perform analyses that are not specifically described in the guidelines cited above. In these cases, the following approach is taken:

- *Review other sources of test methods such as AOAC, ASTM, Pesticide Manual, and methods mandated by the applicable regulatory authorities to find a suitable method for the matrix and analyte in question.*
- *Review Methods published in international, regional or national standards.*
- *Review methods developed by instrument manufacturers*
- *Produce a modification of a standard test procedure for similar parameter or matrix*
- *Develop a special method in house suitable for the particular problem*

For these special situations, the analytical procedure is discussed with the client and performed upon the client's approval. Whenever possible, the same QA/QC guidelines as for standard methods are used, but the laboratory may deviate from these guidelines if necessary. All communications between the laboratory and the customer are documented.

Most methods in use at the laboratory are described in the following publications:

- *Tests Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, current edition,*
- *Methods for Chemical Analysis of Water and Wastewater, EPA-600/4-79-020.*
- *Standard Methods for the Examination of Water and Wastewater, current approved edition, APHA, AWWA, WPCF.*
- *Criteria for Identification of Hazardous and Extremely Hazardous Wastes, California Code of Regulations Title 22.*
- *Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater EPA-600/4-82-057.*
- *Recommended Methods of Analysis for the Organic components required for AB1803, 5th Edition Revised April 1986.*
- *Draft Method for Total Petroleum Hydrocarbons and Total Organic Lead, LUFT Methods, California Department of Health Services.*
- *Methods for the Determination of Organic Compounds in Finished Drinking Water and Raw Source Water - EPA 500 series.*
- *NIOSH Manual of Analytical Methods, US Department of Health and Human Services.*
- *Laboratory Methods of Analysis for Enforcement samples, SCAQMD, 1986.*
- *Stationary Source Test Methods, Air Resources Board, 1990.*
- *OSHA Analytical Methods Manual, 2nd Ed., U.S. Dept. of Labor, 1990.*

- *ASTM International Standards, American Society for Testing and Materials.*
- *AOAC Methods, Official Methods of Analysis of AOAC International (OMA).*
- *FDA Methods, Compendium of Analytical Laboratory Methods for Food and Feed Safety.*
- *U.S Pharmacopeial (USP) Methods Testing and Analysis.*

Reference methods for all analytical procedures are kept in the Laboratory file server.

## Laboratory-Developed Methods

If the laboratory develops a method, the process of designing and validating the method is carefully planned and documented.

The Laboratory in some instances will develop methods for its own use; in this case this is considered a planned activity and will be assigned to qualified personnel equipped with adequate resources. All personnel involved in the method design, development and implementation will be in constant communication during all stages of development. Plans are also updated as development proceeds.

Once the method is satisfactorily developed a validation process takes place before it is implemented and used.

For multi-analyte methods, the laboratory uses a standard set of target analytes but those target analytes identified by the client on a project specific basis will be analyzed. If project-specific information is not available, then the standard list of analytes or the list published in the method is used

## Method Validation

Validation is the confirmation, by examination and objective evidence, that the particular requirements for a specific intended use are fulfilled.

At a minimum, reference methods are validated by performing an initial demonstration of capability. Additional requirements are discussed for each technology.

All methods that are not reference methods are validated before use. The validation is designed so that the laboratory can demonstrate that the method is appropriate for its intended use. All records (e.g., planning, method procedure, raw data and data analysis) shall be retained while the method is in use. Based on the validation process, the laboratory will make a statement in the corresponding SOP of the intended use requirements and whether or not the validated method meets the use requirements.

Method validation and Demonstration of Capability procedures can be found in:

- [\*Appendix J - Chemistry\*](#)
- [\*Appendix K - Microbiology\*](#)
- [\*Appendix L - Radiochemistry\*](#)

## Estimation of Analytical Uncertainty

Analytical Uncertainty: A subset of Measurement Uncertainty that includes all laboratory activities performed as part of the analysis.

When requested, the laboratory will provide an estimate of the analytical uncertainty as determined by the procedure described in SOP MIS047.

## Control of Data

To ensure that data are protected from inadvertent changes or unintentional destruction, the laboratory uses procedures to check calculations and data transfers (both manual and automated).

Some instruments have a computerized data reduction and calculation, such as GC, GC/MS, HPLC, LC/MS, ICP, ICP-MS and automated wet chemistry analyzers. The protocols to perform these tasks are described in the corresponding SOPs and the computer programs used for data reduction are validated before use and checked periodically by manual calculations.

- *Data entry maintains integrity during the analytical process and it is kept confidential.*
- *Data storage is performed on real time as the data is collected in local hard drives of computers connected to the analytical instruments*
- *Data processing is done by the analysts using the software from the instruments*
- *Data transmission is performed directly from instruments to the LIMS by a Data Tool software*

Results for analyses that are performed manually or with instruments that do not have controlling software are entered in appropriate bench sheets or directly in LIMS by the analysts. Results are reviewed by supervisor or peer.

Additional information can be found in Section 16 – “Control of Records”.

### 22.1.1 [Computer and Electronic Data Requirements](#)

The laboratory assures that computers, user-developed computer software, automated equipment, or microprocessors used for the acquisition, processing, recording, reporting, storage, or retrieval of environmental test data are:

- *documented in sufficient detail and validated as being adequate for use;*

- *protected for integrity and confidentiality of data entry or collection, data storage, data transmission and data processing;*
- *maintained to ensure proper functioning and are provided with the environmental and operating conditions necessary to maintain the integrity of environmental test data; and*
- *held secure including the prevention of unauthorized access to, and the unauthorized amendment of, computer records. Data archive security is addressed in Section 16 – “Control of Records” and building security is addressed in Section 21- “Accommodations and Environmental Conditions”.*

Procedures are described in SOP MIS037.

The laboratory uses spreadsheets to calculate final results from the raw data. Before reporting any results derived from these programs, the laboratory shall validate the underlying calculations.

If any changes are made to the spreadsheet program, the laboratory revalidates the entire system before reporting results.

In addition, the algorithms all spreadsheet calculations or other programs that are used to reduce raw data to a reported value will be verified upon first use and annually thereafter to ensure that the process produces accurate results.

Data from all electronic media are backed up daily to ensure that data are not lost. The backed-up copies are stored out of premises by IT Manager.

After the spreadsheet is validated, the calculations are protected from inadvertent manipulations.

Procedures for electronic backups are described in SOP MIS003.

#### 22.1.2 Data Reduction

Some instruments have a computerized data reduction and calculation, such as GC/MS, HPLC, GC and ICP. The protocols to perform these tasks are described in the corresponding SOPs and the computer programs used for data reduction are validated before use and checked periodically by manual calculations.

Internal data review consists of a tiered or sequential system of verification, consisting of at least three tiers, with each check performed by a different person. The three tiers include a 100% review of the entire data package and completion of corresponding Data Review Checklist by the analyst, then a 100% verification review by a technically qualified person, such as a supervisor or another chemist, experienced in that particular method or procedure, who checks for proper integration of peaks, identification of compounds, QC, etc. The third review is mainly an administrative one, to check for accuracy and completeness, typically

performed by the Project Manager in charge of that project. The procedures used for performing the data review are detailed in the SOP MIS018.

If a discrepancy is noted in any stage of the reviewing process, the package is returned to the primary analyst for corrective action. For analyses that do not have automatic data reduction, the analyst performs the necessary calculations to obtain the final result, and then the results are reviewed as indicated above.

All information used in the calculations (e.g., raw data, calibration files, tuning records, results of standard additions, interference check results, sample response, and blank or background correction protocols) as well as sample preparation information (e.g., weight or volume of sample used, percent dry weight for solids, extract volume, dilution factor used) are recorded in order to enable reconstruction of the final result.

The results of the quality control sample analysis are reviewed, and evaluated before data are reported.

After the results are entered into the LIMS, the third tier is completed and if no discrepancies are encountered they are released for reporting.

If electronic audit trail functions are available, they must be in use at all times, and associated data must be accessible. If the instrument does not have an audit trail, the integrity of the data is documented as described in SOP MIS043 Implementation of the Business Ethics and Data Integrity Policy.

The laboratory has manual integration procedures that must be followed when integrating peaks during data reduction. The manual integration procedures are described in SOP MIS039.

The laboratory procedures for use of significant figures are described in SOP MIS012 and in each analytical method SOP.

All raw data must be retained electronically in hard drives or storage boxes if it is printed material for seven years. The storage location is the second story of the laboratory building but could be moved to another location if necessary. Records are maintained as described in Section 16 – “Control of Records”.

#### 22.1.3 Data Review Procedures

Data review procedures are located in Section 23.4 – “Data Review”.

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## Section 23 CALIBRATION REQUIREMENTS

**(TNI V1:M2 – Sect 5.5 and Section 1.7 of  
Technical Modules TNI V1:M 3-7)**

### General Equipment Requirements

The Laboratory is furnished with all items of sampling, measurement and test equipment required for the correct performance of the environmental tests (including sampling, preparation of samples, processing and analysis of environmental data).

All equipment and software used for testing and sampling are capable of achieving the accuracy required for complying with the specifications of the environmental test methods as specified in the laboratory SOPs.

Equipment is operated only by authorized and trained personnel (see Section 20 – "Personnel").

The laboratory has procedures for the use, maintenance, handling and storage of equipment and they are readily available to laboratory personnel.

Manuals provided by the manufacturer of the equipment provide information on use, maintenance, handling and storage of the equipment. The laboratory maintains an equipment table that includes additional information on storage location. The laboratory also has an SOP to summarize planned equipment maintenance (MIS055). These procedures ensure proper functioning of the equipment and prevent contamination or deterioration.

All equipment is calibrated or verified before being placed in use to ensure that it meets laboratory specifications and relevant standard specifications. The calibration procedures are specified in each method SOP and calibration records are as required and kept as electronic files in the corresponding folder of the computer system.

Documents detailing the receipt and specification of analytical equipment are retained. A history of the maintenance record of each system serves as an indication of the adequacy of maintenance schedules and parts inventory. As appropriate, the maintenance guidelines of the equipment manufacturer are followed. When maintenance is necessary, it is documented either in logbooks in the instrument work area or as electronic records in LIMS.

Test equipment, including hardware and software, are safeguarded from adjustments that would invalidate the test result measurements by limiting access to the equipment and using password protection where possible (see Section 22.5 – "Control of Data").

Equipment that has been subject to overloading, mishandling, given suspect results, or shown to be defective or outside specifications is taken out of service. The equipment is isolated to prevent its use or clearly labeled as being out of service until it has been shown to function properly. If it is shown that previous tests are affected, then procedures for nonconforming work are followed and results are documented (see Section 12 – “Control of Nonconforming Environmental Testing Work” and Section 14 – “Corrective Action”).

Older instruments shall be replaced with newer ones or updated if possible as technology improves and efforts shall be made to provide a greater degree of automation and security in analytical instruments.

The Laboratory does not use any equipment outside the permanent control of the laboratory.

Each item of equipment and software used for testing and significant to the results is uniquely identified. Records of equipment and software are maintained. This information includes the following:

- a) *identity of the equipment and its software;*
- b) *manufacturer's name, type identification, serial number or other unique identifier;*
- c) *checks that equipment complies with specifications of applicable tests;*
- d) *current location;*
- e) *manufacturer's instructions, if available, or a reference to their location;*
- f) *dates, results and copies of reports and certificates of all calibrations, adjustments, acceptance criteria, and the due date of next calibration;*
- g) *maintenance plan where appropriate, and maintenance carried out to date; documentation on all routine and non-routine maintenance activities and reference material verifications;*
- h) *any damage, malfunction, modification or repair to the equipment;*
- i) *date received and date placed into service (if available); and*
- j) *condition when received, if available (new, used, reconditioned).*

The list of equipment that is currently in service at the laboratory can be found in Appendix H.

Glassware is cleaned to meet the sensitivity of the method. Any cleaning and storage procedures that are not specified by the method are documented in laboratory records or SOPs.

## Support Equipment

Support Equipment includes, but is not limited to: balances, ovens, refrigerators, freezers, incubators, water baths, temperature measuring devices (including

thermometers, thermocouples and thermistors), mechanical volumetric dispensing devices (such as Eppendorf®, or automatic dilutor/dispensing devices) and thermal/pressure sample preparation devices.

- a) *The results of any calibration or verification shall be within the specifications required of the application for which this equipment is used. The laboratory defines the specifications for acceptability if none exist in method or regulation. If any equipment fails to meet the specifications for acceptability:*
  - i. *the equipment shall be removed from service until repaired; or*
  - ii. *the laboratory shall maintain records of established correction factors to correct all measurements.*
- b) *The laboratory shall maintain all support equipment in proper working order. The records of all repair and maintenance activities, including service calls, shall be kept. The procedure used for calibration is described in SOP MIS031.*
- c) *On each day the equipment is used, balances, ovens, refrigerators, freezers, incubators, and water baths shall be checked and documented. The acceptability for use or continued use shall be according to the needs of the analysis or application for which the equipment is being used.*
- d) *Temperature measuring devices shall be calibrated or verified at least annually. Calibration or verification shall be performed using a recognized National Metrology Institute traceable reference, such as NIST, when available.*
  - i. *If the temperature measuring device is used over a range of 10°C or less, then a single point verification within the range of use is acceptable.*
  - ii. *If the temperature measuring device is used over a range of greater than 10°C, then the verification must bracket the range of use.*
- e) *If quantitative results are dependent on their accuracy, such as in standard preparation or dispensing or dilution into a specified volume, the laboratory shall verify volumetric measuring devices as follows:*
  - i. *glass microliter syringes and Class A glassware are exempt from any verification requirements beyond what is stated in Section 9.1;*
  - ii. *disposable or single-use volumetric equipment shall be verified once per lot, prior to or in conjunction with its first use;*
  - iii. *mechanical devices shall be verified prior to first use and on a quarterly basis; mechanical devices used at more than one volume shall be verified at volumes bracketing the range of use, and at the mid-point of the volumes used by the device;*
  - iv. *all other volumetric support equipment shall be checked for accuracy prior to or in conjunction with its first use.*

- f) All other support equipment shall be calibrated or verified at least annually, using a recognized National Metrology Institute, such as NIST, traceable reference when available, bracketing the range of use.
- g) Raw data records shall be retained to document equipment performance.
- h) DoD/DOE Requirement: In the absence of method-specific requirements, the minimum requirements are as follows:

Table 23-1 Minimum requirements (DoD/DOE) to follow in the absence of method-specific requirements.

Performance Check	Frequency	Acceptance Criteria
Balance calibration check [Using two standard weights that bracket the expected mass]	Daily prior to use	Top-loading balance: $\pm 2\%$ or $\pm 0.02\text{g}$ , whichever is greater  Analytical balance: $\pm 0.1\%$ or $\pm 0.5\text{mg}$ , whichever is greater
Verification of standard mass [Using weights traceable to the International System of Units (SI) through a NMI]	Every 5 years	Certificate of Calibration from ISO/IEC 17025 accredited calibration laboratory
Monitoring of refrigerator/freezer Temperatures	Daily (i.e., 7 days per week) [Use MIN/MAX thermometers or data loggers equipped with notification of out of control event capabilities if personnel not available to record daily. If a notification has been sent to laboratory personnel for out of control conditions, the laboratory is expected to respond with corrective actions within 24 hours of sent notification or the client of the affected samples will be notified.]	Refrigerators: 0°C to 6°C  Freezers: $\leq -10^\circ\text{C}$
Thermometer verification check [Using a thermometer traceable to the SI through an NMI]  [Performed at two temperatures that bracket the target temperature(s). Assume linearity between the two bracketing temperatures.]  [If only a single temperature is used, at the temperature of use]	Liquid in glass: Before first use and annually  Electronic: Before first use and quarterly	Apply correction factors or replace thermometer

Performance Check	Frequency	Acceptance Criteria
Volumetric labware	Class B: By lot before first use  Class A and B: Upon evidence of Deterioration	Bias: Mean within $\pm 2\%$ of nominal volume  Precision: RSD $\leq 1\%$ of nominal volume (based on 10 replicate measurements)
Non-volumetric labware  [Applicable only when used for measuring initial sample volume and final extract/ digestates volume]	By lot before first use and upon evidence of deterioration	Bias: Mean within $\pm 3\%$ of nominal volume  Precision: RSD $\leq 3\%$ of nominal volume (based on 10 replicate measurements)
Mechanical volumetric pipette	Daily before use	Bias: Mean within $\pm 2\%$ of nominal volume  Precision: RSD $\leq 1\%$ of nominal volume (based on minimum of 3 replicate measurements)  [Note: for variable volume pipettes, the nominal volume is the volume of use]
Glass microliter syringe	Upon receipt and upon evidence of deterioration	General Certificate of Bias & Precision upon receipt  Replace if deterioration is evident
Drying oven temperature check	Daily prior to and after use	Within $\pm 5\%$ of set temperature
Water purification system	Daily prior to use	Per Laboratory SOP
Radiological Survey Equipment  [The battery is checked; a background reading is taken; and verified with a radiological source]	Daily prior to use	Per Laboratory SOP

The type of calibration, frequency and acceptance criteria for laboratory support equipment, including equipment used for microbiology analyses is specified in SOP MIS031.

## Analytical Equipment

### 23.1.1 Maintenance for Analytical Equipment

All equipment is properly maintained, inspected, and cleaned.

Maintenance of analytical instruments and other equipment may include regularly scheduled preventive maintenance or maintenance on an as-needed basis.

Instrument malfunction is documented in the Instrument Maintenance logs, either in hardcopy or as electronic records, which become part of the laboratory's permanent records. A description of what was done to repair the malfunction and proof of return to control are also documented in the log.

A description of the laboratory instrumentation maintenance can be found in SOP MIS055

### 23.1.2 Instrument Calibration

Information on instrument calibration can be found in Appendix J (Chemistry), Appendix K (Microbiology) and Appendix L (Radiochemistry).

Initial instrument calibration and continuing instrument calibration verification are an important part of ensuring data of known and documented quality. If more stringent calibration requirements are included in a mandated method or by regulation, those calibration requirements override any requirements outlined here or in laboratory SOPs. Generally, procedures and criteria regarding instrument calibrations are provided in the SOPs corresponding to each test method.

All instruments are calibrated in accordance with the respective SOPs and/or method of analysis. The typical calibration procedure consists of an initial calibration, performed by running a series of standards and calculating the response by using either the response factors or by linear or polynomial regression analysis. This is followed by a calibration verification. All calibration procedures are thoroughly documented.

When an initial instrument calibration is not performed on the day of analysis, it is verified by analyzing CCVs standards using the following criteria, unless something different is specified in the corresponding SOPs or QAPP:

- *The concentration of the CCV standard shall be from the low-calibration standard to the midpoint of the calibration range;*
- *The source of the CCV standard should be the same as the source for the initial calibration standard(s); and*
- *The baseline for evaluating the CCV is the initial calibration curve, except for the evaluation of retention times in organic chromatographic methods, which may be based on comparison with the retention times in the initial CCV.*

When the method specifies to run CCVs at specific sample intervals, the count of these samples shall be of field samples only.

When a CCV fails to fall within acceptance limits then CCVs and all samples analyzed since last successful calibration verification are re-analyzed. If reanalysis is not possible, the client is notified prior to reporting data associated with a noncompliant CCV and if data are reported, appropriate qualifiers are used and if further clarification is needed this is explained in the case narrative. The exception to this is when a CCV fails with high bias, but the field samples remain not detected.

In all cases, the validity of the standards used in the initial calibration is verified using an independently prepared calibration verification solution. For all chemical determinations in which standards are involved for calibration, it is the policy of the company to use a secondary reference material (second source) obtained from a second manufacturer or lot if the lot can be demonstrated from the manufacturer as prepared independently from other lots. Traceability shall be to a national standard, when commercially available. If not commercially available, it can be prepared in-house. This secondary reference can be an LCS or other standard run to verify the integrity of the primary standard. Ideally, the secondary reference will be prepared identically to the calibration standards (i.e. if the calibration standard is directly injected without preparation, then directly injecting the reference standard removes any biases present by any field sample preparation steps).

When project-specific or method-specific requirements do not exist:

- *The initial calibration verification shall be successfully completed prior to analyzing any samples;*
- *The use of a standard from a second lot is acceptable when only one manufacturer of the standard exists (note: manufacturer refers to the producer of the standard, not the vendor); and*
- *The concentration of the second source standard shall be at or near the midpoint of the calibration range. Acceptance criteria for the initial calibration verification must be at least as stringent as those for the continuing calibration verification.*

Specific analyses' calibrations are checked more frequently. Some instruments, such as TOX analyzers have built-in calibration features. The internal calibration of these instruments is monitored daily for accuracy.

Some calibration curves for spectrophotometric methods are very stable over a long period of time, however it is the policy of the Laboratory to perform a new initial calibration curve even if the continuing calibration check meets specified criterion, in any of the following events:

- *At least every three years*
- *When the instrument is moved to a different location*
- *If any maintenance that can affect the calibration has been performed*
- *If the analysts judges it necessary for special projects or different range of calibration*

Spectrophotometers are also subject to wavelength calibration which it shall be performed at least annually, according to the procedure described by the manufacturer in the instrument manual or other documentation.

All results are calculated based on the response curve from the initial calibration and generally not quantitated from any continuing instrument calibration verification unless otherwise required by regulation, method, or program. The results are bracketed by calibration standards which cover the entire quantitation range for each analyte. Any data reported below the lower-limit of quantitation is considered to have an increased quantitative uncertainty and consequently it is reported using defined qualifiers or flags or explained in the case narrative. The highest calibration standard is the highest concentration for which quantitative data

are to be reported. Any data reported above this highest standard is considered to have an increased quantitative uncertainty and it is reported as an estimated value using the defined data qualifiers or explained in the case narrative, unless the sample can be diluted and re-run within the limits of the initial calibration curve.

The following is the criteria used for the acceptance of an initial calibration, unless specified differently in the analytical methods:

- *Use the average response factor (RF) if the percent relative standard deviation (%RSD) of the points is less than 20%. In this case, linearity through the origin is assumed.*
- *If the %RSD is greater than 20%, linearity through the origin cannot be assumed and a linear regression, a weighed linear regression or a non-linear regression can be used. The acceptance criteria for linear regression are a coefficient of correlation (r) equal or greater than 0.99 and for non-linear regression the coefficient of determination (COD) or r<sup>2</sup> equal or greater than 0.99. In both cases, the curve is not to be forced through the origin nor is the origin used as another point. The sample results must be within the first and last standards.*
- *It is recommended and a good practice (but not mandatory unless the SOP specifies that) to back calculate the data points in which case a deviation of less than 20% is considered acceptable (could be as great as 50% for low level points if the system is pushed to the lowest possible limits)*
- *The number of data points to construct the initial calibration curve shall be obtained from the analytical method employed. If no criteria are specified, the laboratory shall construct initial calibration curves using a minimum of five calibration points for organic analytes and three calibration points for inorganic analytes and IH samples. All reported target analytes and surrogates (if applicable) shall be included in the initial calibration. Reported results for all target analytes shall be quantified using a multipoint calibration curve; surrogates are calibrated according to each analytical method requirements, unless there are project specific requirements in which case these are followed. It is not permitted to exclude calibration points unless there is technical justification for it.*
- *The lowest standard shall be at or below the reporting limit for the method and at or below the regulatory limit/decision level if known by the laboratory.*
- *The lowest calibration standard must be above the detection limit. Noted exceptions: for turbidity analysis and for instrument technology (such as ICP or ICP/MS) with validated techniques from manufacturers or methods employing standardization with a zero point and a single point calibration standard:*
  - *Prior to the analysis of samples the zero point and single point calibration must be analyzed and the linear range of the instrument must be established by analyzing a series of standards, one of which must be at the lowest quantitation level.*
  - *Zero point and single point calibration standard must be analyzed with each analytical batch.*
  - *A standard corresponding to the lowest quantitation level must be analyzed with each analytical batch and must meet established acceptance criteria.*

- *The linearity is verified at a frequency established by the method and/or the manufacturer.*
- *If a sample within an analytical batch produces results above its associated single point standard then one of the following should occur:*
  - *analyze reference material at or above the sample value that meets established acceptance criteria for validating the linearity; dilute the sample such that the result falls below the single point calibration concentration (when sufficient sample volume permits);*
  - *Report the data with an appropriate data qualifier and/or explain in the case narrative.*
  - *For metals analysis with a single-point calibration, a sample result may be reported up to 90% of the linear dynamic range (LDR). All samples exceeding this value must be diluted to within the LDR.*

If the initial calibration fails, the analysis procedure is stopped and evaluated. For example, a second standard may be analyzed and evaluated or a new initial calibration curve may be established and verified. In all cases, the initial calibration must be acceptable before analyzing samples. If samples cannot be reanalyzed, data associated with an unacceptable initial instrument calibration must be reported with appropriate data qualifiers.

When an initial calibration is not performed on the day of the analysis, a calibration verification check standard is analyzed at the beginning and at the end of each batch. An exception to this policy is for internal standard methods (e.g., most organic methods). For these analyses, the calibration check is only analyzed at the beginning of the analytical sequence or analytical batch. The concentration of this calibration check is specified in each method SOP and whenever possible is varied within the established calibration range.

Sufficient raw data records are retained electronically as printouts to permit reconstruction of the continuing instrument calibration verification, e.g., test method, instrument, analysis date, each analyte name, concentration and response, calibration curve or response factor, or unique equations or coefficients used to convert instrument responses into concentrations. Continuing calibration verification records explicitly connect the continuing verification data to the initial instrument calibration by listing in the quantification report the initial calibration file that was used for the calculation.

When intermediate checks are needed to maintain confidence in the calibration status of the equipment, these checks shall be carried out according to each Standard Operating Procedure for the analytical method.

Where calibrations give rise to a set of correction factors, the laboratory shall have procedures to ensure that copies (e.g., in computer software) are correctly updated.

If the continuing instrument calibration verification results obtained are outside established acceptance criteria, corrective actions are performed. If routine corrective action procedures fail to produce a second consecutive (immediate)

calibration verification within acceptance criteria, the following options are available:

- *Demonstrate performance after corrective action with two consecutive successful calibration verifications*
- *Perform a new initial instrument calibration.*

If acceptable performance has not been demonstrated, sample analyses shall not occur until a new initial calibration curve is established and verified. However, sample data associated with an unacceptable calibration verification may be reported as qualified data under the following special conditions:

- *When the acceptance criteria for the continuing calibration verification are exceeded high, i.e., high bias, and there are associated samples that are non- detects, then those non-detects may be reported.*
- *When the acceptance criteria for the continuing calibration verification are exceeded low, i.e., low bias, those sample results may be reported if they exceed a maximum regulatory limit/decision level or if the samples are not for regulatory compliance and accurate values are not required by the customer.*

## Section 24 MEASUREMENT TRACEABILITY

(TNI V1:M2 – Section 5.6)

Measurement quality assurance comes in part from traceability of standards to certified materials.

All equipment used to affect the quality of test results are calibrated prior to being put into service and on a continuing basis (see Section 23 – “Calibration Requirements”). These calibrations are traceable to national standards of measurement where available.

If traceability of measurements to SI units is not possible or not relevant, evidence for correlation of results through interlaboratory comparisons, proficiency testing, or independent analysis is provided.

### Reference Standards

Reference standards are standards of the highest quality available at a given location, from which measurements are derived.

Reference Standards, such as ASTM Class 1 weights, are used for calibration only and for verification on unless it is shown that their performance as reference standards will not be invalidated.

Reference standards, such as ASTM Class 1 weights, are calibrated by an entity that can provide traceability to national or international standards. The following reference standards are sent out to be calibrated to a national standard as indicated in Section 23 – “Calibration Requirements”:

- *Class 1 weights.*
- *NIST traceable reference thermometers.*

### Reference Materials

Reference materials are substances that have concentrations that are sufficiently well established to use for calibration or as a frame of reference.

Reference materials, where commercially available, are traceable to national standards of measurement, or to Certified Reference Materials, usually by a Certificate of Analysis.

Purchased reference materials require a Certificate of Analysis where available. If a reference material cannot be purchased with a Certificate of Analysis, it is verified by analysis and comparison to a certified reference material and/or demonstration of capability for characterization.

Internal reference materials, such as working standards or intermediate stock solutions, are checked as far as is technically and economically practical against a second source independent from a known to be of high quality

Working standards or intermediate stock solutions are checked against a second source at first time of use. When a second source is not available, a vendor certified different lot is accepted as a second source. In most cases, the analysis of an Initial Calibration Verification (ICV) standard or a Laboratory Control Sample (LCS) can be used as a second source confirmation. Working standards and intermediate stock solutions are given expiration dates when they are prepared based on method or regulatory requirements. These standards are used up or disposed of by the expiration date.

Additional working standards such as working-class weights or internal thermometers are checked using the frequency summarized in SOP MIS031.

## Transport and Storage of Reference Standards and Materials

The laboratory handles and transports reference standards and materials in a manner that protects the integrity of the materials. Reference standard and material integrity is protected by separation from incompatible materials and/or minimizing exposure to degrading environments or materials.

Reference standards and materials are stored according to manufacturer's recommendations, method SOP requirements and separately from samples. The frequency of preparation is specified in each method SOP and the receipt, storage and preparation of solutions is detailed in SOP MIS004.

## Labeling of Reference Standards, Reagents, and Reference Materials

The laboratory has procedures for purchase, receipt and storage of standards, reagents and reference materials. Purchase procedures are described in Section 9 – "Purchasing Services and Supplies" and receipt and storage procedures are described in SOP MIS004.

Expiration dates can be extended if the reference standard or material's integrity is verified. The extended date may not be beyond the expiration date of the referenced standards used to re-verify. The verification process involves analyzing the expiring standard against a valid standard and obtaining a deviation of not more than 5%.

The reagents and chemicals used in the laboratory are obtained from reputable suppliers that have proven consistency over the years. Purity specifications are chosen based on the analysis and this is always verified by the routine analysis of solvent blanks, method blanks and check standards. In methods where the purity of reagents is not specified, analytical reagent grade is used. Reagents of lesser purity than those specified by the test method are not used. Upon receipt of reagents, the labels on the container are checked to verify that the purity of the

reagents meets the requirements of the particular test method. Such information is documented in the corresponding section of the LIMS.

The following are some of the reagents used:

- *Solvents used for Gas Chromatography and GC/MS are “organic residue analysis” grade or ACS reagent grade equivalent.*
- *Methanol used for volatile organics by GC or GC/MS is “Purge and Trap” grade.*
- *All inorganic chemicals are “ACS reagent grade” or better, depending of the requirement.*
- *Nitric acid used for preparation of standards for ICP/MS analysis is “trace metals”.*

The quality (e.g., purity) specifications for all standards and reagents (including water) are documented in SOP MIS004.

The quality of reagent water sources used for microbiological analyses is monitored for trace metals, TKN, TOC and bacteria content. The results are documented in the corresponding logbook kept at the Microbiological Lab. On daily basis, the quality of reagent water is monitored by performing method blanks and system blanks for all tests that require water and the results documented with the analytical batch. If the reagent water does not meet method specific requirements a corrective action procedure is initiated.

The concentration of titrants is verified in accordance with written laboratory procedures (SOPs) and documented in the Standardization log book kept in the Wet Chemistry section of the Laboratory.

#### 24.1.1 Stock Standards, Reagents, Reference Materials and Media

Records for all standards, reagents, reference materials, and media include:

- *the manufacturer/vendor name (or traceability to purchased stocks or neat compounds)*
- *the manufacturer’s Certificate of Analysis or purity (if supplied)*
- *the date of receipt*
- *recommended storage conditions*

The information is recorded and the materials are given a unique identification number as described in SOP MIS004.

If the original container does not have an expiration date provided by the manufacturer or vendor it is not required to be labeled with an expiration date. If an expiration date is provided, it must be labeled with the expiration date.

In methods where the purity of reagents is not specified, analytical reagent grade is used. If the purity is specified, that is the minimum acceptable grade. Purity is verified and documented according to Section 9 – “Purchasing Services and Supplies” and to SOP MIS004.

#### 24.1.2 Prepared Standards, Reagents, Reference Materials and Media

Records for standards, reagents, reference materials, and media preparation include:

- *traceability to purchased stock or neat compounds*
- *reference to the method of preparation*
- *date of preparation*
- *an expiration date after which the material shall not be used (unless its reliability is verified by the laboratory)*
- *preparer's initials (if prepared)*

This information is recorded as per SOP MIS004.

All containers of prepared standards, reagents, or materials are labeled with a unique ID and an expiration date. The unique ID is determined by the LIMS system and consists of 7 digits being the first digit the year, then two digits for the month and the last four digits are correlative numbers from 0001 to 9999. Each container must be uniquely identified even if it is the same sample in each container.

Prepared reagents are verified to meet the requirements of the test method through the analysis of blanks.

## Section 25 COLLECTION OF SAMPLES

(TNI V1:M2 – Section 5.7)

Most samples processed at the laboratory are collected by clients or their representatives. When required, Weck Laboratories can provide technical assistance for sample collection and handling and can prepare and provide the necessary coolers, reagent water, sample containers, preservatives, sample labels, custody seals, COC forms, ice, and packing materials required to properly preserve, pack, and ship samples to the laboratory.

Weck Laboratories field personnel conduct sampling of wastewater and potable water for projects that require this service. Our personnel do not perform industrial hygiene sampling. Sampling procedures are described in the following SOPs: MIS002 and MIS010

In order to assure the quality of the entire analytical process, Weck Laboratories works closely with field personnel employed by the client to meet general QA criteria and if available specific criteria as per the QAPP.

The procedures to obtain subsamples, such as obtaining sample aliquots, are documented in each analytical SOP that requires it.

Where the client requires deviations, additions or exclusions from the documented sampling procedure, these are recorded in detail in the case narrative of the work order and reported with the analytical report. They are also communicated to the appropriate personnel.

In the instances that the laboratory does not perform the sampling and whenever possible, all sampling information, such as name of sampler, company that employs the sampler, sampling procedure, etc. is recorded in the sampling section of each work order and reported to the client. All other pertinent sampling information and relevant data for operations relating to sampling that forms part of the environmental testing that is undertaken is also recorded and reported with the analytical report.

### Sampling Containers

The laboratory offers clean sampling containers for use by clients. The sample containers are obtained and managed as specified in SOPs MIS007 and MIS028.

#### 25.1.1 Preparing Container Orders

Containers (containing any required preservatives) are provided to the client upon request.

Bottle orders are processed by the Project Managers as per Client's instructions and information provided for the site (whether the site is chlorinated to provide sampling containers with the correct preservation, etc.). The LIMS has a facility in the Project Management section to generate the bottle orders which is done by the PMs after entering the necessary information, such as due date, bottle type and number of bottles. The Shipping Department checks schedules daily for bottle due to be delivered and mode of delivery (FEDEX, Courier, etc) and ship accordingly. If

special instructions or required the bottle order form is printed put and brought to shipping with the special written instructions. For rush orders due in less than 48 hrs, the PM needs to verbally notify shipping to take the necessary steps to complete the order on time.

#### 25.1.2 [Sampling Containers, Preservation Requirements, Holding Times](#)

Sampling container, preservation and holding time requirements can be found in Appendix I of this QA Manual and in Appendix 1 of SOP MIS001.

If preservation or holding time requirements are not met, the procedures in Section 12 – “Control of Nonconforming Environmental Testing Work” are followed.

## Sampling Plan

The laboratory uses sampling plans provided by clients or prepared in consultation with the client. The plan must include any factors that must be controlled to ensure the validity of the test. Sampling plans and written sampling procedures are used for sampling substances, materials or products for testing. The plan and procedures are made available at the sampling location.

The laboratory's procedures for dealing with nonconformances are used when the client requests any deviations from the sampling plan or sampling procedures. The requests are documented and included in the final test report.

## Sampling Records

The following relevant sampling data are recorded: sampling procedure used, the date and time of sampling, the identification of the sampler, environmental conditions (if relevant), the sampling location, and the statistics upon which the sampling procedures are based.



## Section 26

### HANDLING SAMPLES AND TEST ITEMS

**(TNI V1:M2 – Section 5.8 and Section 1.7  
of Technical Modules TNI V1:M 3-7)**

#### Sample Receipt

When samples are received at the laboratory, chain-of-custody is reviewed, condition is documented, samples are given unique identifiers, and they are logged into the sample tracking system (the LIMS).

##### 26.1.1 Chain of Custody

The chain of custody or sample submission sheets from the field are reviewed. This documentation is completed in the field and provides a written record of the handling of the samples from the time of collection until they are received at the laboratory. Section 25 – “Collection of Samples” outlines what information is needed on this record. The chain of custody form also provides information on what type of testing is being requested and can act as an order for laboratory services in the absence of a formal contract. An example chain of custody form can be found in Figure 26-1. Chain of custody and any additional records received at the time of sample submission are scanned and maintained by the laboratory in the form of electronic records.

##### 26.1.1.1 Legal Chain of Custody

When full Legal/Evidentiary Chain of Custody protocols are required, COC records are used to establish an intact, continuous record of the physical possession, storage, and disposal of sample containers, collected samples, sample aliquots, and sample extracts or digestates. The COC records account for all time periods associated with the samples. The COC records identify all individuals who physically handled individual samples. The COC forms remain with the samples during transport or shipment. If shipping containers and/or individual sample containers are submitted with sample custody seals, and any seals are not intact, the lab shall note this on the chain of custody. Other documents pertaining to the transport of the samples, such as receipts from common carriers are kept as part of the documentation. When evidentiary samples, subsamples, digestates or extracts are transferred to another party they are subject to the requirements of legal chain of custody. These samples are kept in a locked area or refrigerator with the key in possession of the designated sample custodian

#### Sample Acceptance

Procedures for opening shipping containers and examining samples are provided in SOP MIS001.

The laboratory has a sample acceptance policy that is made available to sample collection personnel. An example is provided in Figure 26-2. It emphasizes the need for use of water-resistant ink, providing proper documentation (to include sample ID, location, date and time of collection, collector's name, preservation type, sample type and any special remarks about the sample), labeling of sample containers to include a unique sample ID, use of appropriate containers, adherence to holding times, and sample volume requirements. In addition, the laboratory has nonconformance/corrective action procedures to handle samples that don't meet the requirements above or show signs of damage, contamination, or inadequate preservation. Data will be appropriately qualified where samples are reported that do not meet sample acceptance requirements.

If any of the requirements for the sample acceptance policy are not met, the client is notified immediately by the Project Manager or Lab Supervisor, and the irregularity is documented:

- *If the client acknowledges the irregularity and instructs the laboratory to continue with analysis; the decision to proceed is documented either on the COC, LIMS or other lab receipt documents and samples accepted and if needed the data is qualified in the final report*
- *If the client does not acknowledge the irregularity the samples are rejected; also the client may agree that samples need to be rejected.*
- *If the irregularity is noted in samples submitted for bacteriological analysis for compliance purposes, the samples are rejected without exception.*

When a request for a new project is received involving multiple samples or tests that have a short holding time the Management is notified. The Management staff with the assistance of the appropriate technical personnel evaluates the project and calculates the resources needed to complete it within the turnaround time required and the holding times, taking into consideration the volume of work in house and/or expected.

If it is determined that the new project will not affect the proper completion of jobs already in house and that the laboratory has the resources (personnel, equipment and facilities) necessary to accommodate the new project, this is accepted.

If the Management or any of the technical staff involved thinks that the new job will create problems in terms of reduced quality of work, completion out of specified or required time, or any other detrimental situation, the new project is not accepted, and the client notified. If there are alternatives, such as postponement, modification of sampling schedules or partial subcontracting to another lab in order to accommodate the project, this is proposed to the client.

#### 26.1.2 Preservation Checks

The preservation verification is detailed in SOP MIS001; the following common preservation checks are performed and documented upon receipt:

#### 26.1.2.1 Thermal preservation:

- a) For temperature preservation, the temperature must be within  $\pm 2^{\circ}\text{C}$  of the required temperature unless otherwise stated. For samples that require preservation at  $4^{\circ}\text{C}$ , the acceptable range is from just above freezing to  $6^{\circ}\text{C}$ .
- b) Samples that are delivered to the lab the same day as they are collected are likely not to have reached a fully chilled temperature. This is acceptable if the samples were received on ice and the chilling process has begun.
- c) Record on the receipt form if ice is present and the temperature.

#### 26.1.2.2 Chlorine checks:

- d) Laboratories that receive samples from potable water supplies (including source water) that have a demonstrated history of acceptable preservation may check a sample from each client at a frequency of once per month if:
  - i) the laboratory can show that the received sample containers are from their laboratory.
  - ii) sufficient sodium thiosulfate was in each container before sample collection to neutralize at minimum 5 mg/l of chlorine for drinking water and 15 mg/l of chlorine for wastewater samples.
  - iii) one container from each batch of laboratory prepared containers or lot of purchased ready-to-use containers is checked to ensure efficacy of the sodium thiosulfate to 5 mg/l chlorine or 15 mg/l chlorine as appropriate and the check is documented.
  - iv) chlorine residual is checked in the field and actual concentration is documented with sample submission.

#### 26.1.2.3 pH checks:

- e) The pH of samples requiring acid/base preservation is checked upon sample receipt or upon initiation of analysis, except for volatile organic analysis.

### Sample Identification

Samples, including subsamples, extracts and digestates, are uniquely identified in a permanent chronological record in the LIMS database to prevent mix-up and to document receipt of all sample containers.

Samples are assigned sequential numbers that reference more detailed information kept in the LIMS. The sample identification number contains seven digits such as "YMDD# ##"

Where:

- Y correspond to the last digit of the current year
- M corresponds to the month using a letter, for example "A" being January, "B", February and so forth
- DD Corresponds to the two numerical digits for the month
- ### A three-digit subsequent number from 001 to 999 automatically assigned by the system

The detailed description of the sample identification is listed in SOP MIS001

The following information is included in the sample receipt screen of the LIMS:

- *Client or project name*
- *Date and time of receipt at lab*
- *Unique laboratory identification number*
- *Signature or initials of person making the entries*

In addition, the following information is maintained and linked to the log-in record:

- *Date and time of sampling linked to the date and time of laboratory receipt.*
- *Unique field identification number linked to the laboratory sample ID*
- *Analyses requested (including applicable approved method numbers) linked to the laboratory sample ID.*
- *Comments regarding rejection (if any).*

All documentation received regarding the sample, such as memos or chain of custody, are scanned and retained as electronic copies in the computer system.

## Sample Aliquots / Subsampling

In order for analysis results to be representative of the sample collected in the field, the laboratory has subsampling procedures. These procedures are described in SOP MIS026.

## Sample Storage

Storage conditions are monitored for any required criteria, verified, and the verification recorded in logbooks.

Samples that require thermal preservation are stored under refrigeration that is +/-2°C of the specified preservation temperature unless regulatory or method specific criteria require something different. For samples with a specified storage temperature of 4°C, storage at a temperature above the freezing point of water to 6°C is acceptable.

Samples are held secure, as required. Samples are accessible only to laboratory personnel.



Samples are stored apart from standards, reagents, food or potentially contaminating sources, and such that cross-contamination is minimized. All portions of samples, including extracts, digestates, leachates, or any product of the sample is maintained according to the required conditions.

Samples for volatile organic analyses are stored in segregated refrigerators kept in the volatile organics laboratory completely segregated from other samples.

Sample storage is described in Section 2.11 of SOP MIS001

## Sample Disposal

Samples are retained for a minimum of thirty days from report date unless otherwise instructed by the client or if the samples are part of litigation or have been received under legal/evidentiary requirements, in which case the disposal of the physical sample is accomplished with the concurrence of the affected legal authority.

After the retention period samples are either returned to the client or properly disposed of according to Federal, State and local regulations.

Procedures are described in SOP MIS051 for the disposal of samples, digestates, leachates, and extracts.

## Sample Transport

Samples that are transported under the responsibility of the laboratory, where necessary, are done so safely and according to storage conditions. This includes moving bottles within the laboratory. Specific safety operations are addressed outside of this document.

Sample shipping procedures are described in SOP MIS007.



## ***Quality Assurance Manual***

## *Section 26 – HANDLING SAMPLES*

## *AND TEST ITEMS*

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**Figure 26.1 Example Chain of Custody**

*Property of Weck Laboratories, Inc.*

## Figure 26-2 Sample Acceptance Policy

Samples are considered acceptable if all the conditions listed below are met.

- *Proper, full, and complete documentation, including the sample identification, the location, date and time of collection, collector's name, preservation type, sample type and any special remarks concerning the sample. This information must be fully documented in the chain of custody (COC) record.*
- *Unique identification of samples using durable labels completed in indelible ink on all sample containers.*
- *Use of appropriate sample containers and preservatives as per Attachment 2 in SOP MIS001.*
- *All samples have adequate holding time to be analyzed as per Attachment 2 in SOP MIS001.*
- *If no previous special arrangements were made, parameters that are "field" analysis (i.e., pH, residual chlorine, etc.) will be analyzed within 24 hours from arrival at the laboratory. Samples that arrive at the laboratory after 4 PM on Friday or on the weekend will be analyzed no later than the next business day after receipt (Monday unless a holiday).*
- *Adequate sample volume for all analysis requested.*
- *Special instructions and additional information requested to perform the analysis properly (i.e., time, flow rate, etc.).*
- *Samples must be received with no signs of damage or contamination.*
- *Samples received at the required temperature (usually ≤ 6 °C, but above freezing) or with evidence of chilling process started (received "on ice") if they were collected the same day as received at the lab.*

If any sample does not meet these conditions, all deviations are documented in the chain of custody, sample receipt checklist and in the LIMS. The sample should be put on hold. Sample receiving personnel shall immediately inform the project manager about the irregularity and have the project manager sign off on the COC. The project manager shall notify the client as soon as possible regarding the irregularity. If the test is requested to be performed in spite of the irregular sampling procedures, the irregularity is reported with the analytical results and the data appropriately qualified.

## Section 27

### QUALITY ASSURANCE FOR ENVIRONMENTAL TESTING

(TNI V1:M1, V1:M2 – Section 5.9 and Section 1.7 of Technical Modules TNI V1:M 3-7)

Weck Laboratories, Inc. has procedures for monitoring the validity of the testing it performs. The qualities of test results are recorded in a computerized database contained within the LIMS system and in such a way that trends are detectable, and where practicable, are statistically evaluated. To evaluate the quality of test results, the laboratory utilizes the following:

- a) *Use of certified reference materials or cultures and/or internal quality control using secondary reference materials*
- b) *Control charting*
- c) *Participation in proficiency testing programs, interlaboratory comparisons and round robin programs*
- d) *Replicate testing using same or different methods*
- e) *Retesting of retained samples*
- f) *Correlation of results for different characteristics of a sample (for example, total phosphate should be greater than or equal to orthophosphate).*
- g) *Confirmation analyses comparison to historical data*

In addition to procedures for calibration, the laboratory monitors quality control measurements such as blanks, laboratory control samples (LCS), matrix spikes (MS), duplicates, surrogates and internal standards to assess precision and accuracy. Proficiency Testing samples are also analyzed to assess laboratory performance.

Quality control samples are processed in the same manner as field samples. They are analyzed and reported with their associated field samples. Quality control data are analyzed and, when found to be outside pre-defined criteria, action is taken to correct the problem and to prevent incorrect results from being reported. Data associated with quality control data outside of criteria and still deemed reportable will be qualified so the end user of the data may make a determination of the usability of the data - see Section 28 – “Reporting of Results”.

For additional guidance on batch-specific QC samples, refer to the Quality Assurance Matrix contained in the Uniform Federal Policy for Quality Assurance Project Plans (UFP-QAPP).

#### Essential Quality Control Procedures

The quality control procedures specified in test methods are followed by laboratory personnel. The most stringent of control procedures is used in cases where multiple controls are offered. If it is not clear which is the most stringent, that mandated by test method or regulation is followed.

For test methods that do not provide acceptance criteria for an essential quality control element or where no regulatory criteria exist, acceptance criteria are developed following the criteria established for another similar method or similar technology. In some specialized projects, the client may set criteria, and this

should be stated. These limits can be found in the analytical methods SOPs and also in LIMS.

Written procedures to monitor routine quality controls including acceptance criteria are located in the test method SOPs and in LIMS, except where noted, and include such procedures as:

- *use of laboratory control samples and blanks to serve as positive and negative controls for chemistry methods;*
- *use of laboratory control samples to monitor test variability of laboratory results;*
- *use of calibrations, continuing calibrations, certified reference materials and/or PT samples to monitor accuracy of the test method;*
- *measures to monitor test method capability, such as limit of detection, limit of quantitation, and/or range of test applicability, such as linearity;*
- *use of regression analysis, internal/external standards, or statistical analysis to reduce raw data to final results;*
- *use of reagents and standards of appropriate quality and use of second source materials as appropriate;*
- *procedures to ensure the selectivity of the test method for its intended use;*
- *measures to assure constant and consistent test conditions, such as temperature, humidity, rotation speed, etc., when required by test method;*
- *use of sterility checks for equipment, media and dilution water for microbiology; and*
- *use of positive and negative culture controls for microbiology.*
- *For Radiochemistry: Measures to monitor test method capability, such as Minimum Detectable Activity.*

## Internal Quality Control Practices

Analytical data generated with QC samples that fall within all prescribed acceptance limits indicate the test method is deemed to be in control.

QC samples that fall outside QC limits indicate the test method are deemed to be out of control (nonconforming) and that corrective action is required and/or that the data are qualified (see Section 12 – “Control of Nonconforming Environmental Testing Work” and Section 14 - “Corrective Actions”).

Detailed QC procedures and QC limits are included in test method standard operating procedures (SOPs), or where unspecified in the SOPs, are detailed in LIMS.

All QC measures are assessed and evaluated on an on-going basis, so that trends are detected.

## 27.1.1 General Controls

The following general controls are used:

### 27.1.1.1 *Positive and Negative Controls such as:*

- a) *Blanks (negative)*
- b) *Laboratory control sample (positive)*
- c) *Sterility checks and control cultures (positive and negative).*

### 27.1.1.2 *Selectivity is assured through:*

- a) *absolute and relative retention times in chromatographic analyses;*
- b) *two-column confirmation when using non-specific detectors;*
- c) *use of acceptance criteria for mass-spectral tuning (found in test method SOPs);*
- d) *use of the correct method according to its scope assessed during method validation; and*
- e) *use of reference cultures (positive and negative) from a recognized manufacturer (where applicable).*

### 27.1.1.3 *Consistency, Variability, Repeatability, and Accuracy are assured through:*

- a) *proper installation and operation of instruments according to manufacturer's recommendations or according to the processes used during method validation;*
- b) *monitoring and controlling environmental conditions (temperature, access, proximity to potential contaminants);*
- c) *selection and use of reagents and standards of appropriate quality; and*
- d) *cleaning glassware appropriate to the level required by the analysis as demonstrated with method blanks (SOP MIS028).*
- e) *For microbiology, glassware care includes use of borosilicate glassware, use of detergents designed for laboratory use, testing each day for alkaline or acid residue with bromothymol blue, and conduct of the Inhibitory Residue test when the detergent is changed or annually, whichever is more frequent.*
- f) *following SOPs and documenting any deviation, assessing for impact, and treating data appropriately;*
- g) *testing to define the variability and/or repeatability of the laboratory results, such as replicates;*

- h) *use of measures to assure the accuracy of the test method, including calibration and/or continuing calibrations, use of certified reference materials, proficiency test samples, or other measures; and*
- i) *use of duplicate plate counts on positive samples (microbiology only).*

**27.1.1.4** *Test Method Capability (also see Section 22 – “Environmental Methods and Method Validation”) is assured through:*

- a) *establishment of the limit of detection “minimum detectable activity” for Radiochemistry work;*
- b) *establishment of the limit of quantitation or reporting level; and/or*
- c) *establishment of the range of applicability such as linearity.*

**27.1.1.5** *Data reduction is assured to be accurate by:*

- a) *selection of appropriate formulae to reduce raw data to final results such as regression;*
- b) *following specific procedures for data reduction such as manual integration procedures;*
- c) *periodic review of data reduction processes to assure applicability;*
- d) *microbiological calculations, data reduction, and statistical interpretations specified by each test method; and*
- e) *for Radiochemistry work, results reported with its measurement uncertainty. Reports indicate whether the uncertainty is combined standard or expanded uncertainty.*

**27.1.1.6** *Sample Specific controls are used to evaluate the effect of sample matrix on the performance of the selected analytical method (not a measure of laboratory performance):*

Examples:

- *Matrix Spike and Matrix Spike Duplicate (MS/MSD)*
- *Surrogate Spikes*
- *Sample Duplicates*

**27.1.1.7** *The following tables summarize the key elements of a quality control system for a laboratory performing chemistry and microbiology testing.*

**Table 27-1 Essential Quality Control Elements for Chemistry**

Item	Frequency	Acceptance Criteria	Corrective action
Negative Control (Method Blank)	1/batch	Method specific or reporting limit	Qualify data and take corrective action
Positive Control (Laboratory Control Sample)	1/batch	Method specific or determined by laboratory	Reprocess, reanalyze, or qualify data.
Matrix Spike ; Matrix Spike Duplicates  <i>Note : Samples are designed as data quality indicators for a specific sample using the designated method. These controls alone are not used to judge a laboratory's performance.</i>	Per method requirement	Method specific or determined by laboratory	Corrective action and qualify data.
Surrogate spikes  <i>See note above.</i>	Per method requirement	Method specific or determined by laboratory	Corrective action and qualify data
Matrix Duplicates  <i>See note above.</i>	Per method requirement	Method specific or determined by laboratory	Corrective action and qualify data
Continuing Calibration Verification	Per method requirement	Method specific or determined by the laboratory	Reanalyze standard immediately; Corrective action
Initial calibration Verification	Start of each analytical run	Method specific or determined by laboratory	Reanalyze standard immediately; Corrective action

**Table 27-2 Essential Quality Control Requirements for Microbiology – All Methods**

Item	Frequency	Acceptance Criteria	Corrective Action <sup>2</sup>
Sterility check	Each lot of media prior to first use	No growth	Investigate cause
Sterility check containers	One container (bottle) for each lot or batch sterilized (NSGM)	No growth	Investigate cause
Sterility check dilution water	One per batch of dilution water (NSGM)	No growth	Investigate cause

**Table 27-2 Essential Quality Control Requirements for Microbiology – All Methods**

Item	Frequency	Acceptance Criteria	Corrective Action <sup>2</sup>
Positive control <sup>1</sup>	pure culture of target organisms/ each lot or batch of medium (prior to first use of medium)	Positive reaction	Investigate cause If necessary reject the medium
Negative control <sup>1</sup>	Pure culture of non-target organisms/each lot or batch of medium (prior to first use of medium)	Negative reaction	Investigate cause If necessary reject the medium
Duplicate colony counts (For numeric results only)	Monthly on one positive sample for each month performed.	Same analyst <5% difference between counts Two analysts <10% difference between counts	Investigate cause Qualify data
1) Microorganisms may be single use preparations or cultures maintained by documented procedures that demonstrate the continued purity and viability of the organism. 2) Corrective Action may include the need to retrain. 3) NSGM: Non-selective growth media			

**Table 27-3 Essential Quality Control Requirements for Microbiology – Filtration Methods Only**

Item	Frequency	Acceptance Criteria	Corrective Action
Sterility check	Each lot of media prior to first use. Also done on containers, reagents and materials prior to first use. Use NSGM for containers, reagents and materials.	No growth	Investigate cause
Method blank	Beg/end of each run Select one: - 1 for every 10 samples Done as part of the test, use method media.	No growth	Investigate cause Qualify data
Sterility check filters	One filter for each new lot of membrane filters (NSGM)	No growth	Investigate cause
Target organism verification (D.3.4.b)	Method specific	Confirmation of reaction	Investigate cause

**Table 27-4 Essential Quality Control Requirements for Microbiology – Pour Plate Methods Only**

Item	Frequency	Acceptance Criteria	Corrective action

Method Blank	Minimum of one plate per batch Done as part of test, use method media	Less than 8 cfu/plate	Investigate cause, qualify/reject data
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**Table 27-5 Stock Cultures**

Item	Frequency	Handling
Reference cultures	Single use	Preserved and handled per mfg. specifications
Reference culture Reference stock	Culture stocks to make working stocks	Preserved and not refrozen Handling per mfg specs
Working stocks	Not transferred more than five times. Not sub-cultured to replace reference stocks	

**Table 27-6 Essential Quality Control Elements for Radiochemistry**

Item	Frequency	Acceptance Criteria	Corrective action
Negative Control (Method Blank)	1/batch	Method specific or reporting limit	Qualify data and take corrective action
Positive Control (Laboratory Control Sample)	1/batch	Method specific or determined by laboratory	Reprocess, reanalyze, or qualify data.
Matrix Duplicates  <i>Note : Samples are designed as data quality indicators for a specific sample using the designated method. These controls alone are not used to judge a laboratory's performance.</i>	Per method requirement	Method specific or determined by laboratory	Corrective action and qualify data

## 27.1.2 Specific Controls

### 27.1.2.1 Method Blanks

Method blanks are processed along with and under the same conditions as the associated samples to include all steps in the method. A method blank must be analyzed at a minimum of one per preparation batch. When no separate preparation method is used the batch is defined as the environmental samples that are analyzed with the same method and personnel, using the same lots of reagents, not to exceed the analysis of twenty environmental samples, not including method blanks, LCS, matrix spikes and matrix duplicates. The matrix of the method blank

must be similar to the associated samples and be free from any analytes of interest. Method blanks are not required for some analyses such as pH, conductivity, flash point and temperature.

The method blank is used to assess the preparation batch for possible contamination during the preparation and processing steps. The method blank is processed along with and under the same conditions as the associated samples to include all steps of the analytical procedure.

Contaminated blanks are identified according to the acceptance limits in the test method SOPs or laboratory documentation.

Blanks are prepared and analyzed in the following situations, or whenever there is a need to obtain further information:

- *A blank is extracted for every batch and type of matrix for analysis of semi-volatile organics by GC, GC/MS or HPLC.*
- *A blank is carried through all the digestion procedures for analysis of metals by AA, ICP or ICP-MS for every batch of samples and type of matrix for each instrument used.*
- *A blank is carried through the leaching procedures (TCLP, EP TOX, and WET) using the same extraction fluid, bottles and agitators as the samples.*
- *System/Reagent blanks are analyzed at the beginning of the day prior to calibration, after a high-level standard, after changing matrix and after samples that are known or suspected to be very concentrated.*
- *Reagent blanks are analyzed for all wet chemistry determinations involving titrations or spectrophotometry and their value are subtracted from the reading of the samples, if appropriate.*
- *Blanks for mobility procedures (TCLP, ZHE, EP TOX, and WET) are analyzed by the appropriate method.*
- *Additional field and trip blanks are prepared and analyzed where required or whenever requested by the client*

Sometimes the blanks may show detectable amounts of target analytes. In these cases, the source of the contamination must be investigated and measures taken to correct, minimize or eliminate the problem if:

- *The blank contamination is at or above the reporting limit and exceeds a concentration greater than 1/10 of the measured concentration of any sample in the associated sample batch or*
- *The blank contamination exceeds the concentration present in the samples and is greater than 1/10 of the specified regulatory limit.*
- *The blank contamination otherwise affects the sample results as per the test method requirements or the individual project data quality objectives.*
- *For DoD samples, in addition to the above, the method blank will be considered contaminated for a particular target analyte if its concentrations exceed ½ the reporting limit unless is a common*

laboratory contaminant such as acetone, methylene chloride, MTBE, zinc and aluminum, among others.

If the method blank is contaminated as described above, then the affected samples shall be reprocessed in a subsequent preparation batch, qualified or voided, except when sample results are unaffected by the blank contamination (non-detects or other analytes) in which case the results are reported unqualified. If insufficient sample volume remains for reprocessing, the results shall be reported with appropriate data qualifiers.

#### 27.1.2.2 *Laboratory Control Samples*

Laboratory Control Samples (LCS) are also known as LFBs or Blank Spikes, are prepared from analyte free water or other clean matrix and spiked with verified and known amounts of analytes for the purpose of establishing precision or bias measurements.

Laboratory control samples are analyzed at a frequency mandated by method, regulation, or client request, whichever is more stringent. The standard frequency of LCS preparation and analysis is one per analytical batch or as otherwise stated in a laboratory SOP. Exceptions would be for those analytes where no spiking solution is available, such as TSS, TDS, Total Volatile Solids, Total Solids, pH, color, odor, temperature, dissolved oxygen or turbidity. When no separate preparation method is used the batch is defined as the environmental samples that are analyzed with the same method and personnel, using the same lots of reagents, not to exceed the analysis of twenty environmental samples, not including method blanks, LCS, matrix spikes and matrix duplicates.

The LCS is a quality system matrix, known to be free of analytes of interest, spiked with known and verified concentrations of analytes. The matrix spike (Sect. 27.2.2.3) may be used in place of this control as long as the acceptance criteria are as stringent as for the LCS.

Alternatively, the LCS may consist of a media containing known and verified concentrations of analytes or as Certified Reference Material (CRM). All analyte concentrations shall be within the calibration range of the methods.

The analytes to be spiked in the LCS are specified in the test method SOP. In some cases, a client may specify a list of analytes for spiking and the request is handled using the laboratory's nonconformance procedures.

In the absence of specified spiking components, the laboratory shall spike per the following:

- *For those components that interfere with an accurate assessment such as spiking simultaneously with technical chlordane, toxaphene*

and PCBs, the spike should be chosen that represents the chemistries and elution patterns of the components to be reported.

- *For those test methods that have extremely long lists of analytes, a representative number may be chosen. The analytes selected should be representative of all analytes reported. The following criteria shall be used for determining the minimum number of analytes to be spiked. However, the laboratory shall insure that all targeted components are included in the spike mixture over a 2-year period:*
  - a) *For methods that include 1-10 targets, spike all components.*
  - b) *For methods that include 11-20 targets, spike at least 10 compounds or 80% of the total, whichever is greater.*
  - c) *For methods with more than 20 targets, spike at least 16 components.*

The results of laboratory control samples (LCS) are calculated in percent recovery or other appropriate statistical technique that allows comparison to established acceptance criteria. The calculation used is as follows:

$$\%R = \frac{AV}{TV} \times 100$$

Where  
AV = Analyzed Value  
TV = True Value

The individual LCS is compared to the acceptance criteria as published in the mandated test method, or where there are no established criteria, the laboratory establishes limits as described below. If found to be outside of these criteria, there is an indication that the analytical system is "out of control". Any affected samples associated with an out-of-control LCS shall be reprocessed for re-analysis or the results reported with appropriate data qualifying codes. Note: Samples that are not detected (ND) may be reported with an LCS that failed with high bias, but any qualifier may only be used for two consecutive batches before the problem must be corrected.

Where there are no established criteria, internal criteria are generated based on recoveries of past LCSs.

To determine these criteria, at least 30 data points generated under the same analytical process are used and the upper and lower acceptance limits are calculated as the "Mean + 3 SD" and "Mean - 3 SD" respectively, where SD is the standard deviation. These statistically derived limits must:

- *Meet the limits specified by the project or as stated in the method, if available;*
- *Should be updated on an annual basis, or as stated in the method, and re-established after major changes in the analytical process (e.g., new instrumentation);*
- *Should not exclude failed LCS recovery data and statistical outliers from the calculation unless there is a documented and scientifically valid reason.*

Control charts generated from the LIMS are used to detect trends and prevent out-of-control conditions. Control limits are continually monitored for shifts in mean recovery, changes in standard deviation, and development of trends.

If a large number of analytes are in the LCS, it becomes statistically likely that a few will be outside control limits. This may not indicate that the system is out of control, therefore corrective action may not be necessary. Upper and lower marginal exceedance (ME) limits can be established to determine when corrective action is necessary. A ME is defined as being beyond the LCS control limit (3 standard deviations), but within the ME limits. ME limit is 4 standard deviations around the mean. The number of allowable marginal exceedances is based on the number of analytes in the LCS. If more analytes exceed the LCS control limits than is allowed, or if any one analyte exceeds the ME limits, the LCS fails and corrective action is necessary. This marginal exceedance approach is relevant for methods with long lists of analytes. It will not apply to target analyte lists with fewer than 11 analytes. Certain projects, such as DoD work do not allow any target analyte to exceed its LCS control limits, even marginally and if this happens the batch is considered not acceptable .

The number of allowable marginal exceedances is as follows:

- 1) *>90 analytes in LCS, 5 analytes allowed in ME of the LCS control limit;*
- 2) *71-90 analytes in LCS, 4 analytes allowed in ME of the LCS control limit;*
- 3) *51-70 analytes in LCS, 3 analytes allowed in ME of the LCS control limit;*
- 4) *31-50 analytes in LCS, 2 analytes allowed in ME of the LCS control limit;*
- 5) *11-30 analytes in LCS, 1 analytes allowed in ME of the LCS control limit;*
- 6) *<11 analytes in LCS, no analytes allowed in ME of the LCS control limit;*

Marginal exceedances must be random. If the same analyte exceeds the LCS control limit repeatedly (i.e. 2 out of 3 consecutive LCS), it is an indication of a systemic problem. The source of the error must be located and corrective action taken.

The procedure to monitor the application of marginal exceedance allowance to the LCS to ensure random behavior consist of establishing a data base with all exceedances and compare the analytes affected on quarterly basis to verify is not the same analyte having the problem.

#### 27.1.2.3 *Matrix Spikes and Matrix Spike Duplicates*

Matrix Spikes and Matrix Spike Duplicates (MS/MSD or LFSM/LFSMD) are environmental samples fortified with a known amount of analyte to help assess the effect of the matrix on method performance. These controls alone are not used to judge laboratory performance. The information from these controls is sample/matrix specific and would not normally be used to determine the validity of the entire batch

The frequency of the analysis of matrix specific samples is determined as part of a systematic planning process (e.g., Data Quality Objectives) or as specified by the required mandated test method or SOP and it is at a minimum, one per batch of 20 samples or less, per matrix type.

The components to be spiked are the ones specified by the mandated test method or laboratory SOP. Any permit specified analytes, as specified by regulation or client requested analytes shall also be included. Matrix spikes are not performed for analytes for which spiking solutions are not available such as, solids determinations (total suspended, total dissolved, total volatile), pH, color, odor, temperature, dissolved oxygen, BOD, COD or turbidity. If there are no specified components, the following guideline is used:

- *For those components that interfere with an accurate assessment such as spiking simultaneously with technical chlordane, toxaphene and PCBs, the spike should be chosen that represents the chemistries and elution patterns of the components to be reported.*
- *For those test methods that have extremely long lists of analytes, a representative number may be chosen using the following criteria for choosing the number of analytes to be spiked, but alternating them in order to ensure that all targeted components are included in the spike mixture over a 2 year period.*
  - i. *For methods that include 1-10 targets, spike all components;*
  - ii. *For methods that include 11-20 targets, spike at least 10 components or 80% of the total, whichever is greater;*
  - iii. *For methods with more than 20 targets, spike at least 16 components.*

Some project may require MS/MSD to be performed on their samples (i.e. DoD) in which case these are used for the entire batch if it also contains samples from other clients.

The requirements for MS/MSD are not applicable to all methods (e.g., asbestos, certain air-testing samples, classic chemistry, and industrial

hygiene samples). Additional MS/MSDs may be required on a project-specific basis.

The calculations of percent recoveries and relative percent difference (RPD) are performed by the following procedures:

$$\%R = \frac{AV}{TV} \times 100$$

Where

AV = Spike Result – Sample Result

TV = True Value

$$RPD = \frac{|S - D|}{\frac{(S + D)}{2}} \times 100$$

Where:

S=Sample Concentration

D=Duplicate Concentration

Where there are no established criteria, the laboratory uses the mean plus or minus three standard deviations as the control limits for MS/MSD as described in section 27.2.2.2. Some projects may have specific criteria such as DoD work that require that the results of all MS/MSDs must be evaluated using the same acceptance criteria used for the LCS.

For MS/MSD results outside established criteria corrective action is documented or the data are reported with appropriate data qualifying codes. Only the data from the spiked sample is qualified. Poor performance in a matrix spike generally indicates a problem with the sample composition, and not the laboratory analysis and is reported to the client whose sample was used for the spike with the appropriate data qualifiers or in the case narrative to assist in data assessment.

The corrective action for organics may be to evaluate the LCS for comparison and note in the narrative that there may be a matrix interference present. The data to be qualified is only that of the parent sample.

#### 27.1.2.4

##### *Surrogate Spikes*

Surrogate spikes (SUR or SS) are substances with chemical properties and behaviors similar to the analytes of interest used to assess method performance in individual samples. Surrogates are added to all samples (in test methods where surrogate use is appropriate) prior to sample preparation or extraction.

Surrogate recovery results are compared to the acceptance criteria as published in the mandated test method or laboratory SOP, specified in the project by the client or lab generated if there are no established criteria. Acceptance limits generated at the laboratory are established based on a minimum of 30 valid data points by calculating the mean and standard deviation, the upper limit is set at "mean + 3SD" and the lower limit at "Mean - 3SD".

Surrogate results outside the acceptance criteria are evaluated for the effect indicated for the individual sample results. A corrective action is initiated which is guided by the data quality objectives or other site specific requirements. Results reported from analyses with surrogate recoveries outside the acceptance criteria include appropriate data qualifiers

The recovery for a surrogate is calculated using the following equation:

$$\% \text{ Recovery} = \frac{\text{Concentration Found}}{\text{Concentration Added}} \times 100\%$$

Where:

Concentration found = Result obtained after analysis

Concentration added = Amount of surrogate spiked

## 27.2 Proficiency Test Samples or Interlaboratory Comparisons

### 27.2.1 Compliance to Accreditation Requirements

The laboratory analyzes at least two TNI-compliant PT samples per calendar year for each accreditation Fields of Accreditation (FOA) for which the laboratory is accredited. An exception is made for analytes where there is no PT available from any PTPA approved PT provider at least twice per year. In these cases the lab will run the PTs in the minimum time frame the PTs are available and not at all if they are not available.

For DoD related work, PT samples are obtained from a Proficiency Testing Oversight Body (PTOB)/Proficiency Testing Provider Accreditor (PTPA)-approved PT Provider.

Additional analytes or experimental analytes are analyzed based on specific regulatory program requirements and special client requests at the stipulated frequency such as perchlorate and hexavalent chromium for California ELAP certification and NDMA for certain client requests performed once a year.

The successive PTs are analyzed at least five months apart and no more than 7 months apart unless the PT is being used for corrective action to maintain or reinstate accreditation, in which case the dates of successive PT samples for the same accreditation FOA is at least fifteen days apart.

The goal for PT results is obtaining 100% of all analytes within acceptable limits. When there are results out of the acceptance range, corrective action is initiated to prevent the error from reoccurring. A report with the documentation of the corrective action is also filed.

The following are the proficiency testing programs in which the laboratory currently participates on regular basis:

- *Drinking water analysis: WS Studies*
- *Wastewater analysis: WP studies*
- *Hazardous waste and soil*
- *Bacteriological Performance Evaluation Study.*
- *Radiochemistry.*
- *Custom PT samples.*

#### **27.2.2 PT Sample Handling, Analysis and Reporting**

The laboratory does not share PT samples with other laboratories, does not communicate with other laboratories regarding current PT sample results, and does not attempt to obtain the assigned value of any PT sample from the PT provider.

Proficiency Testing (PT) samples are treated as typical samples in the normal production process where possible, including the same analysts, preparation, calibration, quality control and acceptance criteria, sequence of analytical steps, number of replicates, and sample log-in. PT samples are not analyzed multiple times unless routine environmental samples are analyzed multiple times. Where PT samples present special problems in the analysis process, they will be treated as laboratory samples where clients have special requests.

The type, composition, concentration, and frequency of quality control samples analyzed with the PT samples are the same as with typical samples.

Prior to the closing date of a study, laboratory personnel do not:

- *Subcontract analysis of a PT sample to another laboratory being run for accreditation purposes.*
- *Knowingly receive and analyze a PT for another laboratory being run for accreditation purposes.*
- *Communicate with an individual from another laboratory concerning the analysis of the PT sample.*
- *Attempt to find out the assigned value of a PT from the PT Provider.*

The laboratory's procedure for handling low level PT samples is explained in SOP MIS015.

The laboratory institutes corrective action procedures for failed PT samples following the guidelines in Section 14 – “Corrective Action” and SOP MIS015.

Retention of PT records is similar to that maintained for regular environmental samples. In addition, the lab maintains a copy of the online data entry summary when the PT results are submitted online.

### **27.3 Data Review**

The laboratory reviews all data generated in the laboratory for compliance with method, laboratory and, where appropriate, client requirements.

Initially, the analyst reviews data for acceptability of quality control measures and accuracy of the final result(s).

After the initial review, a second reviewer, a technically qualified person, such as a supervisor or another chemist, experienced in that particular method or procedure considers all manual transfers and calculations of data in detail and spot checks all electronic transfers of data.

Final reports are compared to raw data either directly or through several reviewed steps.

Internal data review consists of a tiered or sequential system of verification, consisting of at least three tiers, with each check performed by a different person. The three tiers include a 100% review of the entire data package and completion of corresponding Data Review Checklist by the analyst, then a verification review by a technically qualified person, such as a supervisor or another chemist, experienced in that particular method or procedure, who checks for proper integration of peaks, identification of compounds, QC, data qualifiers, electronic transfer of data (if not performed automatically), etc. The third review is mainly an administrative one, to check for accuracy and completeness, typically performed by the Project Manager in charge of that project. The procedures used for performing the data review are detailed in the SOP MIS018.

If a discrepancy is noted in any stage of the reviewing process, the package is returned to the primary analyst for corrective action. For analyses that do not have automatic data reduction, the analyst performs the necessary calculations to obtain the final result, and then the results are reviewed as indicated above.

All information used in the calculations (e.g., raw data, calibration files, tuning records, results of standard additions, interference check results, sample response, and blank or background correction protocols) as well as sample preparation information (e.g., weight or volume of sample used, percent dry weight for solids, extract volume, dilution factor used) are recorded in order to enable reconstruction of the final result.

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## Section 28 REPORTING THE RESULTS

(TNI V1:M2 – Section 5.10)

The result of each test performed is reported accurately, clearly, unambiguously, and objectively and complies with all specific instructions contained in the test method.

Laboratory results are reported in a test report or “Certificate of Analysis” that includes all the information requested by the client and necessary for the interpretation of the test results and all information required by the method used and TNI and DoD standards. This report could be either as a hard copy or an electronic data transfer or other electronic format.

Data are reported without qualification if they are greater than the lowest calibration standard, lower than the highest calibration standard, and without compromised sample or method integrity.

### Test Reports

The report format has been designed to accommodate each type of test performed and to minimize the potential for misunderstanding or misuse.

The laboratory does not issue multiple reports for the same samples where there is different information on each report unless required to meet regulatory needs and approved by the Quality Manager.

Each test report generated contains the following information:

- a) *a title, such as “Certificate of Analysis”;*
- b) *the name, address and phone number of the laboratory and name of the contact person (project Manager);*
- c) *unique identification of the test report, such as a serial number, on each page and a pagination system that ensures that each page is recognized as part of the test report and a clear identification of the end of the report, such as 10 of 10;*
- d) *the name and address of the client;*
- e) *the identification of the method used;*
- f) *a description of, the condition of, and unambiguous identification of the sample(s) tested, including the client identification code and client project name and number if available;*

- g) *the date of sample receipt when it is critical to the validity and application of the results, date and time of sample collection, dates the tests were performed, the time of sample preparation and analysis if the required holding time for either activity is less than or equal to 72 hours;*
- h) *reference to the sampling plan and procedures used by the laboratory where these are relevant to the validity or application of the results;*
- i) *the test results, units of measurement, an indication of when results are reported on any basis other than as received (e.g. dry weight), failures identified (Data Qualifiers list - Appendix G);*
- j) *the name, function, and signature or an equivalent electronic identification of the person authorizing the test report, and the date of issue;*
- k) *where relevant, a statement to the effect that the results relate only to the samples;*
- l) *Any non-accredited tests or parameters shall be clearly identified as such to the client when claims of accreditation to this Standard are made in the analytical report or in the supporting electronic or hardcopy deliverables; and*
- m) *A statement that the report shall not be reproduced except in full without written approval of the laboratory.*

Exceptions to this standard approach for reporting are allowed with the approval of the QA Director and should be documented; for DoD related work, both date and time of preparation and analysis are considered essential information, regardless of the length of the holding time, and shall be included as part of the laboratory report. If the time of the sample collection is not provided, the laboratory must assume the most conservative time of day (i.e., earliest).

## Supplemental Test Report Information

When necessary for interpretation of the results or when requested by the client, test reports include the following additional information:

- a) *deviations from, additions to, or exclusions from the test method, information on specific test conditions, such as environmental conditions, and any non-standard conditions that may have affected the quality of the results, and any information on the use and definitions of data qualifiers;*
- b) *a statement of compliance/non-compliance when requirements of the management system are not met, including identification of test results that did not meet the laboratory and regulatory sample acceptance requirements, such as holding time, preservation, etc.;*
- c) *where applicable and when requested by the client, a statement on the estimated uncertainty of the measurement;*

- d) where appropriate and needed, opinions and interpretations. When opinions and interpretations are included, the basis upon which the opinions and interpretations are documented. Opinions and interpretations are clearly marked as such in the test report.
- e) additional information which may be required by specific methods or client;
- f) qualification of results with values outside the calibration range as appropriate.

In addition to the items above, for test reports that contain the results of sampling, the following is provided when necessary for the interpretation of the results and if the information is available:

- a) the date and time of sampling;
- b) unambiguous identification of the material sampled;
- c) the locations of the sampling;
- d) a reference to the sampling plan and procedures used;
- e) details of any environmental conditions during sampling that may affect the interpretations of the test results;
- f) any standard or other specification for the sampling method or procedure, and deviations, additions to or exclusions from the specification concerned.

## **Environmental Testing Obtained from Subcontractors**

Test results obtained from tests performed by subcontractors are clearly identified on the test report by subcontractor name.

The subcontractors report their results in writing or electronically.

## **Electronic Transmission of Results**

All test results transmitted by telephone, fax, telex, e-mail, or other electronic means comply with the requirements of the TNI Standard and associated procedures to protect the confidentiality and proprietary rights of the client (see Section 22- "Environmental Methods and Method Validation").

### **28.1.1 Electronic Data Deliverables**

The IT Manager and Project Manager coordinate report generation using Promium Element DataSystem LIMS with assistance from the Office Assistant. The reporting requirements and the process to generate reports are described in Standard Operating Procedure MIS053. However, since each client may require their own format, SOP MIS053 generally addresses how to verify the EDD to ensure its accuracy and agreement with the final report. Weck Laboratories, Inc. makes a concerted effort, whenever possible, to reduce the amount of hand entering of data to avoid transcription errors. Results from the instruments are electronically

processed into the LIMS using Promium's Data Tool or various other electronic means (typically Microsoft Excel).

## **Amendments to Test Reports**

Material amendments to a test report after it has been issued are made only in the form of another document or data transfer. All supplemental reports meet all the requirements for the initial report and the requirements of this *Quality Manual*.

Amended test reports include the statement, "Supplement to Certificate of Analysis, identification number" or an equivalent form of wording to assure they can be differentiated from other test reports.

When it is necessary to issue a complete new report, the new report is uniquely identified and contains a reference to the original that it replaces.



## Appendix A

### Ethics and Data Integrity Policy

Weck Laboratories, Inc. has developed a proactive program for prevention and detection of improper, unethical or illegal actions. A main component of this program is the periodic training and communications that the employees receive from management about the ethics policy and the utmost importance of an honest, impartial and ethical behavior in all activities performed at the laboratory.

Proper ethical conduct in the laboratory is strictly enforced. The Company's Code of Ethics is presented to current and prospective employees in both the QA manual and the Employee Handbook.

The Data Integrity Plan, which includes the description of the data integrity procedures, serves to combine the elements currently in place and document further procedures to ensure our compliance with requirements in the TNI standard and from other regulatory agencies.

These procedures include the following elements:

- *data Integrity training*
- *signed data integrity documentation for all laboratory employees*
- *in-depth, periodic monitoring of data integrity*
- *data integrity procedure documentation.*

The data integrity procedures are signed and dated by senior management. These procedures and the associated implementation records are properly maintained and made available for assessor review. The data integrity procedures are annually reviewed and updated if necessary, by management.

The Data Integrity Plan also provides a mechanism for confidential reporting of data integrity issues in the laboratory. A primary element of the mechanism is to assure confidentiality and a receptive environment in which all employees may privately discuss ethical issues or report items of ethical concern. In instances of ethical concern, the mechanism also includes a process whereby laboratory management is to be informed of the need for any further detailed investigation.

Each employee is required to understand and sign a Data Integrity Agreement, contained in the Data Integrity Plan document. The Laboratory Ethics seminar that is presented as a refresher to current employees on an annual basis and as part of the hiring process for new employees include elements describing examples of improper and illegal actions, how to identify appropriate and inappropriate laboratory and instrument manipulation practices, guidance for manual integration practices and consequences of unethical or improper behavior.

Punishment for improper, illegal or unethical activities range from suspension to termination, depending on the degree and nature of the unethical activity.



Employees are required and encouraged to bring up to management any improper activities they detect or are suspicious of. Any incident reported is immediately investigated by the management and the person or persons involved are subject to disciplinary actions. The Management shall also monitor the program for detecting improper, unethical or illegal action by performing internal proficiency testing (single or double blind), reviewing of analytical data post-analysis, performing electronic data audits using special software if available and providing an open door policy for employees to report any suspicious activity without fears.

In order to assist the laboratory technical personnel in performing their duties without detrimental influences, it is the policy of the Company that the laboratory be impartial and that it and its personnel are free from any undue commercial, financial and other pressures which might influence or adversely affect their normal performance having an impact on the quality of the work they produce or their technical judgment. By this policy all laboratory personnel dedicated to technical activities should not be influenced by or involved in any financial or commercial matter while performing laboratory work. If any employee feels that he or she might be under any kind of pressure as described above, the Laboratory Director must be notified immediately. Additionally, the Laboratory will not engage in any activities that may endanger the trust in its independence of judgment and integrity in relation to its environmental testing.



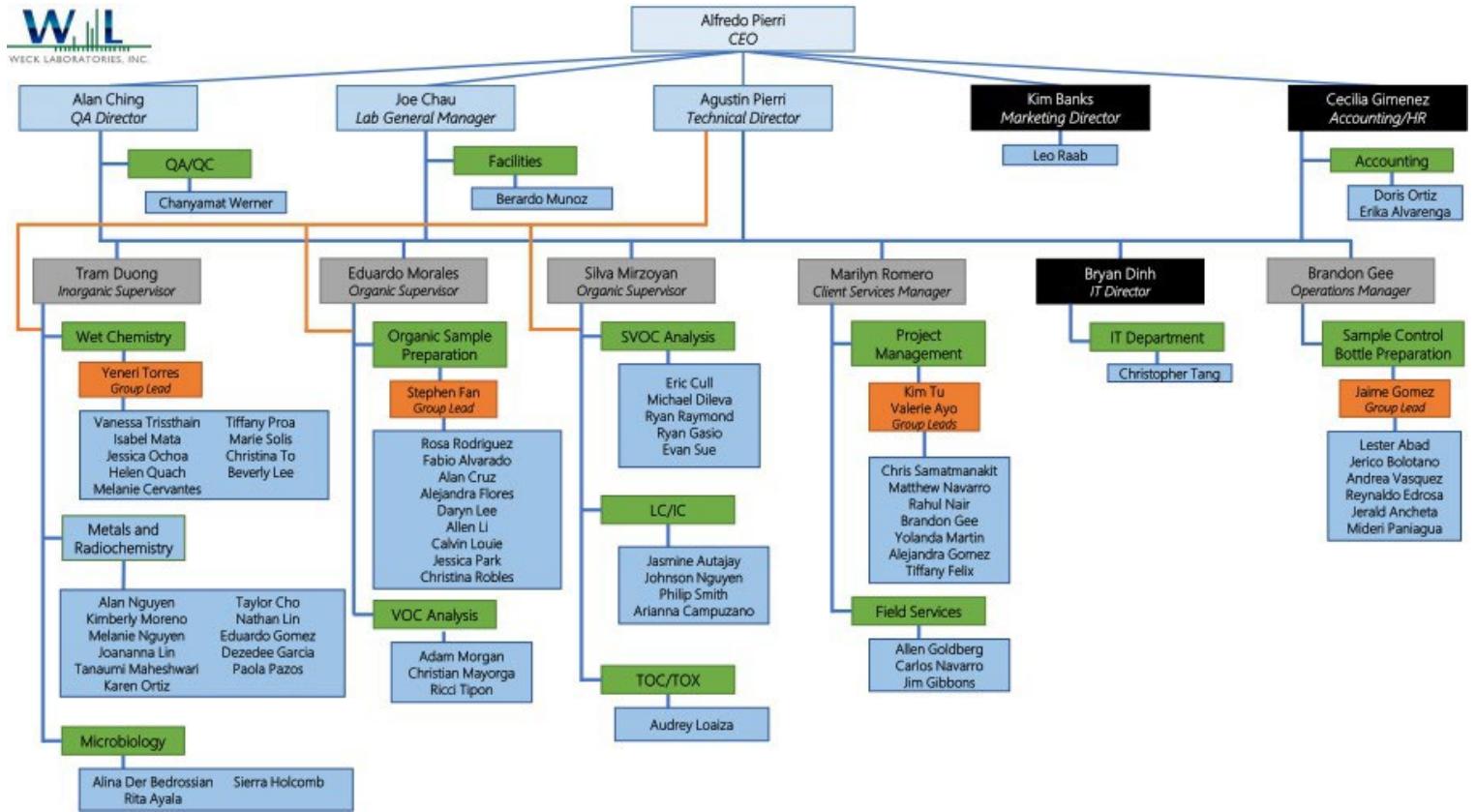
# CODE OF ETHICS

Weck Laboratories, Inc. is committed to ensuring the integrity of our data and meeting the quality needs of our clients. We pledge to manage our business according to the following principals:

- *To produce results that are technically sound and legally defensible;*
- *To assert competency only for work for which adequate equipment and personnel are available;*
- *To present services in a confidential, honest, impartially and forthright manner;*
- *To have a clear understanding with the client as to the extent and kind of services to be rendered;*
- *To provide employees with guidelines and an understanding of the ethical and quality standards required in this industry;*
- *To operate facilities in a manner that protects the environment and the health and safety of employees and the public;*
- *To obey all pertinent federal, state, and local laws and regulations;*
- *To continually improve product and service quality;*
- *To treat employees equitably, acknowledge their scientific contributions, and provide them with opportunities for professional growth and development;*
- *To recognize and respond to community concerns; and*
- *To deal openly, honestly, impartially and fairly in all business and financial matters with employees, clients and the public.*

## Appendix B

### Laboratory Organization Chart and Resumes of Key Personnel





## **RESUMES OF KEY PERSONNEL**

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**Name Position .**

Alfredo Pierri	President – CEO
Alan Ching	Director of QA - QA Director
Joe Chau	Laboratory General Manager and Safety Officer
Agustin Pierri	Laboratory Technical Director
Marilyn Romero	Customer Service Manager
Tram Duong	Inorganic Section Supervisor
Eduardo Morales	Organic Section Supervisor
Silva Mirzoyan	Organic Section Supervisor
Brandon Gee	Laboratory Operations Manager

**ALFREDO E. PIERRI****Title**

President, CEO

**Education**

- M.S. (equiv.) - University of Buenos Aires, Argentina, 1978. Organic Chemistry  
- University of California, Los Angeles  
Certificate in Hazardous Materials Control and Management,  
1991 - 1993

**Affiliations**

- American Chemical Society, member  
American Council of Independent Laboratories (ACIL), member  
The NELAC Institute, member  
AOAC, member

**Professional Experience**

Jan/1987 to Present                    Weck Laboratories, Inc., City of Industry, CA  
Full Service Environmental Testing laboratory

Sep/1984 to Dec/1986 SCS Engineers, Long Beach, CA  
Environmental Testing laboratory

Jul/1979 to Aug/1984                    Argentina Atomic Energy Commission, Buenos Aires  
Government Agency – Research and Development

Mr. Pierri has extensive experience in analytical chemistry. Most of his work in this field has been in the application and development of instrumental methods of analysis for organic analytes using GC, GC/MS, HPLC, IR and UV-Visible spectrometry. He has also worked in Spectrometric techniques for metals analysis such as Atomic Absorption with flame and graphite furnace and Inductively Coupled Plasma with Optical Emission and Mass Spectrometry.

Since 1984 he has been working exclusively in the environmental field obtaining in 1993 the certification as Registered Environmental Assessor (REA-04975) from the California Environmental Protection Agency.

As Laboratory Director, Mr. Pierri is responsible for all laboratory operations including the supervision of the overall performance of the laboratory, revision of analytical reports and Quality Assurance Program, provision of technical assistance and direction to laboratory personnel and consulting with clients about technical and regulatory issues.

Mr. Pierri is well acquainted in all aspects of environmental regulations at Federal and State level, providing consulting services and guidance to clients in regulatory compliance and chemical treatment issues as well as understanding and interpreting analytical data.

Other relevant experience and projects in which Mr. Pierri has participated are as follows:

- *For over 22 years provided Project Management for large environmental monitoring projects for wastewater treatment plants, desalination plants, groundwater studies, potable water compliance monitoring and unregulated contaminants studies managed by the EPA such as ICR, UCMR 1 and UCMR 2. These projects required dealing with significant technical issues, regulatory compliance*



and innovative analytical methods.

- *Characterization of wastes to be classified as hazardous as per State of California and Federal Regulations.*
- *Developing of analytical methods for emerging contaminants in water using GC/MS, LC/MS and other analytical techniques and writing the operating procedures.*
- *Identification and selection of new laboratory equipment for the laboratory*
- *Determination of contamination in soil and groundwater due to leaking underground storage tanks.*
- *Design and implementation of a Quality Assurance Program based on TNI requirements for the laboratory, writing of the QA manual and training of laboratory personnel.*
- *Developing and implementation of an Ethics Training Program for the Laboratory, writing the documentation and training course for laboratory employees.*
- *Interpretation of analytical data and compliance with regulations for drinking water for different potable water purveyors in Southern California.*
- *Compliance for wastewater discharges with local regulatory agencies and NPDES permits.*
- *Consulting services to industrial clients on pre-treatment of effluents in order to minimize organic matter and solids and reduce costs in taxes imposed by POTWs.*
- *Identification of unknown materials by chemical and physical methods.*
- *Implementation of a LIMS and use of personal computers for data acquisition, handling, and reporting.*
- *Teaching of Analytical Organic Chemistry at University Level for MS program.*

#### **Participation in Seminars and Conferences**

Over the years, Mr. Pierri has participated in innumerable conferences and technical meeting involving environmental testing, environmental policy and remediation.

He has been speaker in several conferences and technical meetings related to environmental monitoring in general and emergent contaminants in particular.



ALAN CHING

## Title

## Director of Quality Assurance

## Education

- B.S. - Chu Hai College, Hong Kong, 1985  
Chemistry  
Shanghai University of Technology, China  
Analytical Chemistry Courses 1978 - 1981

M.S. - California Polytechnic University, Pomona  
Analytical Chemistry, 1997

## **Professional Experience**

- |                      |  |
|----------------------|--|
| Oct/1990 to Present  | Weck Laboratories, Inc., City of Industry, CA<br>Full Service Environmental Testing laboratory |
| Jan/1985 to Jun/1989 | Dinippon Ink and Chemical, Sheng Zheng, China<br>Chemical Manufacturing Company                |

Mr. Ching' primary experience is in the organic analysis field although he has performed as bench chemist inorganic and metal analyses as well. At Weck Labs, he has hands on experience in GC, GC/MS, HPLC and organic extractions.

Mr. Ching has developed many analytical procedures for volatile organic compounds, pesticides, herbicide and semivolatile organic analysis.

As lab supervisor, Mr. Ching has provided training and technical advice to bench chemists in the organic section.

Mr. Ching has also served in the past as QA Manager being instrumental in developing the QA/QC program, obtaining accreditation under TNI for the laboratory, writing the QA Manual and monitoring its implementation.

Mr. Ching also provides technical support to clients in the areas of Quality Assurance, analytical chemistry and regulatory compliance.

Other relevant experience and projects in which Mr. Ching has participated are as follows:

- *Project Management for ICR, UCMR 1 and UCMR 2 analysis, including method development, interaction with Utilities and reporting to the EPA.*
  - *Analysis of environmental samples for metals, and other elements by atomic absorption and ICP spectrometry using flame, hydride generation, cold vapor and graphite furnace.*
  - *Hazardous waste characterization by different analytical techniques.*
  - *Maintenance and troubleshooting of GC, GC/MS and HPLC instrumentation.*
  - *Separation and detection of four different arsenic compounds using ion exchange chromatography and UV detection. (Master's degree project).*



- *Development of new methods for UCMR testing and other emergent contaminants*
- *Developing a comprehensive QA/QC program for the Laboratory in compliance with TNI and ISO 17025.*

**Participation in Seminars and Conferences**

Mr. Ching regularly attends many technical meeting regarding technical and regulatory issues. He has participated in TNI conferences and other meeting related to Quality Assurance and regulatory compliance issues.

**JOE CHAU****Title**

*General Manager*

**Education**

B.S. - California Polytechnic University, Pomona, CA, 1988  
Electrical Engineering

B.S. - California Polytechnic University, Pomona, CA, 1988  
Chemistry, Industrial Option

- University of California, Irvine  
Certificate in Hazardous Materials Control and Management, 1991

**Professional Experience**

Sep/1989 to Present                    Weck Laboratories, Inc., City of Industry, CA  
    Full Service Environmental Testing laboratory

Sep/1988 to Sep/1989   Lights of America, Walnut, CA  
    Electrical Engineering

Mr. Chau has extensive experience in environmental analysis, especially for inorganic and physical parameters.

He has been working as analytical chemist for inorganic and wet chemistry determinations, metal analyses by Flame and Graphite furnace AA, ICP, ICP-MS and Cold vapor AA and AF.

Mr. Chau has been instrumental in developing analytical methods for trace metal analyses in a variety of matrices, including brines and sea water. He has also developed for the laboratory especially methods for physical parameters, metal speciation and non-routine determinations.

As lab supervisor, Mr. Chau has provided guidance, technical advice and training to bench chemists and other lab personnel and has managed lab operations to improve logistics such as sample receiving and project management

Mr. Chau is an expert in spectroscopic analysis and provides advice to clients about technical and QA/QC issues.

Other relevant experience and projects in which Mr. Chau has participated are as follows:

- *Coordination of monitoring projects that requires large number of analysis on short turnaround time for metals.*
- *Supervision of lab personnel for the Inorganic Section*
- *Development of analytical procedures for the determination of environmental samples by ICP-MS in particularly difficult matrices*
  
- *Develop of methods by atomic fluorescence and amalgamation for ultra trace level analysis of mercury.*



- *Design of a clean room and develop protocols for its operation for analysis of trace metals in ambient waters and ultra trace levels of mercury*
- *Maintenance and troubleshooting of spectroscopy instrumentation.*
- *Design and improvement of sample digestion procedures for metal analysis to reduce contamination and improve recoveries.*
- *Development of analytical methods for speciation analysis of metals, including the use of hyphenated analytical techniques.*

#### **Participation in Seminars and Conferences**

During his time at Weck Laboratories, Mr. Chau has participated in many technical and user meetings provided by spectroscopy equipment manufacturers, such as Perkin Elmer, Thermo and Agilent. He routinely participates in technical conferences about environmental analysis, where technical issues, new techniques and regulatory subjects are discussed; they include NEMC, TNI and Pittcon, among others.



AGUSTIN PIERRI, PhD.

## Title

### *Laboratory Technical Director*

## Education

B.S. - University of Southern California, 2007  
Chemistry

Ph.D. - University of California, Santa Barbara, 2014  
Chemistry

## **Professional Experience**

May/2007 to Present

Weck Laboratories, Inc., City of Industry, CA  
Full Service Environmental Testing laboratory

Dr. Pierri has extensive experience in the environmental laboratory. He has been a bench chemist running ICP-MS, HPLC, IC, LCMS, GC, GC/MS instrumentation, as well as performing bacteriological tests. This has given him a thorough view of the operation of the environmental laboratory in all its aspects. In addition to serving as a bench chemist, he has also been responsible for method development activities in all departments, with particular emphasis on organic environmental analysis, LC-MS.

all departments, with a particular emphasis on emerging contaminants by LC-MS. As Technical Director, he oversees the technological aspects of the laboratory, ensuring that all scientific activities are performed according to the SOPs and ensuring that all data generated is legally defensible.

Other relevant experience and projects in which Dr. Pierri has participated are as follows:

- *Developing methods for the analysis of emerging contaminants such as Pharmaceuticals and Personal Care Products*
  - *Per- and Poly-fluorinated compounds*
  - *Low-level multi-residue pesticide screens*
  - *Assisting the Director of QA in certain project-specific QA/QC operations.*
  - *Writing and updating of SOPs.*
  - *Troubleshooting and diagnosing analytical challenges in the laboratory.*

#### **Participation in Seminars and Conferences**

Dr. Pierri regularly attends and presents in local, regional, and national technical seminars and meetings regarding analytical chemistry, including the ACS national meetings, AOAC annual meetings, NEMC, and NACRW.



**MARILYN ROMERO**

**Title**

Customer Service Manager - Project Coordinator

**Education**

Mt. San Antonio College, Walnut, CA. AA, Liberal Arts, 1991

**Certification**

Grade II Water Treatment Operator CA DHS

**Professional Experience**

Mar/1985 to Present	Weck Laboratories, Inc., City of Industry, CA Full Service Environmental Testing laboratory
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Ms. Romero has extensive experience in customer service providing assistance to large and medium size environmental testing projects with logistic support and report preparation. She has also successfully provided Project Management to a large number of potable water and wastewater testing projects. Ms. Romero is also very knowledgeable about environmental regulations, especially in the field of potable water testing.

Other relevant experience and projects in which Ms. Romero has participated are as follows:

- *Sample log-in including verification of proper containers, storage conditions, holding times and documentation. Sample custodian*
- *Preparation of analytical reports using LIMS and other computer programs.*
- *Customer support for environmental analysis.*
- *Archival and retrieval of analytical results and related documentation.*
- *Project Management*



TRAM DUONG

**Title**

## Inorganic Section Supervisor

## Education

B.S. - University of Southern California, 1998  
Nursing Minor Biology

## Professional Experience

Jul/2000 to Present

Weck Laboratories, Inc., City of Industry, CA  
Full Service Environmental Testing laboratory

Ms. Duong is responsible for the supervision of the section performing metal analyses (ICP, ICP-MS, and CVAA) and wet chemistry determinations. She performs training of personnel, troubleshooting and maintenance of equipment and data review.

As a bench chemist, Ms. Duong became very familiar with the operation of all instrumentation within her section and has been instrumental in selecting and setting up new lab equipment.

Ms. Duong duties also involve scheduling daily tasks and performing data reviews. She also assists the Technical Director with tasks related to the section and interacts with the QA Manager.

Other relevant experience and projects in which Ms. Duong has participated are as follows:

- *Developing analytical methods by ICP and ICP-MS for environmental samples.*
  - *Improving analytical methods by optimizing conditions for different analytical methods.*
  - *Writing Standard Operating Procedures for newly developed methods and recertifying current SOPs.*
  - *ICP and ICP-MS troubleshooting and maintenance*

#### **Participation in Seminars and Conferences**

Mr. Duong regularly attends user meetings and technical seminars for subjects related with his field.



EDUARDO MORALES

**Title**

## Organic Section Supervisor

## **Education**

B.S. - California State University, Los Angeles, 2001  
Biochemistry

## **Professional Experience**

Jul/1999 to Present

Weck Laboratories, Inc., City of Industry, CA  
Full Service Environmental Testing laboratory

Mr. Morales is responsible for the operation and maintenance of GC, GC/MS and extraction equipment used for semivolatile organic analysis. Over the years he has developed many methods for emergent contaminant testing using non-routine GC/MS techniques such as MS/MS, CI and PTV.

contaminant testing using non routine GC/MS techniques such as HS/HS, CI and PTV. Mr. Morales also provides training for new analysts in the field of GC and GC/MS and has been involved in the decisions for purchasing new instruments for the section. He also provides secondary reviews on data packages produced in his section.

Other relevant experience and projects in which Mr. Morales has participated are as follows:

- *Developing of methods for ultra trace level analysis of NDMA and other nitrosamines by Liquid- Liquid and Solid Phase extractions coupled with GC/MS in various forms.*
  - *Improving GC/MS analytical methods by optimizing conditions.*
  - *Writing Standard Operating Procedures for newly developed methods.*
  - *GC/MS troubleshooting and maintenance*
  - *Developing of methods for emergent contaminants and low level pesticides.*

#### **Participation in Seminars and Conferences**

Mr. Morales regularly attends user meetings and technical seminars for subjects related with his field.



SILVA MIRZOYAN

**Title**

## Organic Section Supervisor

## **Education**

B.S. - Biophysics - Yerevan State University - Yerevan Armenia, 1998  
Biochemistry

## **Professional Experience**

Feb/2005 to Present

Weck Laboratories, Inc., City of Industry, CA  
Full Service Environmental Testing laboratory

Ms. Mirzoyan is responsible for the operation and maintenance of GC, GC/MS and extraction equipment used for semivolatile organic analysis. Over the years he has developed many methods for emergent contaminant testing using non-routine GC/MS techniques such as MS/MS, CI and PTV. Ms. Mirzoyan also provides training for new analysts in the field of GC and GC/MS and has been involved in the decisions for purchasing new instruments for the section. He also provides secondary reviews on data packages produced in his section.

Other relevant experience and projects in which Ms. Mirzoyan has participated are as follows:

- *Developing of methods for ultra trace level analysis of NDMA and other nitrosamines by Liquid- Liquid and Solid Phase extractions coupled with GC/MS in various forms.*
  - *Improving GC/MS analytical methods by optimizing conditions.*
  - *Writing Standard Operating Procedures for newly developed methods.*
  - *GC/MS troubleshooting and maintenance*
  - *Developing of methods for emergent contaminants and low level pesticides.*



## **BRANDON GEE**

### **Title**

Operations Manager

### **Education**

B.S. – Cal Poly Pomona, 2006  
Biology

### **Certifications**

Recycling and Solid Waste Management, UCLA 2013  
Hazardous Materials General Safety, Security and Awareness

### **Professional Experience**

Aug 2007 – Present      Weck Laboratories, Inc. City of Industry, CA  
Full Service Environmental Testing Laboratory

Mr. Gee is responsible for implementing processes and practices across the organization. Some responsibilities include managing of receiving department, laboratory work flow, planning, performance improvements, operations strategy, SOP development, safety and assisting to secure compliance. Mr. Gee is also very well versed in compliance regulations for potable water and wastewater programs, as well as interpretation of analytical data. In his position as Senior Project Manager, he has managed many large environmental projects for potable water, groundwater, wastewater, carbon, air, all four UCMR programs as well as providing consulting to clients and interacting with regulatory agencies.

Other relevant experience and projects in which Mr. Morales has participated are as follows:

- *Project management*
- *Implementation of laboratory safety programs and procedures*
- *Writing Standard Operating Procedures for newly developed methods and recertifying current SOPs.*

### **Participation in Seminars and Conferences**

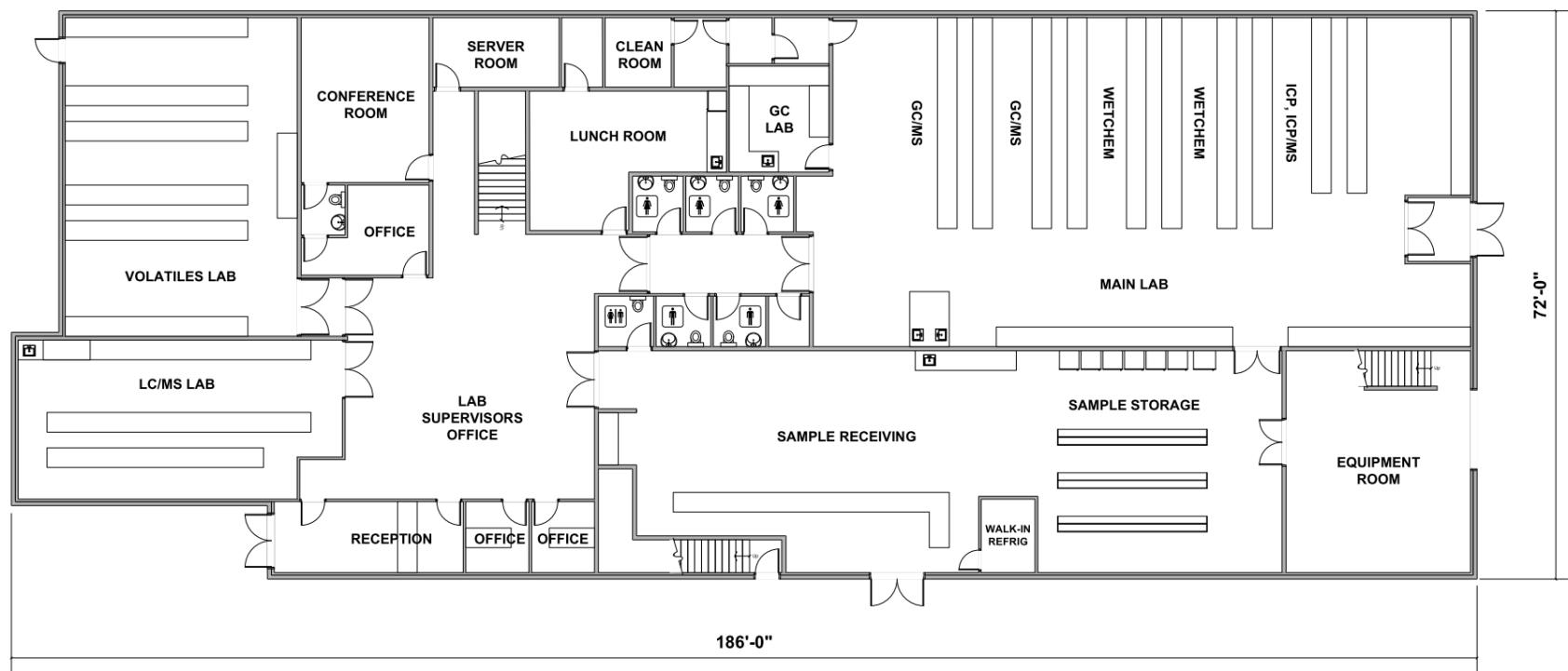
Mr. Gee regularly attends meetings, conferences and technical seminars for subjects related to his field.



## Appendix C Laboratory Floor Plan

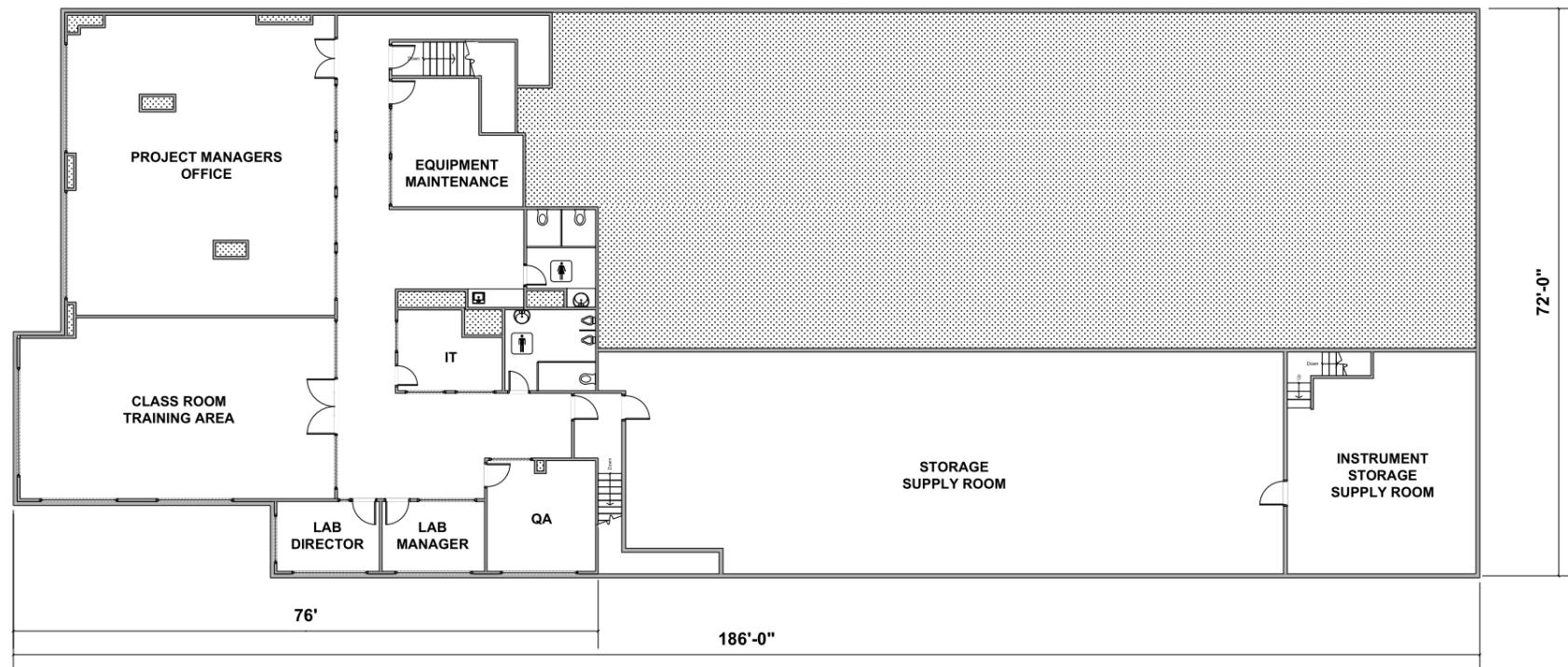


**LABORATORY 1 – 1<sup>st</sup> FLOOR (13392 ft<sup>2</sup>)**



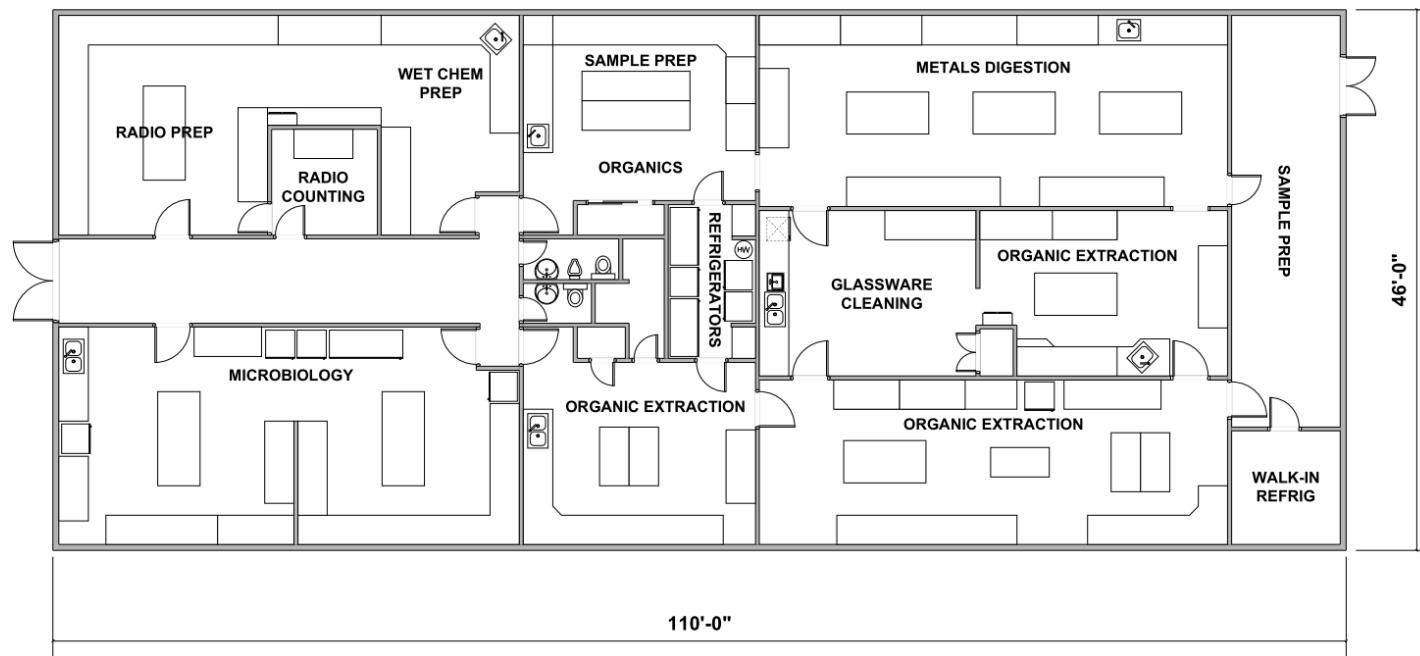


LABORATORY 1 – 2<sup>nd</sup> FLOOR (8500 ft<sup>2</sup>)





LABORATORY 2 – 1<sup>st</sup> FLOOR (5060 ft<sup>2</sup>)





## Appendix D

### **QC Acceptance Limits**

The Acceptance Limits for QC determinations are in some cases mandatory limits and in other cases the limits are updated periodically from past results. This process is performed through the LIMS. For current acceptance limits please refer to the LIMS.

## Appendix E

### List of Standard Operating Procedures (SOPs)

Document ID	Dept./Method	Document Title
MET001	1311	Toxicity Characteristic Leaching Procedure (TCLP)
MET005	3010A	Acid Digestion of Aqueous Samples and Extracts for Total Metals by ICP and ICP-MS, EPA Method 3010A Modified
MET007	3050B	Acid Digestion of Sediments, Sludges and Soils, EPA Method 3050B
MET009	3050M	Acid Digestion of Sediments, Sludges, Soils and Wipes, EPA Method 3050 Modified.
MET010	7471	Analysis of Mercury in Solid Matrices by Cold Vapor Atomic Absorption, EPA 7471A/B
MET011	245.1	Analysis of Hg in water by manual cold vapor technique EPA method 245.1
MET015	1420	Determination of Lead in Suspended Particulate Matter Collected from Ambient Air (Title 40 CFR Part 50, Appendix G)
MET017	6010B	Analysis of Trace Metal in Water and Solid Matrices by ICP-AES, EPA Method 6010B
MET018	200.8	Analysis of Trace Metals in Water by ICP-MS, EPA Method 200.8
MET019	6020	Analysis of Trace Metal in Water and Solid Matrices by ICP-MS, EPA Method 6020A
MET020	200.2	Sample Preparation Procedure for Spectrochemical Determination of Total Recoverable Elements, EPA Method 200.2
MET021	WET	Waste Extraction Test Procedure, Title 22 Part 66261.126 Appendix II
MET025	200.7	Analysis of Trace Metals in Water by ICP-AES, EPA Method 200.7
MET031	7470	Analysis of Mercury in Aqueous Samples and Liquid Waste by Cold Vapor Atomic Absorption, EPA 7470A
MET034	1631E	Analysis of Low Level Mercury by CVAFS with Gold Amalgamation, EPA Method 1631E
MET037	3500FeB	Determination of Ferrous Iron by the Phenanthroline Colorimetric Method, SM3500-Fe B
MET038	1640	Determination of Trace Elements in Saline Waters by Direct Injection and Preconcentration and ICP-MS - EPA Method 1640
MET039	SM2330B	Determination of Corrosivity (Langlier Index) in Water, SM 2330B
MET040	1312	Synthetic Precipitation Leaching Procedure (SPLP), EPA Method 1312
MET041	3051A	Microwave Assisted Acid Digestion of Sediments, Sludge, Soils, and Oils, EPA Method 3051A
MET044	As-LCICPMs	Determination of Arsenic and Selenium Species by HPLC/ICP-MS
MET045	CARB12	Determination of Inorganic Lead Emissions from Stationary Sources. Method 12
MET046	CARB436	Determination of Multiple Metals Emissions from Stationary Sources, CARB Method 436
MET047	3005A	Acid digestion of waters for total recoverable and dissolved metals for ICP (EPA 6010) and ICP/MS (EPA 6020)
MET048	USP<232>	Analysis of Elemental Contaminants in Dietary Supplements and Pharmaceutical Ingredients by Microwave digestion and ICP-MS, USP <232>/<233>
MET049	200.8UCMR4	Analysis of Trace Metal in Water and Aqueous Matrices by ICP/MS under UCMR 4 Program , EPA Method 200.8
MET050	200.7-UCMR5	Analysis of Lithium in Water by ICP-AES, EPA Method 200.7 for UCMR 5
MIC003	SM9223	Analysis of Total Coliform and E. Coli in Water by P/A ColilertTM and Enumeration by the Quanti-Tray® method, SM9223
MIC004	SM9215B/SimPlate	Analysis of Heterotrophic Plate Count by Pour Plate and SimPlate Methods, SM 9215B
MIC005	SM9221	Analysis of Total and Fecal Coliform in Water by Multiple Tube Fermentation Technique, SM9221
MIC006	QAQC	Quality Assurance for Microbiological Tests
MIC009	SM 9230D	Bacteriological Analysis of Ambient Water Samples for Enterococci by Enterolert Presence/Absence and Quanti-Tray® Method
MIC010	Disposal	Disposal of Material Used for Microbiological Determinations
MIC011	SM9230B	Analysis of Fecal Streptococcus and Enterococcus in Water and Solid Samples by Multiple Tube Fermentation Technique, SM9230B
MIC014	CultPrep	Preparation and Maintenance of Control Bacterial Cultures
MIC022	546 ELISA	Determination of Total Microcystins and Nodularins in Drinking Water and Source Water by ELISA
MIC023	Legionella	Bacteriological Analysis of Legionella pneumophila in Water by Quanti-Tray/Legiolert® Method



Document ID	Dept./Method	Document Title
MIC024	1615M	Measurement of SARS-CoV-2 in wastewater by RT-qPCR
MIC025	sal-bio	Salmonella-Biosolids
MIC026	9215E	Analysis of Heterotrophic Plate Count by IDEXX SimPlate Method
MIS001	Sample Receiving	Sample Receiving, Log in, Storage and Disposal
MIS002	Sampling, WW	Industrial Wastewater Sampling Instructions
MIS003	Data Back Up	Back Up and Restoration Systems
MIS004	Material Receipt	Chemicals, Standards and consumable materials, Receipt, Storage and Preparation of Solutions
MIS005	File Servers	Procedures for Start Up and Shut Down the File Servers
MIS007	Sample Container	Sample Container Management and Shipping
MIS008	Waste Mngmt.	Waste Management and Laboratory Disposal Practices
MIS009	Foreign Soil	Receiving and Handling Foreign Soil Samples
MIS010	Sampling, GW	Sampling Instructions for Protected Groundwater Supplies and Water Supplies with Treatment
MIS011	SOP Prep.	Preparation, Approval, Distribution, & Revision of standard Operating Procedures
MIS012	Sig. Fig.	Significant Figures and Rounding
MIS013	Control Chart	Generation and Utilization of Control Charts
MIS014	Internal Audit	Performing Internal Audits
MIS015	PT Samples	Handling and Analysis of Proficiency Testing (PT) Samples
MIS016	CAP	Corrective Action Procedures
MIS017	Logbook	Maintenance, Utilization and Review of Laboratory Logbooks
MIS018	Data Review	Internal Laboratory Data Verification and Review
MIS019	Complaint	Resolution of Customer Complaints
MIS020	Balance	Calibration and Verification of Analytical Balances
MIS021	Pipette	Calibration and Maintenance of Mechanical Pipettes
MIS022	LIMS	LIMS Security Systems
MIS024	DI Water	DI Water Quality Checks
MIS025	Data Control	Control of Data and Manual Data Entry
MIS026	Sub-Sample	Taking Representative Samples and Sub-samples in the Laboratory.
MIS028	Cleaning Labware	Standard Cleaning Protocols for Containers and Labware
MIS029	2550B-Temp & Therm	Temperature, Calibration and Verification of Thermometers
MIS030	Managerial Review	Performing Managerial Reviews
MIS031	Support Equipment	Calibration and Verification of Lab Support Equipment
MIS032	MDL, RL	Calculation of Method Detection Limits (MDL) and Reporting Limits (RL)
MIS033	R/A Criteria	Rejection/acceptance Criteria for Special Analyses
MIS034	DOC	Performing Initial Demonstration of Capability (IDC)
MIS035	New Employee	New Employee Training
MIS036	Use of Area	Use of Areas of Incompatible Activities
MIS037	Computer	Computers and Electronic Data Requirements
MIS038	COC	Chain of Custody Procedures for Legal and Evidentiary Custody of Samples
MIS039	Manual Integration	Proper Raw Data Handling and Manual Integration Procedures
MIS040	Archive, raw data	Archival System for Instrument Raw Data
MIS041	Subcontract	Procedures for Subcontracting Client Samples
MIS042	Support services	Outside Support Services and Supplies
MIS043	Ethics, Data Integrity	Implementation of the Business Ethics and Data Integrity Policy
MIS044	Nonconforming Test	Control of Nonconforming Environmental Testing
MIS045	Record Control	Control of Records and Documents
MIS046	Training	Training of Laboratory Personnel
MIS047	Uncertainty	Estimating the Uncertainty of Measurements
MIS048	SOP Maintenance	Development and Maintenance of Test Method SOPs
MIS049	Health & Safety	Health and Safety Training Procedures
MIS050	Disaster	Disaster Procedures

**Quality Assurance Manual****Appendix E – List of Standard Operating Procedures (SOPs)**

Effective: 11/20/2023, Rev 20.9

App E-3 of App E-7

Document ID	Dept./Method	Document Title
MIS052	Confirmation, Analyte	Acceptance criteria for analyte confirmation
MIS053	Project Management	Project Management, Reports Generation and Electronic Data Transfer
MIS055	Preventive Maintenance	Preventive Maintenance of Laboratory Analytical Instruments
MIS056	Data Package	Compiling Level II, III and IV Data Packages
MIS057	Vehicle	Operating an company vehicle
MIS058	Field Test, Cl2	Field testing for total and residual chlorine in drinking water
MIS059	Field Test, pH	Field testing for pH in drinking water
MIS060	MCL Notification	MCL Notification System
MIS061	LabTalk	Lab Talk Procedure for Querying Analyses and Sorting by Expiration Date
MIS062	Data Verification-538_MDA	Internal Laboratory Data Verification and Review for 538_MDA
MIS063	EAP	Emergency Action Plan
MIS064	Environmental Monitoring Procedure and Compliance	Environmental Monitoring Procedure and Compliance
MIS065	UCMR 5 Sample Receipt	UCMR 5 Sample Receipt and Verification
MIS066	S Sampling	Field sampling for total and diss sulfide in wastewater
MIS067	Respirator Fit Test	Respirator Fit Test
MIS068	UCMR 5 PM	Project Management, UCMR5 Notification, Report Generation and Electronic Data Transfer
ORG004	SM5320B	Determination of Total Organic Halides (TOX) in Water by Adsorption-Pyrolysis-Titrimetric Method, SM 5320B
ORG005	8315A	Analysis of Ketones and Aldehydes by HPLC, EPA Method 8315
ORG006	8318	Analysis of N-Methylcarbamates by HPLC, EPA Method 8318
ORG007	9076	Analysis of Total Halogens and Total Extractable Organic Halides in Solid matrices, EPA Method 9076
ORG008	551.1	Analysis of Chlorination Disinfection Byproducts (DBPs) in Drinking water by Liquid-Liquid Extraction and GC/ECD, EPA Method 551.1
ORG009	8260B	Determination of Volatile Organic Compounds in Groundwater and Soil by GC/MS, EPA 8260B
ORG011	8330A	Analysis of Explosive Residues by HPLC
ORG015	8141A	Analysis of Organophosphorus Pesticides in Water and Solid Matrices by GC/NPD, EPA Method 8141A
ORG016	8081A	Analysis of Organochlorine Pesticides in Water and Solid Matrices by GC/ECD, EPA Method 8081A
ORG017	549.2	Analysis of Diquat and Paraquat by Solid Phase Extraction and HPLC-UV, EPA Method 549.2
ORG020	547	Analysis of Glyphosate by HPLC-Fluorescence, EPA Method 547
ORG022	508	Analysis of Organochlorine Pesticides and PCBs in Drinking Water by LL Extraction and GC-ECD, EPA Method 508
ORG023	8015B-DRO	Analysis of Diesel Range Organics in soil and water samples by GC-FID, EPA Method 8015
ORG025	EPA 24	Determination of Volatile Organic Content (VOC) in Paints and Related Coatings, EPA Method 24
ORG026	524.2	Determination of Volatile Organic Compounds in Water by GC/MS, EPA Method 524.2
ORG028	531.2	Analysis of N-Methylcarbamates in Water by Direct Aqueous Injection HPLC with Post Column Derivatization, EPA Method 531.1
ORG029	8151A	Analysis of Chlorinated Acid Herbicides in Water and Solid Matrices by GC-ECD, EPA Method 8151
ORG030	504.1	Analysis of EDB, DBCP and 123TCP in Water by Microextraction and GC/ECD, EPA 504.1
ORG033	632	Analysis of Diuron by HPLC-UV, EPA Method 632
ORG036	8270C	Analysis of Semi-Volatile Organic Compounds in Water and Solid Matrices by GC/MS, EPA Method 8270C
ORG037	548.1	Analysis of Endothall in Drinking Water by Solid Phase Extraction and GC/MS, EPA Method 548.1
ORG039	525.2	Analysis of Semi-volatile Organic Compounds in Drinking Water by Solid Phase Extraction and GC/MS, EPA Method 525.2
ORG040	625.1	Analysis of Semivolatile Organics in Wastewater by LL Extraction and GC/MS, EPA Method 625

Document ID	Dept./Method	Document Title
ORG042	314	Analysis of Perchlorate in Water and Solid Matrices by Ion Chromatography, EPA Method 314.0
ORG043	8270M-14Dioxane	EPA 8270 Modified, Analyses of 1,4-Dioxane by Isotopic Dilution and GC/MS SIM
ORG045	3600	Cleanup Procedures for Organic Analyses, EPA Method 3600
ORG046	3500Bb	Sample Preparation and Extraction for Hazardous Waste Samples, EPA Method 3500B
ORG047	3510B	Separatory Funnel Liquid-Liquid Extraction, EPA Method 3510B
ORG048	3550B	Ultrasonic Extraction, EPA Method 3550B
ORG049	3580A	Waste Dilution Procedure, EPA Method 3580A
ORG050	5030C	Purge-and-Trap Extraction Procedure, EPA 5030C
ORG058	8082	Analysis of Polychlorinated Biphenyl's (PCBs) in Liquid and Solid Matrices by GC-ECD, EPA Method 8082
ORG059	1666	Determination of Volatile Organic Compounds Specific to the Pharmaceutical Industry by Isotope Dilution GC/MS, EPA Method 1666
ORG060	624.1	Analysis of Volatile Organic Compounds in Wastewater by GC/MS, EPA Method 624
ORG062	9020B	Determination of Total Organic Halides in Water by Adsorption-Pyrolysis-Titrimetric Method, EPA Method 9020B
ORG063	9020M	Determination of Total Halogens and Total Extractable Organic Halides in Solid and Oil Matrices, EPA Method 9020B Modified
ORG064	608.3	Analysis of Organochlorine Pesticides and PCBs in Wastewater by GC-ECD, EPA Method 608.
ORG065	1625B	Determination of low level Nitrosoamines using GC/MS/MS with Isotope Dilution and Chemical Ionization by EPA Method 1625B
ORG066	8270SIM-PAH	Determination of Low Levels of PAHs in Water and Solid Matrices by GC/MS in SIM Mode, EPA Method 8270C-SIM
ORG067	5035	Determination of Volatile Organic Compounds in Soil by Closed-System Purge and Trap and GC/MS, EPA 5035/8260
ORG069	7199	Analysis of Hexavalent Chromium by Ion Chromatography, EPA Method 7199
ORG071	8015-Alc	Analysis of Alcohols by GC-FID, EPA Method 8015B
ORG072	515.4	Analysis of Chlorinated Acid Herbicides in Water by Microextraction and GC-ECD, EPA Method 515.2
ORG074	Iden	Identification of Target Analytes via Retention Time
ORG075	552.3	Analysis of Haloacetic Acids by Microextraction and GC-ECD, EPA 552.3
ORG076	maint	Instrument Maintenance for Organic Analysis
ORG077	218.6	Analysis of Hexavalent Chromium in Water by Ion Chromatography, EPA 218.6
ORG079	8260B-GRO	Analysis of Volatile Gasoline Range Petroleum Hydrocarbons (C6 to C10) and BTEX-MTBE in soil and water samples by Purge and Trap and GC/MS, EPA 8260B
ORG083	TCP-PT	Analysis of Low Levels of 1,2,3-Trichloropropane by Purge and Trap and GC/MS SIM mode, SRL Method
ORG085	556	Analysis of Aldehydes by Microextraction and GC-ECD, EPA Method 556
ORG086	3535	Solid Phase Extraction Procedures - Manual and Automated, EPA Method 3535
ORG087	300.1	Analysis of Low Levels of Oxyhalides by Ion chromatography, EPA Method 300.1
ORG090	8270SIM-Phenol	Determination of Low Levels of Phenols compounds in Water and Solid Matrices by GC/MS in SIM Mode, EPA Method 8270C-SIM
ORG095	1614M	Analysis of PBDEs by isotopic dilution GC/MS-EI, EPA Method 1614 Modified
ORG096	6710B	Determination of Low Levels Organotins by GC-MS.
ORG097	332	Analysis of Low Level Perchlorate by IC-MS/MS, EPA Method 332.0
ORG099	331	Analysis of Low Level Perchlorate by LC-MS/MS, EPA Method 331.0
ORG101	521	Analysis of Nitrosamines by SPE-GC/MS/MS EPA Method 521
ORG107	6850	Analysis of Perchlorate at Low Levels in water and soil matrices by LC-MS/MS, EPA Method 6850

Document ID	Dept./Method	Document Title
ORG108	556M	Analysis of Aldehydes in Solid/Soil by GC-ECD, EPA Method 556 Modified
ORG110	D7065	Analysis of Alkyl Phenols and Alkyl Phenol Ethoxylates by L-Lextraction and GC/MS full scan and SIM, ASTM Method D7065
ORG111	1694M	Analysis of Pharmaceuticals, Personal Care Products and Endocrine Disruptive Compounds LC-MS/MS.
ORG113	632M	Determination of Diuron in solid matrices
ORG114	IC/MS/MS-pCBSA	Analysis of 4-Chlorobenzenesulfonic acid (pCBSA) by IC/MS/MS
ORG115	525.2M/625M (OPP)	Determination of organophosphorous pesticides in drinking water by liquid-solid extraction and capillary column GC/MS, via EPA Method 525.2
ORG116	8316M	Analysis of Acrylamide by LC/MS/MS
ORG117	Pyrethroids	Analysis of Pyrethroid Pesticides in Water and Soil/Sediment by Extraction and GC/MS in NCI mode and SIM
ORG120	SM6040D	Analysis of MIB and Geosmin by on line SPME and GC/MS/MS, SM6040D
ORG121	Bicine by LCMSMS	Analysis of Bicine by LC/MS-MS
ORG123	PCBs By GC-QQQ	Screening for PCB congeners by Tandem GC/MS/MS
ORG124	522	Determination of 1,4-Dioxane in Drinking Water by SPE and GC/MS SIM
ORG125	524.3	Determination of Volatile Organics in Water by Purge & Trap and GC/MS
ORG127	1613M	Analysis of 2,3,7,8-TCDD in Drinking Water by Tandem GC/MS/MS, EPA Method 1613 Modified
ORG129	Melamine	Analysis of Melamine in Water by LC/MS
ORG130	218.7	Analysis of Hexavalent Chromium in Drinking Water by IC with Post-Column Derivatization and UV Detection
ORG131	SM5310B	Total Organic Carbon (TOC) and Dissolved Organic Carbon (DOC) by Combustion, SM 5310B
ORG132	9060M	Total Organic Carbon (TOC) and Inorganic Carbon (IC) in Soil and Solid Matrices by Dry Combustion and NIR detection, EPA Method 9060 modified
ORG136	PAH by GC-QQQ	Determination of Low Levels of PAHs in Water by SPE and tamdem GC/MS/MS, EPA Method 625.1
ORG137	524.4	Determination of Volatile Organics in Water by Purge & Trap using nitrogen as purge gas and GC/MS EPA 524.4
ORG139	537M	Analysis of Perfluorinated (PFCs) Alkyl Acids in Soil/Sediments by LCMSMS
ORG141	8321B	Analysis of Nonvolatile Organic Compounds in Aqueous and solid matrices by LCMSMS
ORG142	9023	Extractable Organic Halides (EOX) in Solids
ORG146	544	Determination of Microcystins and Nodularin in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS)
ORG147	545	Determination of Cylindrospermopsin and Anatoxin-a in Drinking Water by Liquid Chromatography
ORG148	538M	DETERMINATION OF SELECTED ORGANIC CONTAMINANTS IN DRINKING WATER BY DIRECT AQUEOUS INJECTION LIQUID CHROMATOGRAPHY/TANDEM MASS SPECTROMETRY (DAI-LC/MS/MS)
ORG149	TICs	Analysis and reporting of Non-Target Organic compounds (TICs)
ORG150	SIM	Minimum Criteria for Selected Ion Monitoring (SIM) Methods
ORG151	331M-Iodide	Analysis of Iodide by LC-MS/MS
ORG153	547M	Analysis of Glyphosate in water and solid by LC-MS/MS
ORG154	537.1	Analysis of Perfluorinated Compounds in Water by LC-MS/MS
ORG155	559	Analysis of Nonylphenol and 4-tert-Octylphenol in Water by LC-MS/MS
ORG156	533	DETERMINATION OF SELECTED PERFLUORINATED AND POLYFLUORINATED ALKYL SUBSTANCES IN DRINKING WATER BY ANION EXCHANGE SOLID PHASE EXTRACTION AND LIQUID CHROMATOGRAPHY/TANDEM MASS SPECTROMETRY WITH QUANTITATION USING ISOTOPE DILUTION
ORG157	ASTM D-7065M	PPCP ADD
ORG158	557	Analysis of Haloacetic Acids, Bromate and Dalapon in Potable Water by IC-MS/MS
ORG159	555	Analysis of Chlorinated Acid Herbicides and other herbicides in Water by LC/MS/MS

**Quality Assurance Manual****Appendix E – List of Standard Operating Procedures (SOPs)**

Effective: 11/20/2023, Rev 20.9

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Document ID	Dept./Method	Document Title
ORG160	508.1	DETERMINATION OF CHLORINATED PESTICIDES, HERBICIDES, AND ORGANOHALIDES BY SPE and GC-ECD
ORG161	Hydrazine	Hydrazine by LCMSMS
ORG162	625.1-OPP	OP Pesticides by EPA 625.1, GC/MS/MS
ORG163	524.3 (EDB-DBCP)	EDB & DBCP by EPA 524.3, GC/MS SIM
ORG164	332M-Iodide	Analysis of Iodide by IC-MS/MS
ORG165	3546	Microwave Extraction
ORG166	615	The Determination of Chlorinated Herbicides in Municipal and Industrial Wastewater
ORG167	316	Determination of Volatile Organic Content (VOC)
ORG168	1613B ATP	Analysis of Dioxin in Drinking Water by Tandem GC/MS/MS, EPA Method 1613B ATP
ORG169	8321A	Analysis of Nonvolatile Organic Compounds in Aqueous and solid matrices by LCMSMS
ORG170	170 WL	Analysis of Neonicotinoids by LC/MS/MS
ORG171	1664B	Determination of Oil & Grease (HEM and SGT-HEM) by Solid Phase Extraction and Gravimetry, EPA Method 1664B
ORG172	1633	PFAS by LC-MS/MS, EPA Method 1633
ORG173	8270C-PAH(LL)	Determination of Low Levels of PAHs in Water by SPE and tandem GC/MS/MS, EPA Method 8270C
RAD001	900	Determination of Gross Alpha and Gross Beta Radioactivity in water
RAD002	SM7110C	Determination of Gross Alpha Radioactivity in Water by Coprecipitation, SM 7110C
RAD004	All	Quality Control for Radiochemical Analysis
RAD010	SM7500Rn	Radiochemical Determination of Radon-222 in water samples, SM7500-Rn
WET001	300	Analysis of Anions by Ion Chromatography, EPA 300.0
WET004	SM5210B	Biological Oxygen Demand (BOD) Test, SM 5210B
WET008	SM5540D	Non-ionic Surfactants as CTAS (Cobalt Thiocyanate Active Substances) SM 5540D
WET009	SM2120B	Analysis of Color in Water, SM 2120B
WET013	140.1	Analysis of Odor in Drinking Water, EPA Method 140.1/SM 2150
WET018	SM4500CN G	Analysis of Cyanide Amenable to Chlorination in Water - Manual Colorimetric, SM 4500CN-G
WET021	1010	Ignitability by Pensky Marten Closed Cup Method, EPA Method 1010
WET022	SM2320B	Determination of Alkalinity by the Titrimetric Method, SM 2320B
WET027	3060A	Alkaline Digestion for Analysis of Hexavalent Chromium in Solid Matrices, EPA Method 3060
WET028	SM4500 H B	pH (Electrometric), SM 4500-H+ B
WET032	SM4500 S2 D	Analysis of Dissolved Sulfide - Methylene Blue Method, SM 4500-S= D)
WET038	SM4500Cl G	Analysis of Total Residual Chlorine by Colorimetry with DPD, SM 4500Cl G
WET039	SM2510B	Determination of Specific Conductance, SM 2510B
WET041	SM2540C	Filterable Residue (TDS) by Gravimetric analysis, SM 2540C
WET042	SM2540D	Determination of Non-filterable Residue (TSS) by Gravimetry, SM 2540D
WET043	SM5540C	Determination of Methylene Blue Active Substances (MBAS) by Spectrophotometry, SM 5540C
WET044	253B	Analysis of Thiosulfate and Sulfite by Iodometric Titration, LACSD Procedure 253B
WET046	SM2540B	Determination of Total Residue (TS) by Gravimetry, SM 2540B
WET047	160.4	Determination of Volatile Residue (VS) by Gravimetry, EPA Method 160.4
WET048	SM2540F	Determination of Settleable Residue (SS) by Volumetric Imhoff Cone, SM 2540F
WET050	410.4	Determination of Chemical Oxygen Demand in Water by Colorimetry, EPA Method 410.4
WET056	180.1	Determination of Turbidity by Nephelometric Method, EPA Method 180.1
WET059	USPerox	Analysis of Hydrogen Peroxide in Water by the US Peroxide Method
WET062	420.1M	Analysis of Total Recoverable Phenolics in Solid Matrices, EPA Method 420.1 Modified
WET064	9045C	Determination of pH in Soil and Solid Matrices, EPA Method 9045C
WET065	9040B	Determination of pH in Liquid Waste and Multiphase Waste, EPA Method 9040B
WET069	SM2340B/EPA200.7	Determination of Hardness by Calculation, SM 2340B/EPA 200.7/Langlier Index
WET070	SM4500ClO2 D	Analysis of Chlorine Dioxide by Colorimetric Method with DPD, SM 4500-ClO2 D
WET072	SM4500 O G	Determination of Dissolved Oxygen by Membrane Electrode Method, SM 4500-O G



Document ID	Dept./Method	Document Title
WET073	SM4500SO3 B	Analysis of Sulfite by Iodometric Method, SM4500SO32- B
WET074	9010/9014	Distillation and Analysis of Total and Amenable Cyanide in Waste and Solid Matrices ,EPA Method 9010B/9014
WET075	CCR ch10	Determination of Ignitability in Waste, CCR Chapter 10, Article 3
WET078	SM5910B	Determination of UV Absorbing Constituents (UV-254), SM 5910B
WET080	365.3	Analysis of Total Phosphorus and Ortho Phosphate in Water by Manual Colorimetric Method, EPA Method 365.3
WET084	353.2	Analysis of Nitrate and Nitrite by Automated Colorimetry and Segmented Flow Analysis, EPA Method 353.2
WET086	350.1	Analysis of Ammonia in Water by Automated Colorimetry, EPA Method 350.1
WET087	365.1	Analysis of Total Phosphorus in Water by Acid Persulfate Digestion and Automated Colorimetry, EPA Method 365.1
WET089	351.2	Analysis of Total Kjeldahl Nitrogen (TKN) in Water by Heating Block Digestion and Automated Colorimetry, EPA Method 351.2
WET091	335.4	Analysis of Total Cyanide in Water by Midi-Distillation and Automated Colorimetry, EPA Method 335.4
WET094	SM5710B	Determination of Trihalomethane Formation Potential (THMFP), SM 5710B
WET095	415.3	Determination of TOC and SUVA in Drinking Water, EPA Method 415.3
WET096	D6646-03	Analysis of the Accelerated Hydrogen Sulfide Breakthrough Capacity of Granular and Pelletized Activated Carbon, ASTM D6646-03
WET097	D2862	Standard Test Method for Particle Size distribution of Granular Activated Carbon, ASTM D2862-82
WET098	D2867	Standard Test Method for Moisture in Activated Carbon, ASTM D2867-83
WET099	D2866	Standard Test Method for Total Ash in Activated Carbon, ASTM D2866-83
WET100	D3802	Standard Test Method for Ball-Pan Hardness of Activated Carbon, ASTM D3802-79
WET101	D5029	Standard Test Methods for Water Solubles in Activated Carbon, ASTM D5029-98
WET102	D5832	Standard Test Methods for Volatile Matter Content of Activated Carbon, ASTM D5832-98
WET103	USFilter	Standard Test Methods for Contact pH Test Method
WET104	D93	Standard Method for Test for Flash Point by Pensky-Martens Closed Cup Tester, ASTM D93-73
WET105	420.4	Determination of Total Recoverable Phenolics in Water by Semi-Automated Colorimetry, EPA Method 420.4
WET108	160.3M	Total Residue (TS) and Moisture Content by Gravimetric Method, Dried at 103-105°C
WET110	9056A	Analysis of Anions in Soil and Solid Matrices by Water Extraction and Ion Chromatography, EPA 9056A
WET111	9071M	Lipids in tissue, EPA 9071M
WET112	ASTMD7511	Total Cyanide by Segmented Flow Injection Analysis, In-Line Ultraviolet Digestion and Amperometric Detection
WET113	OIA1677	Available Cyanide by Ligand Exchange and Flow Injection Analysis
WET114	350.1/351.2	Analysis of Ammonia and TKN by Gas Diffusion Segmented Flow Analysis (SFA) and Colorimetric Detection, EPA Methods 350.1 and 351.2
WET116	ASTM D3977-9	Standard Method for Determining Sediment Concentration in Water Samples
WET117	SM 5220B	Salinity
WET118	SM 2580BM	ORP Reading



## Appendix F

### Laboratory Accreditation/Certification/Recognition

Weck Laboratories, Inc. maintains the following certifications and accreditations with numerous state and national entities:

#### Nationwide Accreditations

Organization	Certificate Number
NELAP (ORELAP, Accrediting Body)	4047
USEPA – UCMR 1, 2 , 3, 4, 5 Accreditation	CA00211
ISO/IEC 17025:2017, TNI NGAB (ANAB)	AT-3072
DoD/DOE QSM V5.4 (ANAB)	ADE-2882

#### State and Local Accreditations

Organization	Certificate Number
State of California, ELAP	1132
State of Nevada, DEP	CA002112023-1
State of Hawaii, DOH	N/A
State of New Jersey, DEP	CA015
State of Vermont, DOH	VT-4047
Guam Environmental Protection Agency	22-005R
Los Angeles County Sanitation Districts	10143
South Coast Air Quality Management District	93LA1006

The certificates and parameter lists (which may differ) for each organization may be found in the company web page at <http://www.wecklabs.com/Resources/Information/Certifications.aspx>

If accreditation is terminated or suspended, the laboratory will immediately cease to use the certificate number reference in any way and inform clients impacted by the change.

## Appendix G

### Data Qualifiers

Qualifier	TextBody
*	The recommended holding time for this analysis is only 15 minutes. The sample was analyzed as soon as it was possible but it was received and analyzed past holding time.
**	The recommended holding time for field filtering is only 15 minutes. The sample was filtered as soon as possible but it was filtered past holding time. However, the sample was analyzed within holding time.
_<fis	<0.588
_<FL	No free liquids
_<FP65	<65
_<FP70	<70
_>=1.6M	>=1600000
_>=1600	>=1600
_>=160K	>=160000
_>=160M	>=160000000
_>=16K	>=16000
_>=16M	>=16000000
_>=2272.6	>=2272.6
_>=22726	>=22726
_>=227260	>=227260
_>=23	>=23
_>=3.2M	>=3200000
_>=320K	>=320000
_>=32K	>=32000
_>=40K	>=40000
_>=5700	>=5700
_>=570K	>=570000
_>=57K	>=57000
_>=740	>=740
_>200	>200
_>2419.6	>2,419.6
_>24196	>24,196
_>241960	>241960
_>2419600	>2419600
_>FB	>750
_>fis	>750
_>FP185	>185
_>FP200	>200
_A	Absent

Qualifier	TextBody
_FAIL	Fail
_FL	Contains free liquids
_Neg	Negative
_NONE	No Qualifiers
_NoneVis	None Visible
_NoOdor	No Odor Observed
_P	Present
_PASS	Pass
_pH<2	<2
_SeeAtt	See Attachment
_SeeAttR	See Attachment
_Vis	Visible
A-01	[Custom Value]
A-02	[Custom Value]
AN-IP	Sample results for structural isomers may have contribution from their isomeric pair.
B	Blank contamination. The analyte was found in the associated blank as well as in the sample.
B-01	This analyte was found in the method blank, which was possibly contaminated in the lab during preparation. The reporting limit was raised due to the contamination.
B-02	This analyte is detected in the method blank below the MRL, but above the method acceptance criteria.
B-03	Dilution water blank exceeds 0.20mg/L.
B-04	This analyte was found in the travel blank, which was possibly contaminated during transportation and/or preparation. The batch was accepted since this analyte was not detected for all the samples in the batch.
B-06	This analyte was found in the method blank, which was possibly contaminated during sample preparation. The batch was accepted since this analyte was either not detected or more than 10 times of the blank value for all the samples in the batch.
B-08	Analyte is found in the method blank, which was possibly contaminated during sample preparation.
B-field	No field blank was either received or specified in this batch. Therefore, samples were analyzed without field blank.
BOD-01	The sample dilutions set-up for the BOD analysis did not meet the oxygen depletion criterion of at least 2 mg/l, therefore the reported result is an estimated value only.
BOD-02	The sample dilutions set up for the BOD analysis did not meet the criterion of a residual dissolved oxygen of at least 1 mg/l, therefore the reported result is an estimated value only.

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Appendix G – Data Qualifiers  
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Qualifier	TextBody
BOD-03	The sample dilutions set-up for the BOD analysis did not meet the final DO reading with a value of equal or greater than 1 mg/l, therefore the reported result is an estimated value only.
BOD-04	The sample dilutions set-up for the BOD analysis did not meet the final DO reading with a value of equal or greater than 1 mg/l, due to matrix interferences..
BR	Analyte was found in the method blank, which was possibly contaminated in the lab during preparation. The reporting limit was raised to account for the contamination.
BS-01	The recovery of this analyte in the BS/LCS was over the control limit due to a possible contamination. The batch was accepted based on another acceptable BS and/or MS and MSD that meet the BS criteria.
BS-02	The recovery of this analyte in the BS/LCS was outside the control limits due to cross contamination from highly contaminated samples during preparation.
BS-03	The recovery of this analyte in the BS/LCS was outside the control limits. The sample result was accepted based on another acceptable BS/LCS and/or MS and MSD that meet BS criteria.
BS-04	The recovery of this analyte in LCS or LCSD was outside control limit. Sample was accepted based on the remaining LCS, LCSD or LCS-LL.
BS-H	The recovery of this analyte in the BS/LCS was over the control limit. Sample result is suspect.
BS-L	The recovery of this analyte in the BS/LCS was below the control limit. Sample result is suspect.
C-3620	The "Florisil Cleanup" was performed to the sample.
C-3640	The "GPC Cleanup" was performed to the sample.
C-3665	The "Sulfuric Acid Cleanup" was performed to the sample.
CHMT-01	The sample was analyzed directly with acid dilution.
CN-1	See case narrative for an explanation of results.
CN-2	See Case Narrative
DI_WET	On Deionized Water W.E.T extract (STLC).
E	The concentration indicated for this analyte is an estimated value above the calibration range of the instrument. This value is considered an estimate (CLP E-flag).
E-01	The concentration indicated for this analyte is an estimated value above the calibration range.
F-01	The sample was received without proper field flocculation. Therefore, flocculation process was performed at the lab as soon as possible.
FILT	The sample was filtered prior to analysis.
FP	Formation Potential
HC-02	Hydrocarbon pattern present in the requested fuel quantitation range but does not resemble the pattern of the requested fuel.
I	Internal Standard outside of acceptance limit due to possible matrix effects

Qualifier	TextBody
I-03	Low internal standard recovery possibly due to matrix interference or leak in system. The result is suspect.
I-05	Low internal standard recovery possibly due to matrix interference. The result is suspect.
J	Estimated conc. detected <MRL and >MDL.
M	Sample result is matrix suspect.
M-02	Due to the nature of matrix interferences, sample was diluted prior to preparation. The MDL and MRL were raised due to the dilution.
M-03	Due to insufficient sample volume, sample was diluted prior to preparation. The MDL and MRL were raised due to the dilution.
M-04	Due to the nature of matrix interferences, sample extract was diluted prior to analysis. The MDL and MRL were raised due to the dilution.
M-05	Due to the nature of matrix interferences, sample was diluted prior to analysis. The MDL and MRL were raised due to the dilution.
M-06	Due to the high concentration of analyte inherent in the sample, sample was diluted prior to preparation and/or analysis. The MDL and MRL were raised due to this dilution.
M-08	Incomplete sample loading during extraction due to sample matrix
MI	Manual Integration was performed
MI-01	Manual intergration is necessary due to irregular baseline.
MI-02	Manual intergration is necessary due to low signal to noise ratio.
MIC-2	Result is suspect due to QC failure.
MS-01	The spike recovery for this QC sample is outside of established control limits possibly due to sample matrix interference.
MS-02	The RPD and/or percent recovery for this QC spike sample cannot be accurately calculated due to the high concentration of analyte inherent in the sample.
MS-03	Multiple analyses indicate the percent recovery is out of acceptance limits due to a possible matrix effect.
MS-04	Visual evaluation of the sample indicates the RPD or QC spike is above the control limit due to a non-homogeneous sample matrix.
MS-05	The spike recovery and/or RPD were outside acceptance limits for the MS and/or MSD due to possible matrix interference. The LCS and/or LCSD were within acceptance limits showing that the laboratory is in control and the data is acceptable.
MS-06	Due to noted non-homogeneity of the QC sample matrix, the MS/MSD did not provide reliable results for accuracy and precision. Sample results for the QC batch were accepted based on LCS/LCSD percent recoveries and RPD values.
MS-07	The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on acceptable LCS recovery.
MS-08	Due to the nature of matrix interferences, sample was diluted prior to analysis. The MS/MSD could not be quantitated due to the dilution. The batch was accepted based on acceptable LCS recovery.

Qualifier	TextBody
MS-09	The recoveries of MS/MSD are not valid due to high sample background
MS-10	Due to insufficient sample, LCS/LCSD were analyzed in place of MS/MSD.
MS-11	The QC limits for MS/MSD are not applicable due to positive sample background.
MS-BG	The spike recovery was outside of QC acceptance limits for the MS and/or MSD due to sample background. The QC batch was accepted based on LCS and/or LCSD recoveries within the acceptance limits.
O-02	Sulfides present in the sample. Therefore, 24 hours holding time for the analysis already expired.
O-04	This analysis was performed outside the EPA recommended holding time.
O-05	The extraction for this analyte was performed outside of the EPA recommended holding time.
O-07	Sample date and/or time not provided by client. Therefore, default date and/or time has been entered. The analysis may be outside of recommended holding time.
O-08	The original extraction and/or analysis of this sample yielded QC recoveries outside acceptance criteria. It was re-extracted/re-analyzed after the recommended maximum hold time.
O-09	This sample was received with the EPA recommended holding time expired.
O-10	The original analysis of this sample yielded QC recoveries outside acceptance criteria. It was re-analyzed after the recommended maximum hold time.
O-11	The sample was originally analyzed within holding time. However, it required a dilution and the re-analysis was performed after the recommended holding time had expired.
O-12	The sample was originally analyzed within holding time. However, it was reanalyzed without dilution that exceeded the recommended holding time.
O-13	The sample was originally analyzed within hold time. However, the re-analysis was performed due to possible carry over and/or cross contamination after the recommended holding time had expired.
O-14	This analysis was requested by the client after the holding time was exceeded.
O-15	The sample was received with the recommended holding time nearly expired. It was analyzed as soon as possible but the maximum holding time was slightly exceeded.
O-20	As per vial label, this sample was received with HCl preservation, however sample pH was found to be >2 after VOC analysis possibly due to matrix effect or loss of acid during sampling.
O-21	This sample was analyzed 1 hour past the EPA recommended holding time.
O-22	This sample was analyzed 2 hours past the EPA recommended holding time.
O-25	This sample was received unpreserved and with the recommended holding time for preservation of 48 hours expired.
O-26	This sample was received unpreserved and with the recommended holding time for filtration of 24 hours expired.
P-01	Low recovery due to preservative. Sample data accepted based on passing LCS result.

Qualifier	TextBody
P-2	Sample received without proper preservation and was preserved at the lab upon receiving.
P-3	The sample was preserved with ascorbic acid, but the pH was >2 possibly due to no, or insufficient preservation with HCl. The sample was not analyzed within 24 hours, as required by method for sample with pH>2.
P-6	The sample was filtered and preserved prior to analysis.
P-7	The sample was preserved within 14 days.
Q	One or more quality control criteria failed.
Q-01	The recovery of this analyte in QC sample was outside control limits. Sample was justified as ND based on the low level standard at or below the reporting limit.
Q-02	Low recovery of this analyte in the QC sample. The analysis of the low level standard produced acceptable recovery indicating that the sample result might be accurately reported as Not Detected.
Q-08	High bias in the QC sample does not affect sample result since analyte was not detected or below the reporting limit.
Q-09	This analyte bias high in QC sample. A fresh spiking solution is going to be prepared.
Q-10	This analyte is high bias in QC samples, sample result is suspect.
Q-11	This analyte is low bias in QC samples, sample result is suspect.
Q-12	The RPD result exceeded the QC control limits; however, both percent recoveries were acceptable. Sample results for the QC batch were accepted based on the percent recoveries and/or other acceptable QC data.
Q-H-1	High bias, data was accepted since sample was not detected.
Q-L-03	This analyte is low in QC sample. Sample data is accepted based on acceptable CCVs.
Q-ME	Acceptable QC with marginal exceedance
Q-R-01	Analyses are not controlled on RPD values from sample concentrations less than the reporting limit. QC batch accepted based on LCS and/or LCSD QC results.
Q-S	QC samples were not performed due to insufficient sample received.
QC-2	This QC sample was reanalyzed to complement samples that require re-analysis on different date. See analysis date.
QR-03	The RPD value for the sample duplicate or MS/MSD was outside of QC acceptance limits due to matrix interference. QC batch accepted based on LCS and/or LCSD recovery and/or RPD values.
QR-04	The RPD value for the MS/MSD was outside of QC acceptance limits however both recoveries were acceptable. The QC batch was accepted based on acceptable results for the recoveries and RPD for the LCS and LCSD.
QR-BS	The RPD value for the BS/BSD (LCS/LCSD) was outside of QC acceptance limits however both recoveries were acceptable. The QC batch was accepted based on acceptable results for the recoveries of the BS (LCS) and BSD (LCSD).
R-01	The MDL and/or MRL for this analyte has been raised to account for matrix interference.

Qualifier	TextBody
R-02	The RPD was outside of QC acceptance limits due to possible matrix interference.
R-03	The RPD is not applicable for result below the reporting limit (either ND or J value).
R-04	Due to foaming, the sample was diluted prior to analysis. The reporting limits were raised due to the dilution.
R-07	Incomplete sample loading during extraction due to sample matrix. The MDL and MRL were adjusted accordingly.
R-MS	Results reported using MS/MS as the primary detector.
S-01	The surrogate recovery could not be calculated due to sample dilution required from high analyte concentration and/or matrix interferences.
S-02	The surrogate recovery for this sample cannot be accurately quantified due to interference from coeluting organic compounds present in the sample extract.
S-03	High surrogate recovery for this sample is possibly due to a sample matrix effect. The data was accepted since all target analytes were not detected.
S-04	The surrogate recovery for this sample is outside of established control limits due to possible sample matrix effect.
S-05	Surrogate recovery was below acceptance limit possibly due to matrix effect. Sample data was justified as acceptable since all target analytes were still not-detected or below the reporting limits when adjusted accordingly to surrogate recovery.
S-06	The recovery of this surrogate is outside control limits due to sample dilution required from high analyte concentration and/or matrix interference's.
S-07	Surrogate recovery out of acceptance limits for this sample is possibly due to sample matrix effect, confirmed by re-extracting and/or re-analyzing the sample.
S-08	No surrogate recovery, possibly surrogate spiking was missed.
S-09	Wrong amount spiked, quantification is not accurate
S-10	Surrogate recovery outside method QC limits due to extraction related problems
S-11	Surrogate recovery outside of control limits. The data was accepted based on valid recovery of the remaining surrogate.
S-AC	Acid surrogate recovery outside of control limits due to a possible matrix effect. The data was accepted based on valid recovery of remaining two acid surrogates.
S-BLK	Surrogate recovery outside of control limits for Method Blank. The data was accepted since all target analytes were not detected
S-BN	Base/Neutral surrogate recovery outside of control limits due to a possible matrix effect. The data was accepted based on valid recovery of remaining two base/neutral surrogates.
S-BS	Surrogate recovery outside of control limits for LCS. The data was accepted based on valid recovery of the target analytes.
S-GC	Surrogate recovery outside of control limits due to a possible matrix effect. The data was accepted based on valid recovery of the remaining surrogate.
S-HI	High surrogate recovery was confirmed as a matrix effect by a second analysis.



## Quality Assurance Manual

Appendix G – Data Qualifiers  
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Qualifier	TextBody
S-LOW	Low surrogate recovery confirmed as a matrix effect by a second analysis.
S-MS	Surrogate recovery outside of control limits for MS/MSD. The data was accepted based on valid recovery of the target analytes.
S-MS1	Surrogate recovery outside of acceptance window confirmed as matrix effect by analysis of MS/MSD on this sample.
Supp	This result has been revised from the original report.
T-AgBaH	The sample was treated with Silver, Barium and H+ cartridges to minimize chloride and sulfates interferences prior to analysis.
T-RP	The sample was treated with Organics cartridges to minimize organic interferences prior to analysis.
TOX-01	Due to sample matrix interferences, second column measurement exceeding 10% of the two-column total.
U-01	The sample was received without the proper preservation.
U-03	Due to limited sample volume provided, the method criteria cannot be achieved.
VTR-01	The sample was filtered with 1.5 micron filter at lab.

## **Appendix H Laboratory Equipment**

Instrument	Department	Description
_AS01	VOC	EST Analytical Centurion
_AS04	VOC	Teledyne Tekmar AtomX
_AS05	SVOC	Varian Archon
_AS06	SVOC	HP6890/G1513A
_AS09	SVOC	Varian CP8400
_AS10	SVOC	CTC Analytics
_AS11	SVOC	CTC Analytics
_AS12	VOC	Varian Archon
_AS13	SVOC	Agilent 7693/G4513A
_AS14	VOC	Env. Sample Technology Inc.
_AS15	SVOC	Agilent 7693/G4513A
_AS16	SVOC	Agilent 7693/ G4513A
_AS19	SVOC	Agilent 7693/G4513A
_AS20	SVOC	Agilent G4520A
_AS21	VOC	Teledyne Tekmar Atomx XYZ
_AS23	SVOC	Agilent 7683 Series/G2614A
_AS24	SVOC	HP 7673/18593B
_AS25	SVOC	Agilent 7683 Series/G2614A
_AS26	SVOC	Varian CP-8400
_AS27	SVOC	Agilent 7683 B Series
_AS28	SVOC	Agilent 7693/G4513A
_AS32	LC	Dionex AS40 Automated Sampler
_AS33	_STORAGE	Dionex AS40 Automated Sampler
_AS34	LC	Dionex ICS 5000/ 061785
_AS35	METALS	Perkin Elmer Flexar LC Autosampler
_AS36	LC	Agilent 1200 ALS/ G1329A
_AS37	LC	Agilent 1100 ALS/ G1329A
_AS38	LC	Metrohm Autosampler 858 PSP
_AS39	LC	Dionex AS-DV/ 068888
_AS40	LC	Shimadzu SIL-20ACHT
_AS41	LC	Agilent 1260 Infinity II/ G7167A
_AS42	LC	Agilent 1290 Multisampler/G7167B
_AS44	LC	858 Professional Sample Processor
_AS46	METALS	Shimadzu ASI-L
_AS48	METALS	Teledyne Leeman Labs AS
_AS50	_STORAGE	Cetac AS A520
_AS51	METALS	Elemental Scientific, Inc. Model SC-4DXS
_AS53	METALS	ESI SC-4DXS autosampler
_AS54	METALS	Agilent SPS 4 Autosampler G8410A
_AS56	METALS	Agilent SPS 4 Autosampler G8410A
_AS57	LC	Agilent Model G7167A 1260 Multisampler
_AS58	METALS	Agilent G8410A
_AS59	METALS	Agilent SPS 4 G8410A
_AS61	WETCHEM	Mantech Gilson Sample Changer 223
_AS62	VOC	Teledyne Tekmar Atomx XYZ
_AS63	VOC	Teledyne Tekmar Atomx XYZ
_AS64	VOC	Teledyne Tekmar Atomx XYZ w Foam Eliminator

Instrument	Department	Description
_AS66	METALS	Teledyne Cetac ASX-560
_AS67	METALS	Elemental Scientific Model: SC-4CX SP3
_AS68	METALS	Agilent SPS 4 Autosampler8410A
_FIELD	FIELD	Generic Field Readings
_MS02	VOC	HP 5973/G1098A
_MS03	SVOC	Agilent 5973
_MS05	VOC	Agilent 5973/G1098A
_MS06	SVOC	Varian 4000MS
_MS07	SVOC	Varian Model 4000 MS
_MS08	SVOC	Agilent 5975C Inert MSD
_MS09	VOC	HP 5873
_MS10	SVOC	Agilent 7000
_MS11	VOC	Agilent 5975/G3171A
_MS12	SVOC	Agilent 7000
_MS13	SVOC	Agilent 5997A MSD
_MS14	VOC	Agilent 5973/G2577A
_MS15	VOC	HP 5973/G1088A
_MS16	SVOC	Agilent 7010
_MS17	SVOC	Agilent 7890A \ G3440A
_MS18	VOC	Agilent G3170A
_MS22	SVOC	Agilent 7010B GC/TQ G7012B
AA01	WETCHEM	Lachat QuikChem 8500+ autoanalyzer four channels
AA02	WETCHEM	Man-Tech PC-Titrate automated titrator/ISE
AA03	WETCHEM	Seal AQ2+ discrete autoanalyzer
AA04	WETCHEM	Seal Analytical Quattro
AA05	WETCHEM	O-I Analytical automated cyanide analyzer F3100
AA06	WETCHEM	O-I Analytical automated TKN/NH3 analyzer F3100
AC01	MICROBIOLOGY	Market Forge Autoclave STM-EL
AC03	MICROBIOLOGY	Market Forge Autoclave
AIRGEN01	SVOC	Matheson Zero air generator model Chrysalis
BAL01	WETCHEM	Analytical Balance Mettler Toledo Model AG104
BAL02	ORGANIC PREP	Denver top loader
BAL03	SVOC	Sartorius Model BP310S Top loader
BAL04	WETCHEM	Metler Toledo PR503 top loader
BAL05	RADIOCHEM	Shimadzu UW420H top loader
BAL06	VOC	Satorious L-420 P+
BAL08	RADIOCHEM	Satorious 1712MP8 analytical
BAL10	SVOC	Optima OPD-E
BAL12	_STORAGE	Data Support Co., Inc. Model: MB120
BAL13	METALS	Industry Electronic Balance
BAL14	MICROBIOLOGY	Ohaus STX421
CAAS01	MICROBIOLOGY	Chemwell - Cyanotoxins Auto Assay for Elisa
CENT01	ORGANIC PREP	IEC Stand alone centrifuge model UV
CENT02	ORGANIC PREP	Eppendorf Centrifuge model 5810
CENT03	RADIOCHEM	Fisher bench top centrifuge model Centrific 225
CENT04	INORGANIC PREP	Hettich Zentrifugen Universal 320
CENT05	_STORAGE	VWR Stirrer
CHILLO3	SC	Nesslab water chiller model CTF150
CHILLO4	METALS	Thermo Nesslab chiller model Merlin M150
CHILLO5	METALS	Nesslab chiller model CTF-25
CHILLO6	METALS	Agilent Technologies Model G3292-80200

Instrument	Department	Description
CHLORINE2	FIELD	Hach Chlorine MR and HR
CHLORINE3	FIELD	HACH Pocket Colorimeter II
COMM01	_VARIOUS	SAMCOM FPCN30A (6 units)
COMP01	SC	Ingersoll Rand air compressor Model SS3-E
COMP02	SC	Gast Air compressor
COMP03	_VARIOUS	Ingersoll Rand Model 2475
COMP03DRY2	_VARIOUS	Ingersoll Rand D25IN-SR
CONC01	ORGANIC PREP	Horizon conc/evaporator model DryVap
CONC02	ORGANIC PREP	Caliper evaporator/Concentrator model Turbo Vap
CONC03	ORGANIC PREP	Horizon evaporator for O&G model Speed Vap III
CONC04	ORGANIC PREP	Organomation N2 blowdown model OASYS (SPE area)
CONC05	ORGANIC PREP	Organomation N2 evaporator N-Evap III
CONC06	ORGANIC PREP	Organomation K-D concentrator mode ROT-X-TRACT-LC
CONC07	ORGANIC PREP	Organomation concentrator Model N-Evap III
CONC08	ORGANIC PREP	Organomation Cont. L-L Ext/Conc TOT-X-Tract LC
CONC09	ORGANIC PREP	Weck Concentrator
CONC10	ORGANIC PREP	Weck Concentrator
CONC11	ORGANIC PREP	FMS Super Vap Concentrator
CONC12	ORGANIC PREP	FMS Super Vap Concentrator
CONC13	ORGANIC PREP	FMS Super Vap Concentrator
CONC14	ORGANIC PREP	FMS Super Vap Concentrato
CONC15	ORGANIC PREP	FMS Super Vap Concentrato
CONC16	ORGANIC PREP	Biotage Trubovap LV
DESC01	RADIOCHEM	Sanplatec Dry Keeper
DESC02	ORGANIC PREP	Sanplatec Dry Keeper
DESC03	RADIOCHEM	Secador Dessicator
DESC04	WETCHEM	LABCONCO 5530000
DESC05	WETCHEM	Fisher Scientific
DESC06	WETCHEM	Fisher Scientific
DESC07	INORGANIC PREP	SANPLATEC Dry Keeper
DESC08	WETCHEM	Fisher Scientific
DESC10	RADIOCHEM	Glass Jar
DESC11	MICROBIOLOGY	Dessicator no name
DESC12	RADIOCHEM	Sanplatec Dry Keeper
DESC13	WETCHEM	Boekel 134900
DESC14	WETCHEM	Boekel 134900
DESC15	RADIOCHEM	Glass Jar
DIGE05	METALS	Environmental Express
DIGE07	METALS	Environmental Express Model SC154
DIGE08	_STORAGE	Seal Analytical BD50 Block
DIGE09	METALS	Environmental Express SC154
DIGE11	METALS	Environmental Express, Inc. Model: SC2050-54
DIGE13	WETCHEM	Hach Model 45600
DIGE14	INORGANIC PREP	Environmental Express SC2050-54
DIST06	WETCHEM	Glas-Col dist. system for solvents Model TM114
DIST09	WETCHEM	Kimble Chase MIDI-VAP 4000
DIST10	WETCHEM	Kimble Chase MIDI-VAP 4000
DIST11	WETCHEM	Kimble Chase MIDI-VAP 4000
DIST12	WETCHEM	Kimble Chase MIDI-VAP 4000
EC01	FIELD	Hach Pocket Pro Tester

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Instrument	Department	Description
ELGEN01	SC	Electrical Generator Honda Model Power Boss
FIELD EC/RES/TDS	FIELD	Myron L Company Ultrameter II
FIELD PH13	FIELD	Eutech Oakton 35634-10 PHTESTR 10
FIELD PH14	FIELD	Oakton 35634-30
FIELD PH15	FIELD	Oakton 35634-30
FP01	WETCHEM	Hoehler Flash Point tester Pensky-Martens
FURN01	WETCHEM	Barnsted Muffle Furnace Thermolyne 48000
FURN02	WETCHEM	Muffle furnace Thermo Scientific Thermoline
GC03	SVOC	Agilent 6890+ with ECD and FID and 7683 A/S
GC04	SVOC	Agilent 5890 with TCD and FID and 7683 A/S
GC05	SVOC	Agilent 6890+ with dual ECD and 7683 A/S
GC07	SVOC	Agilent 6890N with dual ECD and 7683B A/S
GC08	SVOC	Agilent 7890B/dual ECD/7693
GC09	SVOC	GG Agilent model 7890B with 7693A autosampler and
GCMS_SC1	VOC	EST Analytical Econ EV
GCMS03_SC	VOC	Tekmar 3000
GCMS04	VOC	Agilent 6890/5973 w/Tekmar Solatek 72 and 3100
GCMS06	SVOC	Agilent 6890/5973Turbo w/EI&CI and AS
GCMS08	VOC	Agilent 6890N/5973N w/Tekmar 3100 nd Archon
GCMS09	SVOC	Varian 3800/4000 with CP8400 autosampler and EI/CI
GCMS11	SVOC	Agilent 7890/5975C w/SS and PTV injector and AS
GCMS12	VOC	Agilent 6890+/5973 w/Tekmar 3000 and Archon
GCMS12_SC	VOC	Tekmar 3000
GCMS13	SVOC	Agilent 7000B Triple Quad with EI/CI and 7693 A/S
GCMS14	VOC	Agilent 6890N/5975 w/Tekmar Velocity and Archon
GCMS14_SC	VOC	Teledyne Tekmar
GCMS15	SVOC	Agilent 7890A Triple Quad with EI/CI and 7693 A/S
GCMS16	SVOC	Agilent 7890B/5977A/7693
GCMS17	VOC	Agilent MS5973/GC6890
GCMS17_SC	VOC	TEKMAR Dohr 3100
GCMS18	VOC	Agilent 6890N
GCMS18_SC	VOC	OI Samp. Conc Eclipse 4660
GCMS19	SVOC	Agilent 7890B Triple Quad
GCMS20	SVOC	Agilent G3172A
GCMS21	VOC	Agilent 6890N (G1530N)
GCMS22	SVOC	Agilent 8890 G3540A
GPC01	SVOC	LC Tech auttmated GPC cleanup system model Ultra
H2GEN03	SVOC	Hogen GC, Proton
H2GEN04	SVOC	Parker Balston
H2GEN05	SVOC	Peak Scientific
H2S1	METALS	Interscan H2S Continuous Monitoring System
HG03	METALS	Teledyne Leeman Labs: Quick Trace 7600 Hg Analyzer
HG04	METALS	Teledyne Leeman Quick Trace -8000 CVAFS Hg Analyze
HOOD1	VOC	Fisher Hamilton Safaire
HOOD10	ORGANIC PREP	Genie (Extraction)
HOOD11	ORGANIC PREP	LABCONOCO (Extraction SPE)
HOOD12	RADIOCHEM	Radiochem Hood 12
HOOD13	INORGANIC PREP	Fisher Hamilton Safeaire (Main Lab)
HOOD14	METALS	Genie Scientific (Metals)
HOOD15	LC	SAS Sentry Air Systems (LC/IC)



Instrument	Department	Description
HOOD16	METALS	Hemco 24910
HOOD2	ORGANIC PREP	Extraction Hood 2
HOOD3	INORGANIC PREP	Fisher Hamilton SafeAire (Main Lab)
HOOD4	INORGANIC PREP	Digestion Hood
HOOD5	METALS	Labconoco (Metals Digestion)
HOOD6	METALS	Hemco Chemical Control Sysytems (Metals Dig)
HOOD7	INORGANIC PREP	Genie Scientific (Extraction)
HOOD8	INORGANIC PREP	Extraction Hood 8
HOOD9	INORGANIC PREP	Extraction Hood 9
HOTP01	RADIOCHEM	Barsntead Hot Plate model HPA2245M Type 2200
HOTP02	RADIOCHEM	Corning Hot Plate Model PC101
HOTP03	RADIOCHEM	Barnstead Hot Plate model Cimarec
HOTP04	RADIOCHEM	Heidolph Hot Plate model MR Standard
HOTP05	RADIOCHEM	Corning Hot Plate model PC-420D
HOTP06	RADIOCHEM	Thermoline Hot Plate Model Cimarec 3
HOTP07	RADIOCHEM	Cole Palmer Hot Plate model 51450-72
HOTP08	RADIOCHEM	Barnstead Hot Plate Model Cimarec
HOTP09	RADIOCHEM	Barnstead Hot Plate Model Cimarec
HOTP10	RADIOCHEM	Corning Magnetic Stirrer Model Scholar 171
HOTP11	RADIOCHEM	Fisher Magnetic stirrer model automixer
HOTP14	_VARIOUS	PMC Hot Plate
HOTP15	MICROBIOLOGY	Fisher Scientific Magetic Stirrer Model 120S
HOTP16	RADIOCHEM	Torrey Pine Scientific
HOTP17	RADIOCHEM	Torrey Pine Scientific
HOTP18	RADIOCHEM	Coroning HP Stirrer PC-620D
HOTP20	RADIOCHEM	Barnstead HP Model SP131325
HOTP21	WETCHEM	Cole Palmer 03405-30
HOTP22	WETCHEM	Thermo Scientific Stirbuddy S168515Q
HOTP23	WETCHEM	Coroning Lab Stirrer 440825999
HOTP24	METALS	Torrey Pines Model HS15C
HOTP26	MICROBIOLOGY	Coroning Lab Stirrer/ Hot Plate 6795-620D
HOTP27	RADIOCHEM	Coroning PC-620D
HOTP28	RADIOCHEM	Coroning 6795-620D
HOTP29	_STORAGE	Coroning 6795-600D
HOTP30	RADIOCHEM	Torrey Pines Scientific HS15C
HOTP31	RADIOCHEM	Torrey Pines Scientific HS15C
HOTP32	RADIOCHEM	Torrey Pines Model HS15C
HOTP33	MICROBIOLOGY	Coroning 6795-620D
HOTP34	_STORAGE	Coroning 6795-620D
ICE02	_VARIOUS	Hoshizaki Model KM-520MAJ
ICP02_CHILL	METALS	Polyscience- 6160T21E4Q1N
ICP03	METALS	Agilent Technologies 5110 ICP-OES
ICPMS04	METALS	Agilent 7700 Series ICP-MS
ICPMS04_CHILL	METALS	Polyscience 6750T21SP302
ICPMS05	METALS	Perkin Elmer ELAN DRC II w/FAST A/S, preconc, & LC
ICPMS05_CHILL	METALS	Polyscience G3292-80000
ICPMS05_LC09	METALS	Perkin Elmer Flexar LC
ICPMS06	METALS	Agilent 7900 Series ICP-MS
ICPMS07	METALS	Agilent 7850 G8422A
ICPMS08	METALS	Perkin ELmer NexION 1000 ICPMS

Instrument	Department	Description
INC04	MICROBIOLOGY	VWR Incubator model 1545
INC05	MICROBIOLOGY	VWR Incubator 1535
INC06	MICROBIOLOGY	VWR Incubator double door 1555
INC07	WETCHEM	Precision low temp incubator for BOD model 815
INC12	MICROBIOLOGY	VWR Incubator model 1915
INC13	MICROBIOLOGY	VWR Incubator 1915A
INC14	WETCHEM	VWR VRI20P
INC15	MICROBIOLOGY	Fluidion Microbiology
INC16	MICROBIOLOGY	Sanyo MCO-18AIC(UV)
ISCO05	SC	Teledyne ISCO composite sampler Model GLS
ISCO06	SC	Teledyne ISCO composite sampler Model GLS
ISCO08	SC	Teledyne ISCO composite sampler Model GLS
ISCO11	SC	Teledyne ISCO composite sampler Model GLS
ISCO12	SC	Teledyne ISCO composite sampler Model GLS
ISCO13	SC	Teledyne ISCO composite sampler Model GLS
ISCO16	SC	Teledyne ISCO composite sampler Model GLS
ISCO17	SC	Teledyne ISCO Composite Sampler MODEL GLS
ISCO18	SC	Teledyne ISCO Composite Sampler Model GLS
ISCO19	SC	Teledyne ISCO Model 6712 Desc: 609004330
ISCO20	FIELD	Teledyne ISCO Model GLS Sampler 60-2954-001
ISCO21	FIELD	Teledyne ISCO Model GLS Sampler 60-2954-001
ISCO22	FIELD	ISCO Model GLS Sampler 60-2954-001
ISCO23	FIELD	ISCO Model GLS Sampler 60-2954-001
LC_AXP1	LC	Dionex AXP V10PFT03DX2
LC_PDA1	LC	Dionex PDA-100
LC_SPD1	LC	Shimadzu SPD 10 AV VP
LC04	LC	Dionex DX-120 Ion Chromatograph
LC05	_DISPOSED	Dionex DX-600
LC06	_STORAGE	Dionex ICS 2000
LC08	LC	Dionex IC system model ICS-5000
LC08_Channel1	LC	Dionex IC system model ICS-5000 - Channel 1
LC08_Channel2	LC	Dionex IC system model ICS-5000 - Channel 2
LC08_DP	LC	Dionex ICS 5000 DP/ 072033
LC08_EG	LC	Dionex ICS 5000/ 072046
LC09	METALS	Liquid Chromatograph system Perkin Elmer Flexar
LC09_Column Oven	METALS	Perkin Elmer Flexar Column Oven
LC09_LC PUMP	METALS	Perkin Elmer Flexar Quaternary Pump
LC09_SOLVMANAGER	METALS	Perkin Elmer Flexar Solvent Manager
LC10	LC	Liquid Chromatograph system Agilent 1200
LC10_DG	LC	Agilent 1200 Degasser/ G1379B
LC10_FC/ALS	LC	Agilent FC/ALS Therm/ G1330B
LC10_FLD	LC	Agilent 1200 FLD/ G1321A
LC10_PCD	LC	Pickering P-C Derivatizer Sigma
LC11	LC	Liquid Chromatograph system Agilent 1200 Quat Pump
LC11_DAD	LC	Agilent 1200/ G1315B
LC11_DG	LC	Agilent 1200 Degasser/ G1379B
LC11_FC/ALS	LC	Agilent Agilent FC/ALS Therm/ G133013
LC11_TCC	LC	Agilent 1200 TCC/ G1316A
LC12	LC	Metrohm 930 Compact IC Flex
LC13	LC	Dionex ICS-5000 DP/ 075929

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Instrument	Department	Description
LC13_SPD	LC	Shimadzu UV-Vis SPD-10AVI
LC13_TC	LC	Dionex ICS-5000 TC/ 075961
LC14	LC	Thermo Dionex IC ICS 5000
LC14_AS	LC	Thermo Dionex AS-AP
LC14_DP-5	LC	Thermo Dionex ICS 5000+ DP-5
LC14_EG-5	LC	Thermo Dionex ICS 5000+ EG-5
LC14_UV-VIS	LC	Hewlett Packard G13MA
LCMS03	LC	Triple Quad LC/MS/MS Agilent model 6495
LCMS03_BP1	LC	Agilent 1260 Infinity/ G1312B
LCMS03_BP2	LC	Agilent 1260 Infinity/ G1312B
LCMS03_DG	LC	Agilent 1260 Infinity HiP Degasser/ G4225A
LCMS03_FC	LC	Agilent 1290 Flex Cube Infinity/ G4227A
LCMS03_TCC	LC	Agilent 1260 TCC/ G1316A
LCMS04	LC	Triple Quad LC/MS/MS Agilent Model 6460
LCMS04_HSP	LC	Agilent 1290 High Speed Pump/ G7120A
LCMS04_LC2	LC	940 Professional IC Vario
LCMS04_MCT	LC	Agilent 1290 MCT/ G7116B
LCMS05_FP	_DISPOSED	1260 Infinity II Flexible Pump (Quarternary) G7104C
LCMS06	LC	Ultivo Triple Quad LC/MS/MS Agilent Model G6465A
LCMS06_FC	LC	Agilent Model G4227A 1290 Flex Cube
LCMS06_FT	LC	Agilent Model G7104C 1260 FP
LCMS06_MCT	LC	Agilent Model G7116A 1260 MCT
LCMS07	LC	Agilent G6495B
LCXX	LC	Dionex GP40 Gradient Pump
LH01	MICROBIOLOGY	Opentrons OT2
LMR01	MICROBIOLOGY	Berthold LB 963
MIC02	MICROBIOLOGY	Reichert Scientific Lab Microscope model 410
MIC03	MICROBIOLOGY	Tyco Bacti-cinerator
MIC04	MICROBIOLOGY	Spectroline U Light with cabinet model EA-160
MIC05	MICROBIOLOGY	Baker Laminar flow hood model Sterigard II
MIC07	MICROBIOLOGY	Quebec Darkfield colony counter model 3330
MIC08	MICROBIOLOGY	IDEXX Quanti-Tray Sealer Plus
MIC10	MICROBIOLOGY	Leica Querec Darkfield Colony Counter
MIC11	MICROBIOLOGY	Masterflex ISMATEC
MIX02	SC	Waring Laboratory Blender
MIX03	RADIOCHEM	Jung Ang Laboratory mixer Model Hi-Tec
MIX04	_VARIOUS	Blendtec Model ES3
MM01	WETCHEM	SPER Scientific Bechtop Meter
MP-001	METALS	Socorex
MP-002	METALS	Socorex
MP-003	METALS	Eppendorf
MP-004	METALS	Socorex
MP-005	METALS	Socorex
MP-006	METALS	Socorex
MP-007	METALS	Socorex
MP-008	METALS	Socorex
MP-009	METALS	Fisher Finnpipette
MP-010	METALS	Socorex
MP-011	METALS	Fisher Finnpipette
MP-013	METALS	Socorex

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Instrument	Department	Description
MP-014	UNASSIGNED	Socorex
MP-015	MICROBIOLOGY	Eppendorf
MP-017	MICROBIOLOGY	VWR
MP-018	METALS	Socorex
MP-019	METALS	Socorex
MP-020	METALS	Socorex
MP-023	LC	Socorex
MP-024	LC	Socorex
MP-026	LC	Fisher Finnpipette
MP-028	LC	Wheaton
MP-029	LC	Fisher Finnpipette
MP-031	LC	Fisher Finnpipette
MP-032	WETCHEM	Fisher Finnippette II
MP-033	TOC-TOX	Socorex
MP-036	WETCHEM	Socorex
MP-038	WETCHEM	Socorex
MP-039	WETCHEM	Socorex
MP-040	RADIOCHEM	Fisher Finnpipette II
MP-043	WETCHEM	Fisher Finnpipette
MP-044	TOC-TOX	Fisher Finnpipette
MP-045	RADIOCHEM	Socorex Acura 826.0200
MP-046	RADIOCHEM	Socorex Acura 826.0200
MP-047	WETCHEM	Socorex
MP-048	UNASSIGNED	Socorex
MP-049	WETCHEM	Fisher Elite
MP-050	MICROBIOLOGY	Socorex Acura 826.0200
MP-051	WETCHEM	Wheaton Acura 821
MP-052	ORGANIC PREP	Dispensette Organic
MP-053	ORGANIC PREP	Dispensette Organic
MP-054	ORGANIC PREP	Dispensette Organic
MP-055	METALS	Fisherbrand Elite
MP-057	METALS	Socorex Acura 815
MP-058	METALS	Socorex Acura 815
MP-060	METALS	Fisher Finnpipette II
MP-061	LC	Socorex Acura 825.1000
MP-062	LC	Fisher Elite
MP-063	METALS	Precision Pipette Orbit
MP-064	MICROBIOLOGY	Eppendorf Easypet 3
MP-065	METALS	Socorex Acura 815
MP-066	VOC	Fisher Finnpipette II
MP-067	MICROBIOLOGY	Bio-Rad MC8-50
MP-068	MICROBIOLOGY	Bio-Rad BR-200
MP-069	MICROBIOLOGY	Bio-Rad BR-20
MP-070	MICROBIOLOGY	Bio-Rad BR-20
MP-071	MICROBIOLOGY	Bio-Rad BR-200
MP-072	LC	Bio-Rad BR-20
MP-073	MICROBIOLOGY	Bio-Rad BR-1000
MP-074	MICROBIOLOGY	Bio-Rad BR-1000
MP-075	WETCHEM	Socorex Acura 825.1000
MP-076	WETCHEM	Fisher Elite

Instrument	Department	Description
MP-077	ORGANIC PREP	Dispensette Organic
MP-078	WETCHEM	Socorex Acura 825
MP-079	WETCHEM	Socorex Acura 825.0200
MP-080	WETCHEM	Socorex Acura 815
MP-081	METALS	Socorex Acura 825
MP-084	SC	Brinkmann
MP-085	RADIOCHEM	Beckman Coulter
MP-086	SC	Dispensette
MP-087	WETCHEM	Fisher Elite
MP-089	ORGANIC PREP	Brand Tech Scientific Dispensette Org
MP-090	ORGANIC PREP	Brand Tech Scientific Dispensette Org
MP-091	ORGANIC PREP	Brand Tech Scientific Dispensette Org
MP-092	ORGANIC PREP	Brand Tech Scientific Dispensette Org
MP-093	ORGANIC PREP	Brand Tech Scientific Dispensette Organic
MP-094	METALS	Brand Tech Scientific Dispensette Organic
MP-095	METALS	Brinkmann ChemSaver
MP-096	METALS	Fisher Zippet Classic
MP-098	SC	Dispensette S
MP-099	METALS	Dispensette
MP-100	MICROBIOLOGY	Scorex Acura 825
MP-101	SC	Dispensette
MP-102	MICROBIOLOGY	Eppendorf Easypet 3
MP-103	WETCHEM	Dispensette Organic
MP-104	WETCHEM	FisherBrand
MP-105	WETCHEM	Dispensette S Organic
MP-106	WETCHEM	VWR LABMAX
MP-107	METALS	Fisher Elite
MP-108	ORGANIC PREP	Dispensette S Organic
MP-109	ORGANIC PREP	Dispensette S Organic
MP-110	ORGANIC PREP	Dispensette S Organic
MP-111	ORGANIC PREP	Dispensette S Organic
MP-112	ORGANIC PREP	Dispensette S Organic
MP-113	ORGANIC PREP	Dispensette S Organic
MP-114	ORGANIC PREP	Dispensette S Organic
MP-115	ORGANIC PREP	Dispensette S Organic
MW01	METALS	CEM Microwave digestion system model MARS 907501
MW02	METALS	CEM MARS 6 230/60 Model No 910900
N2GEN01	LC	Dominik Hunter N2 generator model G4510W
N2GEN02	LC	Parker Balston N2 generator w/compressor LCMS5000
N2GEN03	LC	Peak Scientific Genius 3020
N2GEN04	LC	Peak Scientific Genius 3010
N2GEN05_COMP	LC	Powerex SEQ200730HPAJ
N2GEN05_DRYER	LC	Hankison SPX Flow HPR 50
N2GEN05_FILT1_PRG1	LC	Beko Technologies 4030519
N2GEN05_FILT1_PRG2_2	LC	Beko Technologies 4030519
N2GEN05_FILT1_PRG3	LC	Beko Technologies 4030519
N2GEN05_FILT1_WS	LC	Walker Filtration
N2GEN05_FILT2	LC	Walker Filtration
N2GEN05_FILT3	LC	Walker Filtration
N2GEN05_FILT4	LC	Walker Filtration

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Instrument	Department	Description
N2GEN05_FILT5	LC	Walker Filtration
N2GEN05_GEN	LC	Peak Industrial I-Flow 6011
N2GEN05_TANK1	LC	Large Tank
N2GEN05_TANK2	LC	Small Tank
OVEN03	RADIOCHEM	Fisher Scientific oven model Isotemp
OVEN04	_VARIOUS	Duke High Temp oven Model E101-E
OVEN10	MICROBIOLOGY	
OVEN11	METALS	Lab Safety Supply
OVEN13	RADIOCHEM	Humboldt 20GC
OVEN14	WETCHEM	Fisher Scientific 180L Ovn Grvty
OVEN15	WETCHEM	Quincy Lab, Inc. 40GC
OVEN16	RADIOCHEM	Fisher Sci 180L Ovn Grvty 151030521
OVEN17	WETCHEM	Fisher Sci 180L Ovn Grvty 151030521
PCR03	MICROBIOLOGY	Agilent AriaMx Real-Time PCR System G8830A
PH02	RADIOCHEM	Corning pH/mV meter model Scholar 425
PH05	RADIOCHEM	TDSTestr II+ portable TDS meter
PH07	FIELD	HACH Pocket Pro pH
PH10	FIELD	Hach Pocket Pro Tester
PH11	FIELD	HACH Pocket Pro pH
PH12	FIELD	Eutch Oakton pH Tester 30
PH13	WETCHEM	HACH HQ440d multi meter
PH14	FIELD	Oakton pH20 Tester
PH16	FIELD	Oakton pH50 Tester 35634-16
PH17	MICROBIOLOGY	VWR pHenomenal 1100L
PROBE01	MICROBIOLOGY	pH Accumet 13-620-289
PUMPR001	_STORAGE	E2M2
PUMPR002	VOC	E2M2
PUMPR003	_STORAGE	2004A
PUMPR004	_STORAGE	G1099-80023
PUMPR005	_STORAGE	E2M2
PUMPR006	_STORAGE	E2M1.5HP
PUMPR007	_STORAGE	Edwards RV-5
PUMPR008	_STORAGE	Edwards RV-5
PUMPR009	_STORAGE	Varian 949-9335
PUMPR010	_STORAGE	Edwards E2M2
PUMPR011	_STORAGE	Edwards RV5
PUMPR012	VOC	G1099-80023
PUMPR013	VOC	Edwards E2M 1.5 HP
PUMPR014	VOC	Edwards E2M2
PUMPR015	VOC	RV3A65201903
PUMPR016	VOC	Edwards E2M2
PUMPR017	SVOC	G1099-80023
RAD01	RADIOCHEM	Protean Gas Flow Prop Counter model MPC 9604
RAD02	RADIOCHEM	Protean Gas Flow Prop Counter model MPC 9604
RAD03	RADIOCHEM	Beckman Liquid Scintillation Counter Model LS6500
RAD05	RADIOCHEM	Ludlum Measurements Inc. MODEL 3 / Wand Model 44-9
RAD06	RADIOCHEM	Ludlum Measurements Inc. MODEL 3 / Wand Model 44-9
RAD07	RADIOCHEM	Ludlum Model 375/2 Area Monitor
REF001	SC	Heatcraft Inc. Model: ACM090AE
REF003	SC	Kenmore Model: 253.60722000

Instrument	Department	Description
REF005	SC	Kenmore Model: 253.60721006
REF006	SC	Kenmore Model: 253.60722000
REF013F	ORGANIC PREP	Kenmore Model: 253.28052806
REF016	ORGANIC PREP	GE Model: TBX18BADGRAA
REF017	MICROBIOLOGY	Kenmore Model: 253.60722000
REF018	MICROBIOLOGY	Kenmore Model: 253.60722000
REF019	MICROBIOLOGY	Kenmore Model: 833233450400
REF020	ORGANIC PREP	Beverage Air Model: ER48-1AS
REF021	MICROBIOLOGY	Kenmore Model: 253.60722000
REF022	ORGANIC PREP	Kenmore Model: 253.60722000
REF024	_DISPOSED	Oil & Grease
REF025	ORGANIC PREP	Larkin Model: LOA6135AB
REF026	_DISPOSED	SVOC sample double door
REF030	VOC	Kenmore Model: 253.60722000
REF031	_DISPOSED	VOC samples
REF032	METALS	Kenmore Model: 253.60722011
REF033	ORGANIC PREP	Kenmore Model: 253.68802015
REF033F	ORGANIC PREP	Kenmore Model: 253.68802015
REF034	VOC	True Model: GDM-49-LD
REF035	ORGANIC PREP	Kenmore Model: 253.28042808
REF036	VOC	Kenmore Model: 255.20602110
REF037	VOC	Kenmore Model: 253.70722410
REF038	_DISPOSED	Kenmore Model: 253.60412411
REF038F	_DISPOSED	Kenmore Model: 253.60412411
REF039	WETCHEM	True Model:GDM-72-HC-LD
REF040	ORGANIC PREP	True Model: GDM-49-LD
REF041	SC	True Model: GDM-49-LD
REF042	SC	True Model: GDM-49-LD
REF043	ORGANIC PREP	True Model: GDM-49-LD
REF044F	SC	Kenmore Model: 253.28042808
REF045F	SC	Kenmore Model: 253.28042807
REF046F	ORGANIC PREP	Fisher Scientific ISOTEMP Model 525F
REF048	ORGANIC PREP	Frigidaire Electrolux FFRU17B2QWD
REF049	ORGANIC PREP	True GDM-47-HC-LD
REF050	SC	True GDM-72-HC-TSL01
REF051	SVOC	Frigidaire FFTR1835VW0
REF052	SC	Avantco 178GDC49HCB
REF053	SC	True GDM-69-HC-LD 3 door
SHAKE01	_VARIOUS	Environmental Express Rotary Shaker for TCLP
SHAKE02	_VARIOUS	Associated Design Rotary Shaker for TCLP
SHAKE03	INORGANIC PREP	Assoc. Design ZHE Extractor model 3745
SHAKE04	INORGANIC PREP	Assoc. Design ZHE Extractor model 3745
SHAKE05	INORGANIC PREP	Glas-Col Separatory funnel shaker 4-positions
SHAKE06	UNASSIGNED	WS Tyler shaker for sieve testing model RX-29
SHAKE07	METALS	Eberbach Flat shaker for STLC
SHAKE08	MICROBIOLOGY	Q Instruments Bioshake IQ
SOILEX01	ORGANIC PREP	Sonics & Materials sonicator model Vibra Cell
SOILEX02	ORGANIC PREP	Dionex Accelerated Solvent Extractor Model ASE200
SONIC01	SVOC	Branson Ultrasonic cleaner model 2510
SONIC02	SVOC	Fisher Scintific Ultrasonic cleaner Model FS20

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Instrument	Department	Description
SONICO3	ORGANIC PREP	Sonics & Materials Inc / MODEL VC750
SONICO4	ORGANIC PREP	VWR Ultrasonic Cleaner 07043-092
SONICO5	ORGANIC PREP	Fisher Scientific Ultrasonic Cleaner FS60
SPE10	ORGANIC PREP	Caliper/Dionex Cart. SPE Extractor model Autotrace
SPE12	ORGANIC PREP	Thermofisher Cart. SPE Extractor model Autotrace
SPE13	ORGANIC PREP	Supelco SPE manifold model Visiprep 24
SPE14	ORGANIC PREP	FMS Turbo Trace ABN
SPE15	ORGANIC PREP	Horizon Technologies SPE-DEX3100
SPE15_Controller	ORGANIC PREP	Horizon Technologies Controller
SPE15_SOLV1	ORGANIC PREP	N-Hexane Tank
SPE15_SOLV2	ORGANIC PREP	Methanol Tank
SPE16	ORGANIC PREP	PromoChrom Technologies SPE-03
SPE18	ORGANIC PREP	Supelco SPE manifold model Visiprep 24
SPE19	ORGANIC PREP	Supelco SPE manifold model Visiprep 24
SPE20	ORGANIC PREP	Supelco SPE manifold model Visiprep 12
SPE21	ORGANIC PREP	Supelco SPE manifold model Visiprep 24
SPE22	ORGANIC PREP	PromoChrom Technologies SPE-03
SRV.BKCI111	ADMIN	Backup Server 1 (Dell PowerEdge T320)
SRV.BKCI112	ADMIN	Backup Server 2 (FC5WS EVO)
SRV.DCCI111	ADMIN	Domain Controller 1 (Dell PowerEdge 2950)
SRV.DCCI112	ADMIN	Domain Controller 2 (Dell PowerEdge 2950)
SRV.EXCI111	ADMIN	VHCI112
SRV.SQLCI111	ADMIN	VHCI112
SRV.SSCI111	ADMIN	VHCI111
SRV.TRCI111	ADMIN	Temperature Reader Server
SRV.UPSCI101	ADMIN	APC Smart-UPS 3000VA DLA3000RM2U
SRV.UPSCI102	ADMIN	APC Smart-UPS 3000VA DLA3000RM2U
SRV.VHCI111	ADMIN	Virtual Host (DELL Power Edge R720xD)
SRV.VHCI112	ADMIN	Virtual Host (DELL PowerEdge R720xD)
SRV.WEBCI111	ADMIN	VHCI111
T-0052	MICROBIOLOGY	Ertco
T-0056	MICROBIOLOGY	ERTCO 1003-3BLS
T-0103	_STORAGE	ERTCO I-310-3S
T-0117	RADIOCHEM	57MM IMM ASTM
T-0142	MICROBIOLOGY	ThermCo Products ACC713BLS
T-0145	MICROBIOLOGY	Durac Plus B60600-110
T-0182	WETCHEM	Fisher Traceable 15-081-101
T-0183	WETCHEM	Fluke 62 Max +
T-0185	METALS	Block Heater 35mm Immersion
T-0186	RADIOCHEM	Fisherbrand
T-0187	MICROBIOLOGY	H-B Instrument
T-0188	MICROBIOLOGY	H-B Instrument
T-0195	MICROBIOLOGY	H-B Precision Frio-Temp
T-0196	MICROBIOLOGY	H-B Precision Frio-Temp
T-0197	MICROBIOLOGY	H-B Precision Frio Temp
T-0201	WETCHEM	VWR Traceable Lollipop Model: 15551-004
T-0202	WETCHEM	VWR Traceable Lollipop Model: 15551-004
T-0203	WETCHEM	VWR Traceable Lollipop Model: 15551-004
T-0204	MICROBIOLOGY	H-B Instrument B610010400
T-0208	SC	FRIO-Temp B60210-1700

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Instrument	Department	Description
T-0210	METALS	VWR 620-0823
T-0211	WETCHEM	VWR Traceable
T-0213	WETCHEM	VWR Block Heater 35mm
T-0215	MICROBIOLOGY	Fisherbrand Precision Frio-Temp
T-0216	RADIOCHEM	VWR 0-200 C
T-0218	METALS	VWR 0-200 C
T-0223	WETCHEM	VWR
T-0224	WETCHEM	VWR
T-0227	WETCHEM	AA02
T-0228	WETCHEM	PH13
T-0229	WETCHEM	PH01
T-0233	MICROBIOLOGY	H-B Precision Frio-Temp
T-0235	MICROBIOLOGY	Thermco ACCI310S
T-0237	MICROBIOLOGY	Thermco ACCI310S
T-0238	MICROBIOLOGY	Thermco ACCI310S
T-0240	MICROBIOLOGY	VWR 0-50 89095-820
T-0241	METALS	Block Heater 35mm immersion
T-0242	ORGANIC PREP	Block Heater 35mm Immersion
T-0243	MICROBIOLOGY	ACC80135 1mm
T-0244	MICROBIOLOGY	ACC80135 1mm
T-0245	WETCHEM	VWR 0-200
T-0246	RADIOCHEM	VWR 0-200
T-0248	METALS	VWR 10-45
T-0249	WETCHEM	Quincy Lab Inc. 76mm/1mm
T-0251	_STORAGE	Etekcity Lasergrip 1080
T-0252	WETCHEM	LT300 Sixth Sense
T-0256	MICROBIOLOGY	Durac
T-0257	MICROBIOLOGY	VWR
T-0259	WETCHEM	Omega Model: HH911T
T-0260	WETCHEM	Omega Model HH911T
T-0261	METALS	VWR Block Heater 35mm
T-0262	SC	VWR Traceable
T-0264	METALS	VWR 0-200
T-0265	MICROBIOLOGY	VWR U69368
T-0266	SC	VWR Traceable IR Thermometer
T-0267	MICROBIOLOGY	Thermco ACII310S
T-0269	SC	VWR Traceable IR 36934-174
T-0272	METALS	Subdivision Tomyko 76mm immersion
T-0274	METALS	VWR Easy Read
T-0275	MICROBIOLOGY	MadgeTech HiTemp 140-1
T-0276	RADIOCHEM	76MM IMM Sargent-Welch
T-0277	METALS	Thermco ACC6471S 1mm
T-0278	SC	VWR Traceable IR 36934174
T-0279	SC	VWR Traceable IR 36934174
T-0280	METALS	Double Safe 0-150C
TC003	SC	REF048
TC004	SC	REF041
TC005	SC	REF050
TC009	VOC	REF034
TC010	VOC	REF037

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Instrument	Department	Description
TC011	VOC	REF036
TC012	LC	REF038
TC013	_VARIOUS	REF051
TC014	_VARIOUS	REF035
TC016	_VARIOUS	REF013
TC017	WETCHEM	REF016F
TC022	MICROBIOLOGY	REF017
TC025	ORGANIC PREP	REF022
TC026	ORGANIC PREP	REF040
TC029	_DISPOSED	REF021
TC030	ORGANIC PREP	REF033F
TC031	ORGANIC PREP	REF033
TC034	ORGANIC PREP	REF005
TC035	SC	REF044F
TC037	SC	REF001
TC039	VOC	REF030
TC041	MICROBIOLOGY	REF019
TC043	ORGANIC PREP	REF046F
TC048	SC	REF039
TC049	ORGANIC PREP	REF043
TC050	SC	REF042
TC051	SC	REF003
TC052	MICROBIOLOGY	INC03
TC053	MICROBIOLOGY	WB09
TC054		INC06
TC055		INC06R
TC056		INC04
TC058		INC12T
TC059		INC12B
TC060		INC13T
TC061		INC13B
TC063		WB08
TC064		WB02
TC065		REF045F
TC066	MICROBIOLOGY	REF021
TC067	ORGANIC PREP	REF025
TC068	ORGANIC PREP	REF048
TC069	WETCHEM	INC14
TC071		INC05
TC072		WB06
TC073		REF032
TC074		REF049
TC075		REF018
TC076		INC07
TC077		REF016
TC079	ORGANIC PREP	REF020
TDS01	LC	TDSTestr Low 0 to 1990 ppm
TIMER1	MICROBIOLOGY	VWR 62344904
TIMER2	MICROBIOLOGY	SP Bel-Art Durac Timer 617003700
TOC02	TOC-TOX	Shimadzu TOC-LCPH with Solids Module SSM-5000A



Instrument	Department	Description
TOC02_SSM	METALS	Shimadzu SSM-5000A
TOX01_AM	METALS	Mitsubishi Model TXA-03
TOX02	TOC-TOX	Mitsubishi TOX-300
TOX02_ABC	METALS	Mitsubishi ABC-210
TRUCK01	_DISPOSED	Toyota Pickup truck model Tacoma 2006
TRUCK02	_DISPOSED	Toyota Pickup truck model Tacoma 2010
TRUCK03	FIELD	Nissan NV200 2015
TURB01	WETCHEM	HF Scientific Turbidimeter Model Micro100
UVVIS04	WETCHEM	Hach UV-Vis Spectrophotometer Model DR/6000EDU
VORTEX01	_VARIOUS	Thermo Scientific M16715
WASH01	_VARIOUS	Miele Labroatory glassware washing machine
WB02	MICROBIOLOGY	Blue M water bath incubator model MW-1120A-1
WB05	_DISPOSED	Labline Water bath model Magnestrir
WB06	MICROBIOLOGY	Fisher Isotemp Water Bath incubator model 120
WB07	WETCHEM	Boekel Industry
WB08	MICROBIOLOGY	Precision Water Bath Incubator model 265
WB09	MICROBIOLOGY	Precision Microprocessor controlled 280 series
WB10	UNASSIGNED	Sheldon MFG Inc. Model SWB15
WB11	MICROBIOLOGY	M20 Lauda D-6970
WB12	UNASSIGNED	Intertek RWB8L
WPU01	VOC	Puretec Carbon filter VOC Room
WPU02	_VARIOUS	Millipore RO plus filters Model MilliQ w/UV Light
WPU03	_VARIOUS	Millipore Model MilliQ
WPU05	_VARIOUS	Carbon filter VOC Room
WPU06	_VARIOUS	Barnstead model E-Pure
WPU07	_VARIOUS	Watts Premier 4 stage
WPU08	_VARIOUS	Millipore Milli-Q gradient A10
WPU09	_VARIOUS	Carbon Filter Balance Room
WPU10	_VARIOUS	Barnstead Model E-pure
WPU11	_VARIOUS	Millipore Milli-Q gradient A10

## Appendix I

### Summary of Sampling Container, Preservation and Holding Time Requirements

#### Weck Laboratories, Inc. - Sampling Guidelines

Test Name	Matrix	Bottle Type	Bottle size	Preservative (chill all <sup>(1)</sup> , unless noted)		Preservative Volume		Holding Time until start of analysis	Analytical Technique	Analytical Method	Field Blank Required
				Unchlorinated Water (Raw)	Chlorinated Water (Treated)	Unchlorinated	Chlorinated				
1,4-Dioxane_SPE	Water	Amber Glass	2 X 500mL (*)	None	Thiosulfate	None	40mg Na2S2O3	7 days	GC/MS Isot. Dil.	EPA 8270M	
1,4-Dioxane-522	Water	Amber Glass	2X125ml	Sulfite/Bisulfite	Sulfite/Bisulfite	6.5mg Sodium Sulfite, 125mg Sodium Bisulfite (in field)	6.5mg Sodium Sulfite, 125mg Sodium Bisulfite (in field)	28 Days	GC/MS	EPA 522	
1,4-Dioxane_SPME	Water	Amber Glass	2 X 40mL	None	Thiosulfate	None	25mg Na2S2O3	28	GC/MS	EPA 8270M	
Alcohols	Water	Glass	1 x 40 mL	None	None			14 days	Dir. Inj./FID	EPA 8015B	
Alcohols, UCMR4	Water	Glass	1 x 125 mL	Sodium Sulfite, Sodium Bisulfite	Sodium Sulfite, Sodium Bisulfite	6.25mg Sodium Sulfite, 125mg Sodium Bisulfite	6.25mg Sodium Sulfite, 125mg Sodium Bisulfite	14 days	SPE/GC/MS	EPA 541	
Aldehydes	Water	Amber Glass	2 x 40 mL	NH <sub>4</sub> C1CuSO <sub>4</sub>	NH <sub>4</sub> C1CuSO <sub>4</sub>	15mg of each	15mg of each	7 Days	GC/ECD	EPA 556	
Aldehydes	Water	Amber Glass	500 mL (*)	None	None			3 days	HPLC-UV	EPA 8315	
Aldehydes <sup>(1)</sup>	Soil/Solid	Glass	4 oz	None	None			3 days	HPLC-UV	EPA 8315	
Alkalinity, Total	Water	Poly	250 mL	None	None			14 Days	Titration	SM2320B	
Anions by IC (F <sup>-</sup> , Cl <sup>-</sup> , SO <sub>4</sub> <sup>2-</sup> )	Water	Poly	60 mL	None	None			28 days	IC	EPA 300.0	
Anions by IC (NO <sub>3</sub> <sup>-</sup> , NO <sub>2</sub> <sup>-</sup> , PO <sub>4</sub> <sup>3-</sup> )	Water	Poly	60 mL	None	None			48 hours	IC	EPA 300.0	
Arsenic speciation	Water	Poly	125 mL	EDTA/acetic acid	EDTA/acetic acid	0.5ml EDTA / 0.25ml Acetic	0.5ml EDTA / 0.25ml Acetic	14 Days	Resin-ICP/MS	EPA 200.8	
Asbestos-Sub	Water	Poly	1 L	None	None			48 Hours	TEM	CPK 100-112- Sub	
Bacteria-Coliform - solid/sludge/soil	Solid/solid	Glass-Sterile	4 oz	None	None			N/A	MTF	SM 9221B	
Bacteria-Coliform - Wastewater	Water	Poly-Sterile	125 mL	Thiosulfate	Thiosulfate	1g	1g	6 hours	MTF	SM 9221B	
Bacteria-Coliform - Drinking Water	Water	Poly-Sterile	125 mL	Thiosulfate	Thiosulfate	1g	1g	24 Hours	Colony P/A or enumeration	SM 9223B	
Bacteria-Enterococcus - Wastewater	Water	Poly-Sterile	125 mL	Thiosulfate	Thiosulfate	1g	1g	6 Hours	Enumeration Quantifray	Enterolert	
Bacteria-Heterotrophic Plate Count	Water	Poly-Sterile	125 mL	Thiosulfate	Thiosulfate	1g	1g	6 Hours	Pour Plate Method	SM 9215B	
Bacteria-Heterotrophic Plate Count-Sim Plate	Water	Poly-Sterile	125 mL	Thiosulfate	Thiosulfate	1g	1g	6 Hours	Sim Plate Method	SM 9215E	
BOD, Carbonaceous	Water	Poly	1 L	None	None			48 Hours	DO Probe	SM 5210	
Bromate	Water	Poly	60 mL	EDA	EDA	40µl	40µl	28 Days	IC	EPA 300.1	
Bromide	Water	Poly	60 mL	None	None			28 Days	IC	EPA 300.0	
Bromide-Low Level	Water	Poly	60 mL	EDA	EDA	40µl	40µl	28 Days	IC	EPA 300.1	
Carbamates	Water	Amber VOA	1 x 40 mL	Thiosulfate/ K Dihydrogen Citrate	Thiosulfate/ K Dihydrogen Citrate	5mg Thiosulfate / 500mg K Dihydrogen Citrate	5mg Thiosulfate / 500mg K Dihydrogen Citrate	28 days	HPLC	EPA 531.2	
Carbamates and Urea Pesticides	Water	Amber Glass	500mL	MCAA	MCAA	3mL	3mL	7	HPLC	EPA 8318	
Chlorate	Water	Poly	60 mL	EDA	EDA	40µl	40µl	28 Days	IC	EPA 300.1	
Chloride	Water	Poly	60 mL	None <sup>(1)</sup>	None <sup>(1)</sup>			28 Days	IC	EPA 300.0	
Chlorine Dioxide	Water	Amber Glass	250 mL	None	None			24 Hours	Colorimetric	SM 4500CL02D	
Chlorine Residual	Water	Amber Glass	250 mL	None	None			15 Minutes <sup>(2)</sup>	Colorimetric	SM 4500CL-G	
Chlorite	Water	Amber Glass	40 mL	EDA	EDA	40µl	40µl	14 Days	IC	EPA 300.1	
Chlorophyll-a	Water	Amber Poly	1 L	None				48 Hours	Spectrophotometric	SM 10200H	
Chromium-Hexavalent	Water	Poly	60 mL	(NH <sub>4</sub> ) <sub>2</sub> SO <sub>4</sub> buffer	(NH <sub>4</sub> ) <sub>2</sub> SO <sub>4</sub> buffer	0.6mL	0.6mL	14 days	IC	EPA 7199	
Chromium, Hexavalent (low-level)	Water	Poly	60 mL	(NH <sub>4</sub> ) <sub>2</sub> SO <sub>4</sub> buffer	(NH <sub>4</sub> ) <sub>2</sub> SO <sub>4</sub> buffer	0.6mL	0.6mL	14 days	IC	EPA 218.6	
Chromium, Hexavalent (low-level)	Water	Poly	60 mL	(NH <sub>4</sub> ) <sub>2</sub> SO <sub>4</sub> buffer	(NH <sub>4</sub> ) <sub>2</sub> SO <sub>4</sub> buffer	0.6mL	0.6mL	14 days	IC	EPA 218.7	
Cyanide	Water	Amber Glass	500 mL	NaOH	NaOH	2 pellets	2 pellets	14 Days	FIA-Colorimetric	EPA 335.2/335.4	
Cylindrospermopsin & Anatoxin-a - UCMR4	Water	Amber Glass	2 X 40ml	Sodium Bisulfate, Ascorbic Acid	Sodium Bisulfate, Ascorbic Acid	40mg Sodium Bisulfate, 4mg Ascorbic Acid	40mg Sodium Bisulfate, 4mg Ascorbic Acid	28 Days	LC-ESI-MS-MS	EPA 545	
Dioxin-DW	Water	Amber Glass	2 X 1L	None	None			365	GC/MS/MS	EPA 1613	

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Test Name	Matrix	Bottle Type	Bottle size	Preservative (chill all <sup>(*)</sup> , unless noted)		Preservative Volume		Holding Time until start of analysis	Analytical Technique	Analytical Method	Field Blank Required
				Unclorinated Water (Raw)	Chlorinated Water (Treated)	Unchlorinated	Chlorinated				
Dioxin-Sub	Water	Amber Glass	2 x 1 L	None	None			1 year	HR GC/MS	EPA 1613/6290	
Dioxin-Sub	Sol/Solid	Glass	4 oz	None	None			1 year	HR GC/MS	EPA 820/6290	
Diquat/Paraquat	Water	Amber poly	1 L	None / H <sub>2</sub> SO <sub>4</sub>	Thiosulfate	2mL (if Bioactivity is present)	100 mg	7 Days	HPLC	EPA 549.2	
Disinfection by-products	Water	Glass	2 x 60 mL	NH <sub>4</sub> Cl/Buffer	NH <sub>4</sub> Cl/Buffer	0.8g	0.8g	14 days	GC/ECD	EPA 551.1	
Diuron	Water	Amber Glass	1 L <sup>(*)</sup>	None	None			7 days	HPLC/UV	EPA 632	
Diuron-UCMR	Water	Amber Glass	1 L <sup>(*)</sup>	CuSO <sub>4</sub> /Trizma	CuSO <sub>4</sub> /Trizma	0.25g CuSO <sub>4</sub> / 2.5g Trizma	0.25g CuSO <sub>4</sub> / 2.5g Trizma	14 days	HPLC/UV	EPA 532	
Endothal	Water	Amber Glass	250 mL	None / HCL	Thiosulfate	1mL (if Bioactivity is present)	25mg	7 days	GCMS	EPA 548.1	
Ethanol	Water	Glass	1 x 40 mL	None	None			14 Days	Dir. Inj/FID	EPA 8015B	
Explosives	Water	Amber Glass	1 L <sup>(*)</sup>	None	Thiosulfate		100mg	7 days	HPLC/UV	EPA 8330A	
Explosives	Sol/Solid	Glass	4 oz	None	None			14 days	HPLC/UV	EPA 8330A	
Fluoride	Water	Poly	250 mL	None <sup>(?)</sup>	None <sup>(?)</sup>			28 Days	IC	EPA 300.0	
Fumigants EDB and DBCP	Water	Glass	2 x 40 mL	None	Thiosulfate		3mg	14 Days	GC/ECD	EPA 504.1	Per Event
Fumigants EDB and DBCP	Water	Amber VOA	2 X 40 mL <sup>(*)</sup>	Ascorbic / Maleic	Ascorbic / Maleic	25mg Ascorbic / 200mg Maleic	25mg Ascorbic / 200mg Maleic	14 Days	GC/MS	EPA 524.3	Per Event
General Minerals (excluding metals)	Water	Poly	2 L	None	None			Various	Wet Chem methods	various	
General Minerals (metals only)	Water	Poly	250 mL	HNO <sub>3</sub> <sup>(3)</sup>	HNO <sub>3</sub> <sup>(3)</sup>	1mL pH<2	1mL pH<2	6 Months	ICP-AES	EPA 200.7	
General Physical (Color, Odor, Turbidity)	Water	Glass	500 mL	None	None			24 Hours	Wet Chem methods	various	
Geosmin & MIB	Water	Amber Glass	1 x 40 mL	Sodium Omadine	Sodium Omadine	80µL	80µL	7 Days	GC/ECD	SM 6040D	
Glyphosate	Water	Amber Glass	1 x 40 mL	None	Thiosulfate		3mg	14 Days	HPLC	EPA 547	
H <sub>2</sub> S Breakthrough Capacity	Carbon	Poly/Glass	1L/lb	None	None			180 Days	NA	ASTM D6646-03	
HAA <sub>s</sub>	Water	Amber Glass	125 mL <sup>(*)</sup>	NH <sub>4</sub> Cl	NH <sub>4</sub> Cl	12.5mg	12.5mg	14 days	GC/ECD	EPA 552.3	
HAA <sub>s</sub> -Formation Potential	Water	Amber Glass	1 L	None	None			14 days	GC/ECD	SM 5710B/EPA 552.3	
Herbicides-DW	Water	Amber Glass	125 mL <sup>(*)</sup>	None	Sulfite		10mg	14 days	GC/ECD	EPA 515.4	
Herbicides-GW	Water	Amber Glass	2 x 1 L <sup>(?)</sup>	None	Thiosulfate		100mg	7 Days	GC/ECD	EPA 8151A	
Herbicides-Soil	Sol/Solid	Glass	4 oz	None	None			14 Days	GC/ECD	EPA 8151A	
Hormones	Water	Amber Glass	2 X 500ml	Thiosulfate / 2-mercaptoypyridine-1-oxide	Thiosulfate / 2-mercaptoypyridine-1-oxide	40mg Thiosulfate / 32.5 mg 2-mercaptoypyridine-1-oxide	40mg Thiosulfate / 32.5 mg 2-mercaptoypyridine-1-oxide	28 Days	LC/MS/MS	EPA 539	
Iodide	Water	Poly	60 mL	None	None			28 Days	LC/MS/MS	EPA331/332	
Mercury	Water	Poly	250 mL	HNO <sub>3</sub>	HNO <sub>3</sub>		1mL pH<2	28 Days	Cold Vapor AAS	EPA 245.1/7470	
Mercury LL	Water	Glass	250 mL	KBrO3/KBr/HCL	KBrO3/KBr/HCL			48hrs / 90 after pres	LL by CVAFS	EPA 1631E	Per Event
Mercury	Sol/Solid	Glass jar	4 oz.	None	None			28 Days	Cold Vapor AAS	SW 7471	
Metals	Water	Poly	250 mL	HNO <sub>3</sub> <sup>(3)</sup>	HNO <sub>3</sub> <sup>(3)</sup>	1mL pH<2	1mL pH<2	6 Months	ICP/MS or ICP-AES	EPA 200.8/200.7	
Metals	Seawater	Poly	1L	HNO <sub>3</sub> <sup>(3)</sup>	HNO <sub>3</sub> <sup>(3)</sup>	2mL pH<2	2mL pH<2	6 Months	ICP/MS	EPA 1640	
Metals	Sol/Solid	Glass/Poly	4 oz	None	None			6 Months	ICP/MS or ICP-AES	EPA 6010B/6020	
Methanol	Water	Glass	1 x 40 mL	None	None			14 Days	Dir. Inj/FID	EPA 8015B	
Microcystins, Total - UCMR4	Water	Amber Glass	1 X 125ml	Sodium Thiosulfate	Sodium Thiosulfate	12.5mg Na2S2O3	12.5mg Na2S2O3	14 Days	Elsa	EPA 546	
Microcystins and Nodularin - UCMR4	Water	Amber Glass	2 X 500 mL	Trizma, 2-Chloroacetamide, Ascorbic Acid, EDTA	Chloroacetamide, Ascorbic Acid, EDTA	2.85g Trizma, 1g 2-chloroacetamide, 50mg Ascorbic, 0.18g EDTA	2.85g Trizma, 1g 2-chloroacetamide, 50mg Ascorbic, 0.18g EDTA	28 Days	LC/MS/MS	EPA 544	
NDMA/Nitrosamines	Water	Amber Glass	2 x 500mL <sup>(*)</sup>	None	Thiosulfate	45mg	45mg	7 days	GC/MS/Cl SIM	EPA1625M	
Nitrate	Water	Poly	250 mL	None	None			48 Hours	IC or FIA	EPA 300.0/353.2	
Nitrite	Water	Poly	250 mL	None	None			48 Hours	IC or FIA	EPA 300.0/353.2	
Nitrite+Nitrate as N	Water	Poly	250 mL	H <sub>2</sub> SO <sub>4</sub>	H <sub>2</sub> SO <sub>4</sub>	1mL pH<2	1mL pH<2	28 Days	FIA-Colorimetric	EPA353.2	
Nitrogen, Total Kjeldahl (TKN)	Water	Poly	250 mL	H <sub>2</sub> SO <sub>4</sub>	H <sub>2</sub> SO <sub>4</sub>	1mL pH<2	1mL pH<2	28 Days	FIA-Colorimetric	EPA 351.2	
Nitrogen-Ammonia	Water	Poly	250 mL	H <sub>2</sub> SO <sub>4</sub>	H <sub>2</sub> SO <sub>4</sub>	1mL pH<2	1mL pH<2	28 Days	FIA-Colorimetric	EPA 350.1	
Nitrogen-Ammonia in ww with distillation	Water	Poly	250 mL	H <sub>2</sub> SO <sub>4</sub>	H <sub>2</sub> SO <sub>4</sub>	1mL pH<2	1mL pH<2	28 Days	FIA-Colorimetric	EPA 350.1	

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Test Name	Matrix	Bottle Type	Bottle size	Preservative (chill all <sup>(*)</sup> , unless noted)		Preservative Volume		Holding Time until start of analysis	Analytical Technique	Analytical Method	Field Blank Required
				Unchlorinated Water (Raw)	Chlorinated Water (Treated)	Unchlorinated	Chlorinated				
Nitrosamines	Water	Amber Glass	2 x 500mL (*)	Thiosulfate	Thiosulfate	45mg	45mg	7 days	GC/MS/Ci SIM	EPA 521, 1625M	
Oil and Grease	Water	Glass	1 L (*)	HCl	HCl	3mL	3mL	28 Days	Gravimetric	EPA1664	
Organotins (tributyltin)	Water	Glass	1 L (*)	HCL	HCL	3mL	3mL	14 Days	GC/MS	SM 6710B	
Organotins (tributyltin)	Solid	Glass	4 oz	None	None			14 Days	GC/MS	SM 6710M	
Oxygen, Dissolved	Water	Poly Opaque	2 X 300 mL	None	None			15 Minutes <sup>(*)</sup>	O <sub>2</sub> Probe	SM 4500-OG	
PBDEs	Water	Amber Glass	2 x 1 L (*)	None	None			14 days	GC/MS SIM	EPA 1614M	
Perchlorate	Water	Poly	60 mL	None <sup>(*)</sup>	None <sup>(*)</sup>			28 Days	IC	EPA 314	
Perchlorate - Low Level by LC/MS/MS	Water	Poly Sterile	125 mL	Sterile field filtration	Sterile field filtration			28 Days	LC/MS/MS	EPA 331/332	
Perchlorate in soils	Soil	Glass jar	4 oz	None	None			28 Days	IC	EPA 314M	
PCBs - GW	Water	Amber Glass	2 x 1 L (*)	None	Thiosulfate		100 mg	7 Days	GC/ECD	EPA 6082	
Pesticides- Organophosphorus	Water	Amber Glass	2 x 1 L (*)	None	Thiosulfate		100 mg	7 Days	GC/NPD	EPA 8141	
Pesticides- Chlorinated (DW)	Water	Amber Glass	2 x 1 L (*)	HCL	Sulfite/HCL	3mL HCL	50mg Sulfite/3mLHCL	14 days	GC/ECD	EPA 508.1	
Pesticides- Chlorinated WW/GW	Water	Amber Glass	2 x 1 L (*)	None	Thiosulfate		100 mg	7 Days	GC/ECD	EPA 608.3/8081	
Pesticides- N/P -DW	Water	Amber Glass	2 x 1 L (*)	None	Thiosulfate		100 mg	14 days	GC/ NPD	EPA 507/8141	
Pesticides/Ahericides	Water	Amber VOA	2 X 40mL	Thiosulfate	Thiosulfate	3mg	3mg	7	LC/MS/MS	EPA 8321A	
Pest/Herb/Organics	Water	Amber VOA	2 X 40mL	Thiosulfate	Thiosulfate	3mg	3mg	14	LC/MS/MS	EPA 538	
PFAS LCMS 1633	Water	HDPE	2 X 125 mL	None	None			28 days	LC/MS/MS	EPA 1633	Per Sample
PFAS LCMS 533	Water	HDPE	2 X 250 mL	Ammo Acetate	Ammo Acetate	0.25g	0.25g	28 days	LC/MS/MS	EPA 533	Per Sample
PFAS LCMS DS 537M	Water	HDPE/PP	2 X 15mL	None	None			21 days	LC/MS/MS	EPA 537M	
PFAS DW Comp 537.1	Water	HDPE	2 X 250 mL	Trizma	Trizma	1.25g	1.25g	14 days	LC/MS/MS	EPA 537.1	Per Sample
PFAS LCMS Non-DW 537M	Water	HDPE	2 X 125ml	None	None			21 days	LC/MS/MS	EPA 537M	Per Sample
PFAS LCMS 537M	Solid	HDPE	1 X 100 mL	None	None			21 days	LC/MS/MS	EPA 537M	
Phenolics	Water	Amber Glass	1 X 500mL	H <sub>2</sub> SO <sub>4</sub>	H <sub>2</sub> SO <sub>4</sub>	2mL pH<2	2mL pH<2	28 days	Wet Chem Methods	EPA 420.4	
Phosphate, Ortho	Water	Poly	250 mL	None	None			48 hours	FIA-Colorimetric	EPA 365.1	
Phosphate, Total	Water	Poly	250 mL	H <sub>2</sub> SO <sub>4</sub>	H <sub>2</sub> SO <sub>4</sub>	1mL pH<2	1mL pH<2	28 Days	FIA-Colorimetric	EPA 365.1	
Polyaromatic Aromatics (PNAAs) Low level	Water	Amber Glass	2 x 1 L (*)	None	Thiosulfate		80mg	7 Days	GC/MS SIM mode	EPA 625.1/8270SIM	
Polyaromatic Aromatics (PNAAs) Low level	soil/solid	Glass jar	4 oz	None	None			14 Days	GC/MS SIM Mode	EPA 8270	
PPCP Alkyl Phenols	Water	Amber Glass	1 L (*)	H <sub>2</sub> SO <sub>4</sub>	H <sub>2</sub> SO <sub>4</sub>	4mL	4mL	28 Days	GC/MS SIM	In-house	
PPCP Isotope Dilution	Water	Amber VOA	2 X 40mL	Sodium azide, Ascorbic acid	Sodium azide, Ascorbic acid	8mg NaN3, 4mg AA	8mg NaN3, 4mg AA	21 Days	LC/MS/MS	EPA 1694M	
Radiological-Gross Alpha	Water	Poly	1 L	None <sup>(*)</sup>	None <sup>(*)</sup>			6 Months	GPC	EPA 900.0	
Radiological-Gross Alpha high TDS	Water	Poly	1 L	None <sup>(*)</sup>	None <sup>(*)</sup>			6 Months	Coprecipitation-GPC	SM7110C	
Radiological-Gross Beta	Water	Poly	1 L	None <sup>(*)</sup>	None <sup>(*)</sup>			6 Months	GPC	EPA 900.0	
Radiological-Radium 226-Sub	Water	Poly	1 L	HNO <sub>3</sub>	HNO <sub>3</sub>	4mL	4mL	6 Months		EPA 903.0/903.1 Sub	
Radiological-Radium 228-Sub	Water	Poly	2 L	HNO <sub>3</sub>	HNO <sub>3</sub>	8mL	8mL	6 Months		RA-05 Sub	
Radiological-Radon 222-Sub	Water	Glass	2 x 60 mL	None	None			4 Days (DW), 8 Days (WW)	LSC	SM7500-RN	
Radiological-Stronium 90-Sub	Water	Poly	1 L	HNO <sub>3</sub>	HNO <sub>3</sub>	4mL	4mL	6 Months		EPA 905.0 sub	
Radiological-Tritium-Sub	Water	Amber Glass	2x125 mL	None	None			6 Months	LSC	EPA 906.0 sub	
Radiological-Uranium-Sub	Water	Poly	250 mL	HNO <sub>3</sub>	HNO <sub>3</sub>	1mL pH<2	1mL pH<2	6 Months	ICP-MS	EPA 200.8	
Semivolatile Organics EPA 530 - UCMR4	Water	Amber Glass	2 X 1L	Acetic Acid, EDTA, Diazoxydyl Urea, Toluene	Acetic Acid, EDTA, Diazoxydyl Urea, Toluene	0.10g Acetic acid, 0.05g EDTA, 1g C8H14N4O7, 7.75g Toluene	0.10g Acetic acid, 0.05g EDTA, 1g C8H14N4O7, 7.75g Toluene	14 Days	GC/MS	EPA 530	

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Test Name	Matrix	Bottle Type	Bottle size	Preservative (chill all <sup>(1)</sup> , unless noted)		Preservative Volume		Holding Time until start of analysis	Analytical Technique	Analytical Method	Field Blank Required
				Uncchlorinated Water (Raw)	Chlorinated Water (Treated)	Unchlorinated	Chlorinated				
Semivolatile Organics (BNA) - GW or WW	Water	Amber Glass	2 x 1 L (*)	None	Thiosulfate		100mg	7 Days	GC/MS	EPA 625.1/8270C	
Semivolatile Organics (BNA) - Soil/Solid	Soil/solid	Glass jar	4 oz	None	None			14 Days	GC/MS	EPA 8270C	
SVOCs - OPP (DW)	Water	Amber Glass	2 x 500mL(*)	Thiosulfate	Thiosulfate	40mg Thiosulfate	40mg Thiosulfate	14 days	GC/MS	EPA 525.2 OPP	
SVOCs - OPP	Water	Amber Glass	2 x 500mL(*)	Thiosulfate	Thiosulfate	40mg Thiosulfate	40mg Thiosulfate	7 days	GC/MS	EPA 625.1 OPP	
SVOCs - (DW)	Water	Amber Glass	2 x 1 L (*)	HCl	Thiosulfate/HCl	3mL HCl	100mg SO3 / 3mL HCl	14 days	GC/MS	EPA 525.2	
Solids, Settleable	Water	Poly	1 Gallon	None	None			48 Hours	Gravimetric	SM 2540F	
Solids, TDS	Water	Poly	1 L	None	None			7 Days	Gravimetric	SM2540C	
Solids, Total	Water	Poly	1 L	None	None			7 Days	Gravimetric	SM2540B	
Solids, TSS	Water	Poly	2 L	None	None			7 Days	Gravimetric	SM 160.2	
Solids, TVS	Water	Poly	1 L	None	None			7 Days	Gravimetric	EPA 160.4	
Solids, VSS	Water	Poly	1 L	None	None			7 Days	Gravimetric	SM 2540E	
Sulfate	Water	Poly	60 mL	None	None			28 Days	IC	EPA 300.0	
Sulfide, Dissolved	Water	Poly	250 mL	ZnAc	ZnAc	0.25mL (5 drops)	0.25mL (5 drops)	7 Days	Colorimetric	SM4500S2D	
Sulfide, Total	Water	Poly	250 mL	ZnAc/NaOH	ZnAc/NaOH	0.25mL (5 drops)/ 2-3 pellets	0.25mL (5 drops)/ 2-3 pellets	7 Days	Colorimetric	SM4500S2D	
Surfactants (MBAS)	Water	Poly	500 mL	None	None			48 Hours	Colorimetric	SM5540C	
THMs	Water	Amber Glass	3 x 40 mL	Thiosulfate	Thiosulfate	25mg	25mg	14 Days	GC/MS	EPA 524.2	
TOC (Combustion)	Water	Amber VOA	2 X 40mL	HCl	HCl	0.5mL	0.5mL	28 Days	EPA 415.3, 5310B	SM 5310B	
TOX	Water	Amber Glass	500 mL	H <sub>2</sub> SO <sub>4</sub>	H <sub>2</sub> SO <sub>4</sub>	2mL	2mL	14 Days	Pyrolysis/ Colorimetric	SM5320B/EPA 9020	
Gasoline -TPH	Water	Glass	3 x 40 mL	HCl	Thiosulfate/HCl	0.5mL	25mg/5 drops HCl	14 Days	P&T/GCMS	EPA 8260	
Gasoline -TPH soil/solid	Soil/solid	Glass/Jar/other <sup>(2)</sup>	4 oz/other <sup>(3)</sup>	None	None			14 Days	P&T/GCMS	EPA 8260	
Diesel/Oil-TPH	Water	Amber Glass	2 X 250 mL (*)	HCl	Thiosulfate/HCl	0.5mL HCl	25mg/ 0.5HCL	7 Days	GC/FID	EPA 8015B	
Diesel/Oil-TPH	Soil/Solid	Glass jar	4 oz	None	None			14 Days	GC/FID	EPA 8015B	
Turbidity	Water	Glass	500 mL	None	None			48 Hours	Nephelometric	EPA 180.1	
UV254	Water	Amber Glass	250 mL	None	None			48 Hours	Spectrophotometric	SM 5910B	
Volatile Organics-DW	Water	Glass	3 x 40 mL	HCl	Ascorbic/HCl	0.5mL	25mg/5 drops HCl	14 Days	GC/MS	EPA 524.2	
Volatile Organics	Water	Glass	3 x 40 mL	None	Thiosulfate		25mg	3 Days	GC/MS	EPA 624.1	
Volatile Organics	Water	Glass	3 x 40 mL	HCl	Thiosulfate/HCl	0.5mL	25mg/5 drops HCl	7 Days	GC/MS	SM 8260B	
Volatile Organics 1,2,3-TCP	Water	Amber Glass	3 x 40 mL	Ascorbic	Ascorbic	25mg Ascorbic	25mg Ascorbic	14 days	GC/MS Isot. Dil.	EPA 524.2SIM	
Volatile Organics Acrolein/Acrylonitrile	Water	Glass	3 x 40 mL	None	Thiosulfate	None	25mg Na2S2O3	3 Days	GC/MS	EPA 624.1/8260B	
Volatile Organics-Soil/Solid	Soil/solid	Glass/Jar/other <sup>(2)</sup>	4 oz/other <sup>(3)</sup>	None	None			14 Days	GC/MS	EPA 8260B	

**Notes:**

- (1): Formaldehyde and acetaldehyde only.
- (2): This is field test; if requested to be performed at the lab it will be done ASAP.
- (3): Samples can be received unpreserved and preserved at the lab at least 24 hours before analysis.
- (4): Al, Sb, As, Ba, Be, B, Cd, Ca, Na, Mg, K, Cr, Co, Cu, Fe, Pb, Li, Mn, Mo, Ni, Se, Ag, Sr, Ti, Ti, V, Zn
- (5): Preserve at the lab with Nitric acid to pH <2 and wait 24 hours before analysis starts.
- (6): No headspace required or preferably EPA Method 5035 sample collection. Consult the laboratory for special requirements.
- (7): No cooling required.
- (8): Chill samples to < 6°C, but above freezing.
- (9): Needs extra bottles for QA/QC for certain projects.

## Appendix J

### Chemistry

#### Method Validation

Reference methods are validated by determining the MDL (LOD) and/or LOQ by procedures outlined below, and determining precision and bias by using the demonstration of capability procedures.

Non-standard methods, laboratory-designed/developed methods, standard methods used outside their intended scope are validated prior to their use. The validation shall be as extensive as is necessary to meet the needs of the given application or field of application using quality control procedures and acceptance criteria that are consistent with those of similar standard methods or technology. At a minimum, quality control procedures must address:

- *Calibration;*
- *Interferences/contamination (method blanks, calibration blanks);*
- *Analyte identification;*
- *Selectivity;*
- *Sensitivity (MDL and/or LOQ);*
- *Precision and Bias.*

Based on the intended use, the laboratory establishes quality control acceptance criteria for precision, accuracy, selectivity (if applicable). In addition, the action level (compliance level, project decision level, etc.) is used to establish the LOQ and/or MDL.

For both reference and non-standard methods, laboratories shall participate in proficiency testing programs. The results of these analyses shall be used to evaluate the ability of the laboratory to produce acceptable data.

##### a) Method Detection Limit (MDL)

The laboratory MDL procedure, unless following a mandated test method or procedure, at a minimum, shall incorporate language addressing the following requirements:

- *the MDL shall reflect current operating conditions;*
- *the MDL determination shall incorporate the entire analytical process, including sample preservations;*
- *the MDL determination shall include data from low level spikes and routine method blanks prepared and analyzed over multiple days;*
- *results from spiked samples used in the MDL determination shall meet qualitative identification criteria in the method, and shall be above zero;*

- *the MDL procedure shall include criteria for and evaluation of false positive rates in routine method blanks;*
- *the MDL shall be determined for the analytes of interest in each test method in the quality system matrix of interest in which there are neither target analytes nor interferences at a concentration that would impact the results or the MDL shall be performed in the sample matrix of interest.*

NOTE: One option is to follow EPA's MDL procedure specified at 40 CFR Part 136 Appendix B. Another option is to follow MUR's MDL procedure, EPA 821-R-16-006, December 2016.

#### Ongoing verification of the MDL

- *At a minimum, ongoing verification of the MDL shall include assessments of spikes at or below the LOQ and of method blanks. A minimum of one*  
(1) verification spike and one (1) blank shall be analyzed on each instrument during each quarter in which samples are being analyzed and results are being reported below the LOQ. The criteria listed in Section 1.5.2.1.1 shall be met for ongoing verification over the course of a year.
- *If the method is altered in a way other than routine maintenance and the change can be expected to elevate the detection limit, then a spike at or below the LOQ concentration and a blank shall be prepared and analyzed. If the spike at the LOQ concentration gives a result meeting qualitative identification criteria above zero, and the blank gives a result below the MDL, then the MDL is verified. If not, the MDL shall be re-determined.*
- *In the event that verification fails, the laboratory shall perform a new MDL study within thirty (30) calendar days.*

When a new MDL is determined, the laboratory shall verify that the LOQ value must be greater than the MDL. The LOQ must also be at or above the spiking concentration and the lowest calibration concentration. If it is not, the laboratory shall raise the LOQ value to at least above the MDL.

#### b) Limit of Detection (LOD) (DoD-ELAP requirement)

The MDL shall be used to determine the LOD for each analyte and matrix as well as for all preparatory and cleanup methods routinely used on samples.

Each preparation method listed on the scope of accreditation (DoD-ELAP) must have quarterly LOD verifications. However, not all possible combinations of preparation and cleanup techniques are required to have LOD verifications. If LOD verifications are not performed on all combinations, the laboratory must base the LOD verifications on the worst-case basis (preparation method with all applicable cleanup steps).

After each MDL determination, the laboratory must establish the LOD by spiking a quality system matrix at a concentration of at least 2 times but no greater than four times the DL. This spike concentration establishes the LOD and the concentration at which the LOD shall be verified. It is specific to each suite of analyte, matrix, and method (including sample preparation). The following requirements apply to the initial LOD establishment and to the LOD verifications:

- *The apparent signal to noise (S/N) ratio at the LOD must be at least three and the results must meet all method requirements for analyte identification (e.g., ion abundance, second column confirmation, or pattern recognition). For data systems that do not provide a measure of noise, the signal produced by the verification sample must produce a result that is at least three standard deviations greater than the mean Method Blank concentration. This is initially estimated based on a minimum of four Method Blank analyses and later established with a minimum of 20 Method Blank results.*
- *If the LOD verification fails, then the laboratory must repeat the MDL determination and LOD verification or perform and pass two consecutive LOD verifications at a higher spike concentration and set the LOD at the higher concentration.*
- *The laboratory shall maintain documentation for all DL determinations and LOD verifications.*
- *The MDL and LOD must be reported for all analyte-matrix-methods suites, unless it is not applicable to the test or specifically excluded by project requirements.*

In situations where methods are setup and used on an infrequent basis, the laboratory may choose to perform LOD verifications on a one per batch basis, prior to sample analysis, in lieu of quarterly verification. All verification data shall be in compliance, reported, and available for review.

c) Limit of Quantitation (LOQ)

If a mandated test method or applicable regulation includes protocols for determining quantitation limits, they shall be followed. The procedure used for determining the LOQ shall be documented by the laboratory. The laboratory shall select an LOQ for each analyte, consistent with the needs of their clients, and at least above the MDL. An LOQ is required for each quality system matrix of interest, technology, method, and analyte, except for any component or property for which spiking solutions are not available or a quantitation limit is not appropriate, such as pH, color, odor, temperature, dissolved oxygen, or turbidity.

- *Each selected LOQ shall be verified through analysis of initial verification samples. An initial verification sample consists of a spiked matrix blank at or below the selected LOQ.*
- *All sample preservation, processing and analysis steps performed for routine sample analysis shall be included in the LOQ verification testing.*

- *The LOQ must be at or above the lowest corresponding calibration standard concentration with the exception of methods using a single point calibration.*
- *The laboratory shall establish acceptance criteria for accuracy for the LOQ verification spikes.*

#### Initial verification of the LOQ

When first establishing an LOQ, or when an LOQ concentration has been selected that is lower than the concentration of the LOQ verification spikes previously performed, an initial verification shall be performed as follows:

- *A minimum of seven (7) blanks spiked at or below the LOQ concentration shall be processed through all steps of the method, including any required sample preservation. Both preparation and analysis of these samples shall include at least three (3) batches on three (3) separate days.*

NOTE: Spiking slightly below the LOQ may help ensure that the results are also suitable for MDL determination.

NOTE: If spiked blanks have been analyzed in order to generate a MDL, the results may be used to perform the initial verification of the LOQ.

- i. *If there are multiple instruments that will be assigned the same LOQ, then these spiked blanks shall be distributed across all of the instruments.*
  - ii. *A minimum of two (2) spiked blanks prepared and analyzed on different days shall be tested on each instrument.*
- *Existing data may be used if compliant with the requirements for at least three (3) batches, generated within the last two (2) years and representative of current operations.*
  - *The LOQ is verified if the following criteria are met:*
    - i. *All results are quantitative (above zero and meet the qualitative identification criteria of the method (e.g., recognizable spectra, signal to noise requirements, and presence of qualifier ions).*

If a result from an LOQ verification sample is not above zero and/or does not meet the qualitative identification criteria in the method, the problem shall be corrected and the verification repeated, or the LOQ verification shall be repeated at a higher concentration.

- ii. *Recovery of each analyte is within the laboratory established accuracy acceptance criteria.*
- iii. *The LOQ is at least above the established MDL and at or above the spiking concentration.*

If the LOQ is less than the MDL, the LOQ shall be raised to at least above the MDL.

NOTE: It is not necessary to repeat the LOQ verification at a higher concentration when it is necessary to raise the LOQ to above the MDL.

- *The laboratory shall document the results of the initial LOQ verification as described in SOP MIS032.*

#### Ongoing verification of the LOQ

The laboratory shall prepare and analyze a minimum of one (1) LOQ verification sample spiked at the same concentration as the initial LOQ verification on each instrument during each quarter in which samples are being analyzed for each quality system matrix, method, and analyte.

- *Results of each LOQ verification sample analysis shall be evaluated at the time of the testing and shall meet the qualitative identification criteria in the method and laboratory Standard Operating Procedure (SOP) and the quantitated result shall be greater than zero. If a continuing LOQ verification test does not meet this requirement, the laboratory shall take corrective action. Corrective action shall be either (i) raising the spiking level (and the quantitation limit if the spiking level is above it) and repeating the initial verification study, or (ii) correcting method or instrument performance and repeating the verification test one time. In the event of second failure of a quarterly verification sample, the quantitation limit shall be raised and the initial study repeated within thirty (30) calendar days.*

NOTE: If no analysis was performed in a given year, the verification of the MDL/LOQ is not required, but a new initial MDL/LOQ verification shall be performed prior to analysis of client samples.

#### d) Precision and Bias

Precision is the degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves. Precision is usually expressed as standard deviation, variance, or range, in either absolute or relative terms.

Bias is the systematic error that contributes to the difference between the mean of a significant number of test results and the accepted reference value.

Precision and bias using non-reference, modified reference or laboratory-developed methods are established using the procedure outlined below and compared to the criteria established by the client (when requested), the method, or the laboratory.

Precision and bias are determined by processing samples through all phases of the method (sample preparation, cleanup, analysis, etc.) and are evaluated across the analytical calibration range of the method. This study is performed for all quality system matrices for which the test is to be used.

Precision is determined by the demonstration of capability procedure described below.

Precision is assessed through the calculation of relative percent differences (RPD) and relative standard deviations (RSD) for replicate samples. For analyses that have detectable levels of analytes (for example inorganic analyses), laboratory precision is usually assessed through the analysis of a sample/sample duplicate pair and field duplicate pairs. For analyses that frequently show no detectable levels of analytes (e.g., organic analyses), the precision is usually determined through the analysis of matrix spike/matrix spike duplicates (MS/MSD) and field duplicate samples.

d) **Selectivity**

Selectivity is the capability of a test method or instrument to respond to a target substance or constituent in the presence of non-target substances (EPA-QAD).

The laboratory evaluates selectivity through procedures defined in the test method SOPs.

Absolute retention time and relative retention time aid in the identification of components in chromatographic analyses and to evaluate the effectiveness of a column to separate constituents. Acceptance criteria for retention time windows are documented in the corresponding method SOP or in the SOP ORG074.

A confirmation shall be performed to verify the compound identification when positive results are detected on a sample from a location that has not been previously tested by the laboratory. Such confirmations shall be performed on organic tests such as pesticides, herbicides, or acid extractable or when recommended by the analytical test method except when the analysis involves the use of a mass spectrometer. Confirmation is required unless stipulated in writing by the client. The confirmation is documented in the bench sheets and/or the LIMS.

When reporting data for methods that require analyte confirmation using a secondary column or detector, project-specific reporting requirements shall be followed. If project-specific requirements have not been specified, the reporting requirements in the method are followed. If the method does not include reporting requirements, the results from the primary column or detector are reported, unless there is a scientifically valid and documented reason for not doing so.

Results that are unconfirmed, or for which confirmation was not performed, shall be identified in the test report, using appropriate data qualifier flags, and explained in the narrative. The laboratory shall use method-specified acceptance

criteria for analyte confirmation. If method-specific criteria do not exist, the analyte confirmation is performed as specified in SOP MIS052.

Other procedures for evaluating selectivity are described in the analytical methods, which may include mass spectral tuning, ICP inter-element interference checks, sample blanks, spectrochemical absorption or fluorescence profiles, co-precipitation evaluations, and electrode response factors. Acceptance criteria for mass spectral tuning are contained in the corresponding analytical method SOPs.

## Demonstration of Capability

Demonstration of Capability (DOC): A procedure to establish the ability of the analyst to generate analytical results of acceptable accuracy and precision.

Before reporting any data with a given method, a satisfactory DOC is performed. Thereafter, each analyst demonstrates continuing proficiency through the procedures outlined in Ongoing Demonstration of Capability.

The laboratory has several methods that meet the requirements of EL-V1M4-2016, Section 1.6.1 of the TNI Standard (methods that have been in use at the laboratory for over one year prior to applying for accreditation and there has been no significant changes in instrument type, personnel or test method) and is demonstrating capability through the use of on-going DOCs (see below). Records to indicate that the requirements of the cited paragraph have been met are available for review.

a) Initial Demonstration of Capability (IDOC)

An IDOC is performed:

- *Before using any method*
- *Each time there is a change in instrument type, personnel or method and*
- *If the laboratory or analysts has not performed the method in a twelve-month period.*

The IDOC(s) for each analyst is documented electronically as a LIMS generated DOC summary report in the QC\IDCs folder under each analytical method with different tabs for different analysts. The document identifies the analyst(s) involved in preparation and/or analysis; matrix; analyte(s), class of analyte(s), or measured parameter(s); the method(s) performed; the laboratory-specific SOP used for analysis (including revision number); the date(s) of analysis; and a summary of the results used to calculate the mean recovery and standard deviations.

All raw data, preparation records, and calculations for each IDOC are retained and are available for review.

For new methods that need to be implemented, a validation procedure is documented before they are used in the laboratory. Appropriate method validation techniques include the following:

- *Testing of reference standards or reference materials;*
- *Comparison of results to those achieved using other validated, standard methods*
- *Interlaboratory comparisons.*

When the above techniques are not feasible, the following options are used:

- *Systematic assessment of factors that could influence the result; and/or*
- *Assessment of the precision and bias of the result based on the science of the method and practical experience.*

When the method specifies a procedure to be followed, only those procedures will be used. If no procedures are specified the laboratory uses its own procedure, which is documented in SOP MIS034.

b) Ongoing Demonstration of Capability

After the demonstration of capability is completed, on-going proficiency is maintained and demonstrated at least annually. Each analyst is expected to consistently meet the QC requirements of the method, the laboratory SOP, client requirements and/or the TNI Standard. Ongoing DOCS are documented in spreadsheets under each department in the QC\IDC folder of the computer system and all records related to the demonstration are retained.

The laboratory uses any of the following procedures to demonstrate ongoing DOC:

- a) *acceptable performance of a blind sample (single blind to the analyst). This can be PT sample or other blind sample prepared by QA personnel or obtained from external source. Successful analysis of a blind performance sample on a similar method using the same technology (e.g., GC/MS volatiles by purge and trap for Methods 524.2, 624 or 8260) would only require documentation for one of the test.;*
- b) *another initial DOC; perform this as per SOP MIS034*
- c) *at least four (4) consecutive laboratory control samples with acceptable levels of precision and accuracy, as specified by the method or using lab generated acceptance limits. The laboratory shall tabulate or be able to readily retrieve four (4) consecutive passing laboratory control samples (LCS) for each method for each analyst each year; The four LCSs used for demonstration of ongoing capability must be obtained within a period of no more than 3 months and the date of the last one used as demonstration of ongoing capability.*
- d) *a documented process of analyst review using quality control (QC) samples. QC samples can be reviewed to identify patterns for individuals or groups of analysts and determine if corrective action or retraining is necessary; or*
- e) *if a) through d) are not technically feasible, then analysis of real-world samples with results within predefined acceptance criteria (as defined by the laboratory or method) shall be performed.*

## Calibration

Section 23.2.2 includes information on calibration of support equipment. This Section covers calibration of analytical equipment.

Initial instrument calibration and continuing instrument calibration verification are an important part of ensuring data of known and documented quality. If more stringent calibration requirements are included in a mandated method or by regulation, those calibration requirements override any requirements outlined here or in laboratory SOPs. Generally, procedures and criteria regarding instrument calibrations are provided in the SOPs for each analytical method.

### J.1.1 Initial Instrument Calibration

- **Records:**

Initial instrument calibration includes calculations, integrations, acceptance criteria, and associated statistics. All instruments are calibrated in accordance with the respective SOPs and/or method of analysis. The typical calibration procedure consists of an initial calibration, performed by running a series of standards and calculating the response by using either the response factors or by linear or polynomial regression analysis. This is followed by a calibration verification. All calibration procedures are thoroughly documented.

Sufficient raw data records are collected to allow reconstruction of the initial instrument calibration. These include, at a minimum, calibration date, test method, instrument, analysis date, analyte names, analysts signature or initials, concentration and response, calibration curve or response factor, or unique equation or coefficient used to reduce instrument responses to concentration. Calibration date and expiration date (when recalibration is due) is documented for equipment requiring calibration, where practicable (see Section 23.1).

- **Number of Standards and Concentrations:**

If the reference or mandated method does not specify the number of calibration standards to use, the minimum number is three, not including blanks or a zero standard.

For instrumentation where single point calibration is recommended by manufacturer's instructions, such as with some ICP and ICP/MS technologies (with a zero and single point calibration), the following apply:

- a) *For single point plus zero blank calibrations, the zero point and the single point standard are analyzed prior to the analysis of samples, and the linear range of the instrument established by analyzing a series of standards, one of which is at the lowest quantitation level.*
- b) *Zero blank and single point calibration standards are analyzed with each analytical batch for methods where they are specified.*

- c) A standard corresponding to the limit of quantitation is analyzed with each analytical batch and must meet established acceptance criteria when using single point plus zero blank calibrations.
- d) The linearity of single point plus zero blank calibrations is verified at a frequency established by the method or the manufacturer.

The lowest calibration standard is the lowest concentration for which quantitative results can be reported without qualification. The lowest calibration standard is at or below the Limit of Quantitation (LOQ) and is greater than the Limit of Detection. Results that are less than the LOQ are considered to have increased uncertainty, and are either reported with a qualifier code or explained in the case narrative.

The highest calibration standard is the highest concentration for which quantitative results can be reported. Data reported exceeding the highest calibration standard without dilutions is considered to have increased uncertainty and are reported with a qualifier code or reanalyzed and explained in the case narrative.

- **Evaluation, Verification and Corrective Action**

All initial instrument calibrations are verified with a standard obtained from a second source or lot if the lot can be demonstrated from the manufacturer as prepared independently from other lots. Traceability shall be to a national standard, when commercially available. If not commercially available, it can be prepared in-house.

The following is the criteria used for the acceptance of an initial calibration, unless specified differently in the analytical methods, the criteria used are appropriate to the calibration technique:

- Use the average response factor (RF) if the percent relative standard deviation (%RSD) of the points is less than 20%. In this case, linearity through the origin is assumed.
- If the %RSD is greater than 20%, linearity through the origin cannot be assumed and a linear regression, a weighed linear regression or a non-linear regression can be used. The acceptance criteria for linear regression are a coefficient of correlation (*r*) equal or greater than 0.99 and for non-linear regression the coefficient of determination (COD) must be equal or greater than 0.98. In both cases, the curve is not to be forced through the origin nor is the origin used as another point. The sample results must be within the first and last standards.
- The number of data points to construct the initial calibration curve shall be obtained from the analytical method employed. If no criteria are specified, the laboratory shall construct initial calibration curves using a minimum of five calibration points for organic analytes and three calibration points for inorganic analytes and IH samples. All reported target analytes and surrogates (if applicable) shall be included in the initial calibration. Reported results for all target analytes shall be quantified using a multipoint calibration curve; surrogates are calibrated according to each analytical method

requirements, unless there are project specific requirements in which case these are followed. It is not permitted to exclude calibration points unless there is technical justification for it.

- *The lowest standard shall be at or below the reporting limit for the method and at or below the regulatory limit/decision level if known by the laboratory.*
- *The lowest calibration standard must be above the detection limit. Noted exceptions: for turbidity analysis and for instrument technology (such as ICP or ICP/MS) with validated techniques from manufacturers or methods employing standardization with a zero point and a single point calibration standard:*
  - *Prior to the analysis of samples, the zero point and single point calibration must be analyzed and the linear range of the instrument must be established by analyzing a series of standards, one of which must be at the lowest quantitation level.*
  - *Zero point and single point calibration standard must be analyzed with each analytical batch.*
  - *A standard corresponding to the lowest quantitation level must be analyzed with each analytical batch and must meet established acceptance criteria.*
  - *The linearity is verified at a frequency established by the method and/or the manufacturer.*
  - *If a sample within an analytical batch produces results above its associated single point standard then one of the following should occur:*
    - *analyze reference material at or above the sample value that meets established acceptance criteria for validating the linearity; dilute the sample such that the result falls below the single point calibration concentration (when sufficient sample volume permits);*
    - *Report the data with an appropriate data qualifier and/or explain in the case narrative.*
    - *For metals analysis with a single-point calibration, a sample result may be reported up to 90% of the linear dynamic range (LDR). All samples exceeding this value must be diluted to within the LDR.*

Where appropriate, the laboratory has manual integration procedures (SOP MIS039) that are adhered to when evaluating calibration data.

Any samples that are analyzed after an unacceptable initial calibration are re-analyzed or the data are reported with qualifiers, appropriate to the scope of the unacceptable condition (see Section 12 – “Control of Nonconforming Environmental Testing”).

Quantitation is always determined from the initial calibration unless the test method or applicable regulations require quantitation from the continuing instrument calibration verification.

Corrective actions are performed when the initial calibration results are outside acceptance criteria. Calibration points are not dropped from the middle of the curve unless the cause is determined and documented. If the cause cannot be

determined, the calibration curve is re-prepared. If the low or high calibration point is dropped from the curve, the working curve is adjusted and sample results outside the curve are qualified.

Specific analyses' calibrations are checked more frequently. Some instruments, such as TOX analyzers have built-in calibration features. The internal calibration of these instruments is monitored daily for accuracy.

Some calibration curves for spectrophotometric methods are very stable over a long period of time, however it is the policy of the Laboratory to perform a new initial calibration curve even if the continuing calibration check meets specified criterion, in any of the following events:

- *At least every three years*
- *When the instrument is moved to a different location*
- *If any maintenance that can affect the calibration has been performed*
- *If the analysts judges it necessary for special projects or different range of calibration*

Spectrophotometers are also subject to wavelength calibration which it shall be performed at least annually, according to the procedure described by the manufacturer in the instrument manual or other documentation.

#### J.1.2 Continuing Instrument Calibration

- **Records**

The calculations and associated statistics for continuing instrument calibration are included or referenced in the test method SOP.

Sufficient raw data records are retained to allow reconstruction of the continuing instrument calibration verification. Continuing instrument calibration verification records connect the continuing verification date to the initial instrument calibration.

Where appropriate, the laboratory has manual integration procedures (SOP MIS039) that are adhered to when evaluating calibration data.

- **Frequency**

Calibration is verified for each compound, element, or other discrete chemical species. For multi-component analytes, such as aroclors, chlordane, toxaphene, or total petroleum hydrocarbons, a representative chemically related substance or mixture is used.

Calibration verifications are performed:

- *at the beginning and end of each analytical batch, except for instances when an internal standard is used. For methods employing internal standards, one verification is performed at the beginning of the analytical batch. Some methods have more frequent CCV requirements (see specific SOPs). Many inorganic methods require the CCV to be analyzed after every 10 samples.*

- whenever it is expected that the analytical system may be out of calibration or might not meet verification acceptance criteria.
  - when the time period for calibration or the most recent calibration verification has expired.
  - for all analytical systems that have a calibration verification requirement. Requirements can be found in the method SOPs. Many inorganic methods require the CCV to be analyzed after every 10 samples.
- **Evaluation, Verification and Corrective Actions**

The validity of the initial calibration is verified prior to sample analysis by use of a continuing instrument calibration verification (CCV) standard.

The acceptance criteria, unless something different is specified in the corresponding SOPs or QAPP, is the following:

- *The concentration of the CCV standard shall be from the low-calibration standard to the midpoint of the calibration range;*
- *The source of the CCV standard should be the same as the source for the initial calibration standard(s); and*
- *The baseline for evaluating the CCV is the initial calibration curve, except for the evaluation of retention times in organic chromatographic methods, which may be based on comparison with the retention times in the initial CCV.*
- *The actual acceptance ranges for CCVs are specified in each method SOP*

When the method specifies that CCVs shall be run at specific sample intervals, the count of these samples shall be of field samples only.

When a CCV fails to fall within acceptance limits then CCVs and all samples analyzed since last successful calibration verification are re-analyzed. If reanalysis is not possible, the client is notified prior to reporting data associated with a noncompliant CCV and if data are reported, appropriate qualifiers are used and if further clarification is needed this is explained in the case narrative. The exception to this is when a CCV fails with high bias, but the field samples remain not detected.

Corrective action is initiated for CCV results that are outside of acceptance criteria (see Section 12 – "Control of Nonconforming Environmental Testing").

#### J.1.3 Unacceptable Continuing Instrument Calibration Verifications

If routine corrective action for continuing instrument calibration verification fails to produce a second consecutive (immediate) calibration verification within acceptance criteria, then a new calibration is performed or acceptable performance is demonstrated after corrective action with two consecutive calibration verifications.

For any samples analyzed on a system with an unacceptable calibration, some results may be useable if qualified and under the following conditions:



- a) *If the acceptance criteria are exceeded high (high bias) and the associated samples are below detection, then those sample results that are non-detects may be reported as non-detects.*
- b) *If the acceptance criteria are exceeded low (low bias) and there are samples that exceed the maximum regulatory limit, then those exceeding the regulatory limit may be reported.*

## Appendix K Microbiology

### Method Validation

Microbiological methods are validated according to the following:

- a) *Accuracy – The methods are validated for accuracy by using at least one (1) known pure reference culture at the anticipated environmental conditions, and compare the method results to that of a reference method.*
- b) *Precision – Is validated by performing at least ten (10) replicate analyses with both the proposed and reference method, using the target microorganisms of choice. The results shall show that the methods are not statistically different.*
- c) *Selectivity (sensitivity) – By verifying all responses in at least ten (10) samples using mixed cultures that include the target organism(s), and at varying concentrations (microbial identification testing or equivalent processes may be used). Calculate the number of false positive and false negative results.*

The laboratory will compare the results of these tests with the data quality objectives stated by the client. The data from the above tests must be equal to or better than the stated DQOs. A statement comparing the client DQOs against the above-mentioned QC measures will be included in the validation records.

The laboratory will confirm the validation by participating in a proficiency test program with acceptable results and retain the records of the validation for five years past the date of last use of the method.

## Demonstration of Capability (DOC)

Demonstration of Capability: A procedure to establish the ability of the analyst to generate analytical results of acceptable accuracy and precision.

Before reporting any data with a given method, a satisfactory initial DOC (IDOC) is performed. Thereafter, each analyst will demonstrate continuing proficiency through the procedures outlined in Ongoing Demonstration of Capability.

The laboratory has several methods that meet the requirements of EL-V1M5-2009, Section 1.6.1, paragraph 3 of the TNI Standard and is demonstrating capability through the use on-going DOCS (see below). Records to indicate that the requirements of the cited paragraph have been met are available for review. The methods are: Total Coliforms and E. Coli by SM9223B, Total Coliforms by SM9221B, Fecal Coliforms by SM9221E and Heterotrophic Plate Count by SM9215B.

- a) Initial Demonstration of Capability (IDOC)

An IDOC is performed:

- *before using any method;*
- *each time there is a change in instrument type, personnel or method; and*
- *if the laboratory or analysts has not performed the method in a twelve-month period.*

The IDOC(s) for each analyst is documented electronically in the QC\IDC folder of the computer system. The document identifies the analyst(s) involved in preparation and/or analysis; matrix; analyte(s), class of analyte(s), or measured parameter(s); the method(s) performed; the laboratory-specific SOP used for analysis (including revision number); the date(s) of analysis; and a summary of the results used to calculate the mean recovery and standard deviations.

All raw data, preparation records, and calculations for each DOC are retained and are available for review.

When methods specify a procedure to be followed, only those procedures will be used. If no procedures are specified the laboratory uses its own procedure, which is documented in the corresponding SOP.

The procedure for IDOC for Microbiological methods is as follows:

- a) *The target organism(s) is diluted in a volume of clean quality system matrix (a sample in which no target organisms or interferences are present at concentrations that will impact the results of a specific method). This matrix shall be sterile phosphate or sterile peptone solution unless specified by the manufacturer. Prepare at least four (4) aliquots at the concentration specified, or if unspecified, to the countable range for plate methods or working range for most probable number (MPN) type methods.*
- b) *At least four (4) aliquots shall be prepared and analyzed according to the method either concurrently or over a period of days.*
- c) *Using all of the results, convert these results to logarithmic values, then calculate the mean recovery and standard deviation of the log converted results in the appropriate reporting units for each organism of interest. When it is not possible to determine mean and standard deviations, such as for presence/absence, the laboratory shall assess performance against established and documented criteria.*
- d) *For qualitative tests, acceptable performance in a blind study, either internally or externally generated, may be used to meet this Standard, provided that the study consists of a minimum of a blank, a negative culture, and a positive culture for each target organism or metabolite (e.g. b-glucuronidase in E. coli.).*
- e) *Compare the information from c) above to the corresponding acceptance criteria for precision and accuracy in the method (if applicable) or in laboratory-generated acceptance criteria (if there are not established mandatory criteria). If all parameters meet the acceptance criteria, the analysis of actual samples may begin. If any one of the parameters does not meet the acceptance criteria, the performance is unacceptable for that parameter.*
- f) *When one or more of the tested parameters fail at least one of the acceptance criteria, the analyst shall proceed according to i) or ii) below.*

- i) *Locate and correct the source of the problem and repeat the initial DOC for all parameters of interest beginning with b) above.*
- ii) *Repeat the initial DOC for all parameters that failed to meet criteria.*
- g) *Repeated failure, however, confirms a general problem with the measurement system. If this occurs, locate and correct the source of the problem and repeat the test for all organisms of interest beginning with b).*

The organisms used *Escherichia coli* for positive total coliform and fecal coliform bacteria source, *Enterobacter aerogenes* for positive total coliform and negative fecal coliform bacteria and *Pseudomonas aeruginosa* for negative total coliform and negative fecal coliform bacteria

For enumeration, since it is hard to determine the amount of bacteria in the source, a senior chemist or the Microbiology Technical Director makes a serial dilution of bacteria source and run it side by side with the chemist performing the IDOC; the results from the senior chemist are used as True Value.

For Heterotrophic Plate Count (HPC) real samples are used to perform IDOCs. The chemist performing the IDOC runs the samples side by side with a senior chemist or supervisor and record their findings in comparison to result of the senior chemist.

b) **Ongoing Demonstration of Capability**

After the demonstration of capability is completed, on-going proficiency is maintained and demonstrated at least annually. Each analyst is expected to consistently meet the QC requirements of the method, the laboratory SOP, client requirements and/or the TNI standard. Ongoing DOCS are documented as electronic files in spreadsheets located in the folder QC\IDC of the computer system, and all records related to the demonstration are retained.

The laboratory uses the following procedure to demonstrate ongoing DOC:

- a) *Performing another initial demonstration of capability*
- b) *Analysis of one sample or clean matrix that is fortified with a known quantity of the target organism, with results meeting the laboratory acceptance criteria for accuracy and, where applicable to the testing technique, also meeting the observational details expected for the presumptive, confirmed and completed phases defined in the method.*
- c) *Analysis of one sample in duplicate for each target organism and test, with results meeting the laboratory acceptance criterion for precision.*
- d) *Acceptable results for one-single-blind proficiency test sample for target organisms in each field of accreditation.*
- e) *Performance of an alternate adequate procedure for the field of accreditation, the procedure and acceptance criteria being documented in the laboratory's quality system.*
- f) *A documented process of analyst review using QC samples. QC samples can be reviewed to identify patterns for individuals or groups of analysts and determine if corrective action or retraining is necessary; or*

- g) if a) through f) are not technically feasible, then analysis of real-world samples with results within predefined acceptance criteria (as defined by the laboratory or method) shall be performed.

## Calibration

Section 23.2.2 includes information on calibration of support equipment. This section covers calibration of analytical equipment.

The laboratory has methods that describe how the support equipment such as conductivity meters, oxygen meters, pH meters, hygrometers, and other similar equipment are calibrated and verified. These are found in logbooks or as electronic records.

The laboratory is not currently using continuous monitors but if these monitors are used in the future they will be verified at least once per month. If the verification fails, an initial calibration is performed and verified. If the instrument is taken off-line, an initial calibration and verification is performed before returning to service.

### K.1.1 Specific Equipment Requirements

- *Autoclave*

The laboratory initially evaluates the performance of each autoclave before first use by establishing its functional properties and performance by the procedures described in SOP MIS031.

Autoclaves meet specified manufacturer's temperature tolerances. Pressure cookers shall not be used for sterilization of growth media.

With each use:

- *The laboratory ensures that the sterilization temperature is reached by using a maximum registering thermometer.*
- *The laboratory records date, contents, maximum temperature reached, pressure, time in sterilization mode, total run time (may be recorded as time in and time out) and analyst's initials.*
- *Temperature sensitive tape is used with the contents of each autoclave run to indicate that the autoclave contents have been processed.*

On a monthly basis, when the autoclave is in use, the laboratory verifies that the autoclave is effectively sterilizing the contents by using BT Sure Biological indicator, Geobacillus stearothermophilus, for steam sterilization at 121°C, kills in a normal cycle time as lactose based media.

The autoclave mechanical timing device is checked quarterly against a stopwatch and the actual time elapsed documented.

Autoclave maintenance, which is performed internally, is performed annually. The activities include a pressure check and verification of temperature device.

- **Volumetric Equipment**

Equipment with movable parts such as automatic dispensers, dispensers/diluters, and mechanical hand pipettes are verified for accuracy quarterly.

Equipment such as filter funnels, bottles, non-Class A glassware, and other containers with volumetric markings (including sample analysis vessels) are verified once per lot prior to first use. The volume of the disposable volumetric equipment, such as sample bottles, and disposable pipettes are checked once per lot. The verification is either volumetric or gravimetric depending on the volume measured, acceptance range is 5%.

- **UV instruments Used for Sanitization**

UV instruments for sanitation are not used in the lab. If put in operation they will be tested quarterly for effectiveness by using uvcide strips.

Bulbs would be replaced when the output is less than 70% of original for light tests or if count reduction is less than 99% for a plate containing 200 to 300 organisms.

- **Water Baths and Incubators**

The laboratory initially establishes the uniformity of temperature distribution in incubators and water baths by placing calibrated thermometer in different areas of the water batch or incubator.

On each day of use, the temperature of incubators and water baths is recorded twice a day, at least four hours apart.

- **Ovens Used for Sterilization**

Ovens are not currently used at the laboratory for sterilization. If they were used, they would be checked for sterilization effectiveness monthly with the appropriate biological indicator. Records would be maintained for each cycle that include date, cycle time, temperature, contents and analyst's initials

## Appendix L Radiochemistry

### Method Validation

Reference methods are validated by determining the minimum detectable activity as outlined below, and precision and bias using an initial demonstration of capability.

The laboratory will compare the results of these tests with the data quality objectives stated by the client. The data from the above tests must be equal to or better than the stated DQOs. A statement comparing the client DQOs against the above-mentioned QC measures will be included in the validation records.

The laboratory will confirm the validation by participating in a proficiency test program with acceptable results and retain the records of the validation for five years past the date of last use of the method.

#### a) Detectable Activity

##### 1. Minimum Detectable Activity (MDA)

The laboratory will determine the MDA of a method by a procedure that reflects instrument limitations and the intended data use. When the method requires a specific procedure for determining the MDA, only that procedure will be used.

MDAs are determined in samples that represent the quality system matrices to be evaluated. All sample processing/preparation steps and all determinative steps are used to validate the method for all targeted analytes. The representative quality system matrix will be free from the target analytes of interest or interfering analytes that impacts the MDA.

For all quality systems (except drinking water), the MDA represents the estimate of the smallest true activity (or activity concentration) of an analyte that ensure a 95% probability of detection.

For the Safe Drinking Water Act (SDWA) (drinking water quality system matrix), the MDA (SDWA "detection limit"), the MDA is equal to the concentration of analyte that can be counted with a precision of 100% at the 95% confidence level ( $1.96\sigma$  where  $\sigma$  is the standard deviation of the net counting rate of the sample). The SDWA detection limit (MDA) is equivalent to the concentration at which the relative standard deviation of the measurement due to counting statistics is  $1/1.96$ . The laboratory shall ensure that the determined MDA meets (or is lower than) the published detection limits published in 40 CFR Part 141.25.

#### b) Precision and Bias

Precision is the degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves.

Precision is usually expressed as standard deviation, variance, or range, in either absolute or relative terms.

Bias is the systematic error that contributes to the difference between the mean of a significant number of test results and the accepted reference value.

Precision and bias for non-reference, modified reference or laboratory-developed methods are established using the procedure outlined below and compared to the criteria established by the client (when requested), the method, or the laboratory.

Precision and bias are determined by processing samples through all phases of the method (sample preparation, cleanup, analysis, etc.). This study is performed for all quality system matrices for which the test is to be used.

The following is the procedure use to evaluate precision and bias:

1. *Analyze QC samples in triplicate containing the analytes of concern at or near the MDA, at a level near ten (10) times the MDA, and at a mid-range concentration.*
2. *Process these samples on different days as three (3) sets of samples through the entire measurement system for each analyte of interest.*
3. *Each day one QC sample at each concentration is analyzed. A separate method blank shall be subjected to the analytical method along with the QC samples on each of the three (3) days.*
4. *For each analyte, calculate the mean recovery for each day, for each level over days, and for all nine (9) samples. Calculate the relative standard deviation for each of the separate means obtained.*

The precision value that is determined is compared against uncertainty estimates. The precision at each testing level must be statistically greater than the maximum combined standard uncertainty of measurement at the testing level.

c) **Measurement of Uncertainty**

The laboratory will report the measurement uncertainty of all radioactive tests. The report will explain the uncertainty and will include:

- *An indication of whether the uncertainty is the combined standard uncertainty ("one sigma") or an expanded uncertainty; and*
- *If expanded, an indication of the coverage factor (k) and optionally the approximate level of confidence.*

The laboratory uses the a procedure to determine the uncertainty consistent with ISO Guide 98: 1995, Guide to the Expression of Uncertainty in Measurement (GUM), and The recommendations of Chapter 19 of the Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP) Volume I (EPA 402-B-04-001A), Volume II (EPA 402-B-04-001B), Volume III (EPA 402-B-04-001C), July 2004.

d) Selectivity

The laboratory will evaluate selectivity using the checks established in the method.

**L.2 Demonstration of Capability (DOC)**

Demonstration of Capability: A procedure to establish the ability of the analyst to generate analytical results of acceptable accuracy and precision.

Before reporting any data with a given method, a satisfactory initial DOC (IDOC) is performed. Thereafter, each analyst will demonstrate continuing proficiency through the procedures outlined in Ongoing Demonstration of Capability.

The laboratory has several methods that meet the requirements of EL-V1M4-2009, section 1.6.1 paragraph 3 of the TNI standard and is demonstrating capability through the use on-going DOCs (see below). Records to indicate that the requirements of the cited paragraph have been met are available for review. The methods are: EPA 900.0, SM7110C, EPA 20.8 and SM7500-Rn.

a) Initial Demonstration of Capability (IDOC)

An IDOC is performed:

- *Before using any method,*
- *Each time there is a change in instrument type, personnel or method, and*
- *If the laboratory or analysts has not performed the method in a twelve-month period.*

The IDOC(s) for each analyst is documented in QA folder. The document identifies the analyst(s) involved in preparation and/or analysis; matrix; analyte(s), class of analyte(s), or measured parameter(s); the method(s) performed; the laboratory-specific SOP used for analysis (including revision number); the date(s) of analysis; and a summary of the results used to calculate the mean recovery and standard deviations.

All raw data, preparation records, and calculations for each DOC are retained and are available for review.

When methods specify a procedure to be followed, only those procedures will be used. If no procedures are specified the laboratory uses its own procedure, as follows:

- a) *The analyte(s) will be diluted in a volume of clean quality system matrix (a sample in which no target analytes or interferences are present at concentrations that will impact the results of a specific method) sufficient to prepare four (4) aliquots at a laboratory specified concentration. Where gamma-ray spectrometry is used to identify and quantify more than one analyte, the laboratory control sample shall contain gamma-emitting radionuclides that represent the low (e.g., 241Am), medium (e.g., 137Cs)*

and high (e.g., 60Co) energy range of the analyzed gamma-ray spectra. As indicated by these examples, the nuclides need not exactly bracket the calibrated energy range or the range over which nuclides are identified and quantified.

- b) *At least four (4) aliquots shall be prepared and analyzed according to the method either concurrently or over a period of days.*
- c) *Using all of the results, calculate the mean recovery in the appropriate reporting units and the standard deviations of the population sample (in the same units) for each parameter of interest. When it is not possible to determine mean and standard deviations, such as for presence/absence and logarithmic values, the laboratory shall assess performance against established and documented criteria.*
- d) *Compare the information from (c) above to the corresponding acceptance criteria for precision and accuracy in the method (if applicable) or in laboratory-generated acceptance criteria (if there are not established mandatory criteria). If all parameters meet the acceptance criteria, the analysis of actual samples may begin. If any one of the parameters does not meet the acceptance criteria, the performance is unacceptable for that parameter.*
- e) *When one or more of the tested parameters fail at least one of the acceptance criteria, the analyst shall proceed according to i) or ii) below.*
  - i) *Locate and correct the source of the problem and repeat the test for all parameters of interest beginning with b) above.*
  - ii) *Beginning with b) above, repeat the test for all parameters that failed to meet criteria.*
- f) *Repeated failure, however, confirms a general problem with the measurement system. If this occurs, locate and correct the source of the problem and repeat the test for all compounds of interest beginning with b).*
- g) *When an analyte not currently found on the laboratory's list of accredited analytes is added to an existing accredited method, an initial DOC shall be performed for that analyte. When analytes are added to gamma-ray spectrometry and quantified this is not required.*

b) **Ongoing Demonstration of Capability**

After the demonstration of capability is completed, on-going proficiency is maintained and demonstrated at least annually. Each analyst is expected to consistently meet the QC requirements of the method, the laboratory SOP, client requirements and/or the TNI standard. Ongoing DOCS are documented in the QC\IDC folder of the network computer system, and all records related to the demonstration are retained.

The laboratory uses the following procedure to demonstrate ongoing DOC:

- a) *Performing another initial demonstration of capability*
- b) *Acceptable results for one-single-blind proficiency test sample (may be applied to similar methods using the same technology).*
- c) *Having at least four (4) consecutive laboratory control samples with acceptable levels of precision and accuracy. The laboratory shall determine the acceptable limits for precision and accuracy prior to analysis. The*

laboratory shall tabulate or be able to readily retrieve four (4) consecutive passing LCS for each method for each analyst each year;

- d) *Performance of an alternate adequate procedure for the field of accreditation, the procedure and acceptance criteria being documented in the laboratory's quality system.*
- f) *A documented process of analyst review using QC samples. QC samples can be reviewed to identify patterns for individuals or groups of analysts and determine if corrective action or retraining is necessary; or*
- g) *if a) through f) are not technically feasible, then analysis of real-world samples with results within a predefined acceptance criteria (as defined by the laboratory or method) shall be performed.*

## Calibration

Section 23.2.2 includes information on calibration of support equipment. This section covers calibration of analytical equipment.

The calibration of the radiation counting equipment is performed as specified in the methods SOPs and following instrument manufacturer's instructions.

## **Attachment 2B – Receiving Water Flow Data**

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**Provided in Separate Microsoft Excel Files**

## **Attachment 2C – Receiving Water Laboratory Reports and EDDs\***

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**\*Electronic Data Deliverables Provided in Separate  
Microsoft Excel File**

# Certificate of Analysis

FINAL REPORT

**Work Orders:** 3B27020

**Report Date:** 3/29/2023

**Received Date:** 02/25/2023

**Project:** COSD Upper San Marcos Creek Monitoring

**Turnaround Time:** Normal

**Phones:** (760) 795-6984

**Fax:** (760) 931-1580

**Attn:** Michelle Mattson

**P.O. #:**

**Client:** Weston Solutions, Inc. - Carlsbad  
5817 Dryden Place, Suite 101  
Carlsbad, CA 92008

**Billing Code:**

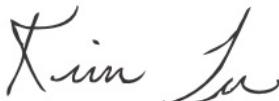
**DoD-ELAP ANAB #ADE-2882 • DoD-ISO ANAB # • ELAP-CA #1132 • EPA-UCMR #CA00211 • ISO17025 ANAB #L2457.01 • LACSD #10143**

*This is a complete final report. The information in this report applies to the samples analyzed in accordance with the chain-of-custody document. Weck Laboratories certifies that the test results meet all requirements of TNI unless noted by qualifiers or written in the Case Narrative. This analytical report must be reproduced in its entirety.*

Dear Michelle Mattson,

Enclosed are the results of analyses for samples received 2/25/23 with the Chain-of-Custody document. The samples were received in good condition, at 3.0 °C and on ice. All analyses met the method criteria except as noted in the case narrative or in the report with data qualifiers.

**Reviewed by:**



Kim G. Tu  
Project Manager

3B27020





WECK LABORATORIES, INC.

Weston Solutions, Inc. - Carlsbad  
5817 Dryden Place, Suite 101  
Carlsbad, CA 92008

# Certificate of Analysis

FINAL REPORT

**Project Number:** COSD Upper San Marcos Creek Monitoring

**Reported:**  
03/29/2023 10:48

**Project Manager:** Michelle Mattson

## Sample Summary

Sample Name	Sampled By	Lab ID	Matrix	Sampled	Qualifiers
SM-TWAS-1a	Client	3B27020-01	Water	02/25/23 04:26	
SM-TWAS-1a-Dup	Client	3B27020-02	Water	02/25/23 04:26	
FB-02252023	Client	3B27020-03	Water	02/25/23 07:25	



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# Certificate of Analysis

FINAL REPORT

Project Number: COSD Upper San Marcos Creek Monitoring

Reported:

03/29/2023 10:48

Project Manager: Michelle Mattson

## Sample Results

Sample: SM-TWAS-1a Sampled: 02/25/23 4:26 by Client  
3B27020-01 (Water)

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
<b>Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods</b>							
<b>Method:</b> Calculation							
<b>Batch ID:</b> [CALC]	<b>Preparation:</b> [CALC]						
<b>Nitrogen, Total</b>	<b>2.1</b>	0.036	0.20	mg/l	1	03/14/23	
<b>Method:</b> EPA 350.1							
<b>Batch ID:</b> W3C1057	<b>Preparation:</b> _NONE (WETCHEM)						
<b>Ammonia as N</b>	<b>0.10</b>	0.017	0.10	mg/l	1	03/13/23	
<b>Method:</b> EPA 351.2							
<b>Batch ID:</b> W3C1019	<b>Preparation:</b> _NONE (WETCHEM)						
<b>TKN</b>	<b>1.0</b>	0.13	0.20	mg/l	1	03/14/23	
<b>Method:</b> EPA 353.2							
<b>Batch ID:</b> W3B2128	<b>Preparation:</b> _NONE (WETCHEM)						
<b>Nitrate as N</b>	<b>1.0</b>	0.040	0.20	mg/l	1	02/25/23 11:47	
<b>Nitrite as N</b>	<b>0.051</b>	0.042	0.10	mg/l	1	02/25/23 11:47	J
<b>NO2+NO3 as N</b>	<b>1.1</b>	0.036	0.20	mg/l	1	02/25/23	
<b>Method:</b> EPA 365.1							
<b>Batch ID:</b> W3B2139	<b>Preparation:</b> _NONE (WETCHEM)						
<b>o-Phosphate as P, dissolved</b>	<b>0.17</b>	0.0012	0.0020	mg/l	1	02/25/23 16:12	
<b>Method:</b> SM 2540D							
<b>Batch ID:</b> W3C0076	<b>Preparation:</b> _NONE (WETCHEM)						
<b>Total Suspended Solids</b>	<b>100</b>	1	1	mg/l	1	03/01/23	
<b>Metals by EPA 200 Series Methods</b>							
<b>Method:</b> EPA 200.7							
<b>Batch ID:</b> W3C1657	<b>Preparation:</b> EPA 200.2						
<b>Phosphorus, Total</b>	<b>0.29</b>	0.018	0.050	mg/l	1	03/23/23	



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Carlsbad, CA 92008

# Certificate of Analysis

FINAL REPORT

Project Number: COSD Upper San Marcos Creek Monitoring

Reported:

03/29/2023 10:48

Project Manager: Michelle Mattson

(Continued)

## Sample Results

Sample: SM-TWAS-1a-Dup  
3B27020-02 (Water) Sampled: 02/25/23 4:26 by Client

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
<b>Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods</b>							
<b>Method:</b> Calculation							
<b>Batch ID:</b> [CALC]	<b>Preparation:</b> [CALC]						
<b>Nitrogen, Total</b>	<b>2.1</b>	0.036	0.10	mg/l	1	03/14/23	<b>Analyst:</b> YMT
<b>Method:</b> EPA 350.1							
<b>Batch ID:</b> W3C1057	<b>Preparation:</b> _NONE (WETCHEM)						
<b>Ammonia as N</b>	<b>0.10</b>	0.017	0.10	mg/l	1	03/13/23	<b>Analyst:</b> HEQ
<b>Method:</b> EPA 351.2							
<b>Batch ID:</b> W3C1019	<b>Preparation:</b> _NONE (WETCHEM)						
<b>TKN</b>	<b>1.1</b>	0.065	0.10	mg/l	1	03/14/23	<b>Analyst:</b> YMT
<b>Method:</b> EPA 353.2							
<b>Batch ID:</b> W3B2128	<b>Preparation:</b> _NONE (WETCHEM)						
<b>Nitrate as N</b>	<b>1.0</b>	0.040	0.20	mg/l	1	02/25/23 11:49	<b>Analyst:</b> ism
<b>Nitrite as N</b>	<b>0.042</b>	0.042	0.10	mg/l	1	02/25/23 11:49	J
<b>NO2+NO3 as N</b>	<b>1.1</b>	0.036	0.20	mg/l	1	02/25/23	
<b>Method:</b> EPA 365.1							
<b>Batch ID:</b> W3B2139	<b>Preparation:</b> _NONE (WETCHEM)						
<b>o-Phosphate as P, dissolved</b>	<b>0.17</b>	0.0012	0.0020	mg/l	1	02/25/23 16:14	<b>Analyst:</b> ism
<b>Method:</b> SM 2540D							
<b>Batch ID:</b> W3C0076	<b>Preparation:</b> _NONE (WETCHEM)						
<b>Total Suspended Solids</b>	<b>98</b>	1	1	mg/l	1	03/01/23	<b>Analyst:</b> mes
<b>Metals by EPA 200 Series Methods</b>							
<b>Method:</b> EPA 200.7							
<b>Batch ID:</b> W3C1657	<b>Preparation:</b> EPA 200.2						
<b>Phosphorus, Total</b>	<b>0.30</b>	0.018	0.050	mg/l	1	03/23/23	<b>Analyst:</b> kvm



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# Certificate of Analysis

FINAL REPORT

Project Number: COSD Upper San Marcos Creek Monitoring

Reported:  
03/29/2023 10:48

Project Manager: Michelle Mattson

(Continued)

## Sample Results

Sample: FB-02252023 Sampled: 02/25/23 7:25 by Client  
3B27020-03 (Water)

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
<b>Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods</b>							
<b>Method:</b> Calculation							
<b>Batch ID:</b> [CALC]	<b>Preparation:</b> [CALC]						
Nitrogen, Total	ND	0.036	0.10	mg/l	1	03/14/23	
<b>Method:</b> EPA 350.1							
<b>Batch ID:</b> W3C1057	<b>Preparation:</b> _NONE (WETCHEM)						
Ammonia as N	0.030	0.017	0.10	mg/l	1	03/13/23	J
<b>Method:</b> EPA 351.2							
<b>Batch ID:</b> W3C1019	<b>Preparation:</b> _NONE (WETCHEM)						
TKN	ND	0.065	0.10	mg/l	1	03/14/23	
<b>Method:</b> EPA 353.2							
<b>Batch ID:</b> W3B2128	<b>Preparation:</b> _NONE (WETCHEM)						
Nitrate as N	ND	0.040	0.20	mg/l	1	02/25/23 11:50	
Nitrite as N	ND	0.042	0.10	mg/l	1	02/25/23 11:50	
NO2+NO3 as N	ND	0.036	0.20	mg/l	1	02/25/23	
<b>Method:</b> EPA 365.1							
<b>Batch ID:</b> W3B2139	<b>Preparation:</b> _NONE (WETCHEM)						
o-Phosphate as P, dissolved	ND	0.0012	0.0020	mg/l	1	02/25/23 16:15	ism
<b>Method:</b> SM 2540D							
<b>Batch ID:</b> W3C0076	<b>Preparation:</b> _NONE (WETCHEM)						
Total Suspended Solids	ND	1	1	mg/l	1	03/01/23	mes
<b>Metals by EPA 200 Series Methods</b>							
<b>Method:</b> EPA 200.7							
<b>Batch ID:</b> W3C1657	<b>Preparation:</b> EPA 200.2						
Phosphorus, Total	ND	0.018	0.050	mg/l	1	03/23/23	kvm

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**Project Number:** COSD Upper San Marcos Creek Monitoring

**Reported:**

03/29/2023 10:48

**Project Manager:** Michelle Mattson

## Quality Control Results

Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods

Analyte	Result	MDL	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
<b>Batch: W3B2128 - EPA 353.2</b>											
<b>Blank (W3B2128-BLK1)</b>											
Nitrate as N	ND	0.040	0.20	mg/l	<b>Prepared &amp; Analyzed: 02/25/23</b>						
Nitrite as N	ND	0.042	0.10	mg/l							
NO <sub>2</sub> +NO <sub>3</sub> as N	ND	0.036	0.20	mg/l							
<b>LCS (W3B2128-BS1)</b>											
Nitrate as N	0.916	0.040	0.20	mg/l	1.00		92	90-110			
Nitrite as N	0.934	0.042	0.10	mg/l	1.00		93	90-110			
NO <sub>2</sub> +NO <sub>3</sub> as N	0.916	0.036	0.20	mg/l	1.00		92	90-110			
<b>Duplicate (W3B2128-DUP1)</b>											
Nitrate as N	ND	0.040	0.20	mg/l	<b>Prepared &amp; Analyzed: 02/25/23</b>						
Nitrite as N	ND	0.042	0.10	mg/l			ND				20
NO <sub>2</sub> +NO <sub>3</sub> as N	ND	0.036	0.20	mg/l			ND				20
<b>Matrix Spike (W3B2128-MS1)</b>											
Nitrate as N	6.68	0.040	0.20	mg/l	2.00	4.78	95	90-110			
Nitrite as N	0.967	0.042	0.10	mg/l	1.00	ND	97	90-110			
NO <sub>2</sub> +NO <sub>3</sub> as N	6.68	0.036	0.20	mg/l	2.00	4.81	93	90-110			
<b>Matrix Spike (W3B2128-MS2)</b>											
Nitrate as N	3.78	0.040	0.20	mg/l	2.00	1.84	97	90-110			
Nitrite as N	0.933	0.042	0.10	mg/l	1.00	ND	93	90-110			
NO <sub>2</sub> +NO <sub>3</sub> as N	3.78	0.036	0.20	mg/l	2.00	1.87	96	90-110			
<b>Matrix Spike Dup (W3B2128-MSD1)</b>											
Nitrate as N	6.67	0.040	0.20	mg/l	2.00	4.78	94	90-110	0.1	20	
Nitrite as N	0.966	0.042	0.10	mg/l	1.00	ND	97	90-110	0.1	20	
NO <sub>2</sub> +NO <sub>3</sub> as N	6.67	0.036	0.20	mg/l	2.00	4.81	93	90-110	0.1	20	
<b>Matrix Spike Dup (W3B2128-MSD2)</b>											
Nitrate as N	3.77	0.040	0.20	mg/l	2.00	1.84	96	90-110	0.3	20	
Nitrite as N	1.03	0.042	0.10	mg/l	1.00	ND	103	90-110	10	20	
NO <sub>2</sub> +NO <sub>3</sub> as N	3.77	0.036	0.20	mg/l	2.00	1.87	95	90-110	0.3	20	
<b>Batch: W3B2139 - EPA 365.1</b>											
<b>Blank (W3B2139-BLK1)</b>											
o-Phosphate as P, dissolved	ND	0.0012	0.0020	mg/l	<b>Prepared &amp; Analyzed: 02/25/23</b>						
<b>LCS (W3B2139-BS1)</b>											
o-Phosphate as P, dissolved	0.0518	0.0012	0.0020	mg/l	0.0500		104	90-110			
<b>Duplicate (W3B2139-DUP1)</b>											
o-Phosphate as P, dissolved	ND	0.0012	0.0020	mg/l	<b>Prepared &amp; Analyzed: 02/25/23</b>						
<b>Matrix Spike (W3B2139-MS1)</b>											
o-Phosphate as P, dissolved	0.0554	0.0012	0.0020	mg/l	0.0500	ND	111	90-110			MS-01
<b>Matrix Spike Dup (W3B2139-MSD1)</b>											
o-Phosphate as P, dissolved	0.0563	0.0012	0.0020	mg/l	0.0500	ND	113	90-110	2	20	MS-01



# Certificate of Analysis

FINAL REPORT

Weston Solutions, Inc. - Carlsbad  
5817 Dryden Place, Suite 101  
Carlsbad, CA 92008

Project Number: COSD Upper San Marcos Creek Monitoring

Reported:

03/29/2023 10:48

Project Manager: Michelle Mattson

## Quality Control Results

(Continued)

Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods (Continued)

Analyte	Result	MDL	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
<b>Batch: W3C0076 - SM 2540D</b>											
<b>Blank (W3C0076-BLK1)</b>											
Total Suspended Solids											
ND											
<b>LCS (W3C0076-BS1)</b>											
Total Suspended Solids											
52.8											
mg/l											
<b>Duplicate (W3C0076-DUP1)</b>											
Total Suspended Solids											
39.6											
mg/l											
<b>Duplicate (W3C0076-DUP2)</b>											
Total Suspended Solids											
99.0											
mg/l											
<b>Batch: W3C1019 - EPA 351.2</b>											
<b>Blank (W3C1019-BLK1)</b>											
TKN											
ND											
mg/l											
<b>Blank (W3C1019-BLK2)</b>											
TKN											
ND											
mg/l											
<b>LCS (W3C1019-BS1)</b>											
TKN											
0.959											
mg/l											
1.00											
96											
90-110											
<b>LCS (W3C1019-BS2)</b>											
TKN											
0.952											
mg/l											
1.00											
95											
90-110											
<b>Duplicate (W3C1019-DUP1)</b>											
TKN											
ND											
mg/l											
ND											
<b>Matrix Spike (W3C1019-MS1)</b>											
TKN											
1.17											
mg/l											
1.00											
0.205											
97											
90-110											
<b>Matrix Spike (W3C1019-MS2)</b>											
TKN											
1.13											
mg/l											
1.00											
0.270											
86											
90-110											
<b>Matrix Spike Dup (W3C1019-MSD1)</b>											
TKN											
1.18											
mg/l											
1.00											
0.205											
98											
90-110											
<b>Matrix Spike Dup (W3C1019-MSD2)</b>											
TKN											
1.15											
mg/l											
1.00											
0.270											
88											
90-110											
1											
10											
<b>Batch: W3C1057 - EPA 350.1</b>											
<b>Blank (W3C1057-BLK1)</b>											
Ammonia as N											
ND											
mg/l											
1.00											
<b>Blank (W3C1057-BLK2)</b>											
Ammonia as N											
ND											
mg/l											
1.00											
0.250											
104											
90-110											
<b>LCS (W3C1057-BS2)</b>											



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# Certificate of Analysis

FINAL REPORT

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03/29/2023 10:48

Project Manager: Michelle Mattson

(Continued)

## Quality Control Results

Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods (Continued)

Analyte	Result	MDL	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
<b>Batch: W3C1057 - EPA 350.1 (Continued)</b>											
Matrix Spike (W3C1057-MS1)	Source: 3B24027-08			Prepared: 03/12/23 Analyzed: 03/13/23							
Ammonia as N	0.483	0.017	0.10	mg/l	0.250	0.236	99	90-110			
Matrix Spike (W3C1057-MS2)	Source: 3B27020-03			Prepared: 03/12/23 Analyzed: 03/13/23							
Ammonia as N	0.271	0.017	0.10	mg/l	0.250	0.0304	96	90-110			
Matrix Spike Dup (W3C1057-MSD1)	Source: 3B24027-08			Prepared: 03/12/23 Analyzed: 03/13/23							
Ammonia as N	0.479	0.017	0.10	mg/l	0.250	0.236	97	90-110	0.9	15	
Matrix Spike Dup (W3C1057-MSD2)	Source: 3B27020-03			Prepared: 03/12/23 Analyzed: 03/13/23							
Ammonia as N	0.271	0.017	0.10	mg/l	0.250	0.0304	96	90-110	0.1	15	

## Quality Control Results

(Continued)

Metals by EPA 200 Series Methods

Analyte	Result	MDL	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
<b>Batch: W3C1657 - EPA 200.7</b>											
Blank (W3C1657-BLK1)	Source: 3B27020-01			Prepared: 03/20/23 Analyzed: 03/23/23							
Phosphorus, Total	ND	0.018	0.050	mg/l							
LCS (W3C1657-BS1)	Source: 3B27020-01			Prepared: 03/20/23 Analyzed: 03/23/23							
Phosphorus, Total	2.15	0.018	0.050	mg/l	2.00		107	90-110		25	
Matrix Spike (W3C1657-MS1)	Source: 3B27020-01			Prepared: 03/20/23 Analyzed: 03/23/23							
Phosphorus, Total	2.43	0.018	0.050	mg/l	2.00	0.289	107	90-110		25	
Matrix Spike Dup (W3C1657-MSD1)	Source: 3B27020-01			Prepared: 03/20/23 Analyzed: 03/23/23							
Phosphorus, Total	2.41	0.018	0.050	mg/l	2.00	0.289	106	90-110	0.7	25	



WECK LABORATORIES, INC.

Weston Solutions, Inc. - Carlsbad  
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Carlsbad, CA 92008

# Certificate of Analysis

FINAL REPORT

**Project Number:** COSD Upper San Marcos Creek Monitoring

**Reported:**

03/29/2023 10:48

**Project Manager:** Michelle Mattson

## Notes and Definitions

Item	Definition
J	Estimated conc. detected <MRL and >MDL.
MS-01	The spike recovery for this QC sample is outside of established control limits possibly due to sample matrix interference.
%REC	Percent Recovery
Dil	Dilution
MDL	Method Detection Limit
MRL	The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence. The MRL is also known as Limit of Quantitation (LOQ)
ND	NOT DETECTED at or above the Method Reporting Limit (MRL). If Method Detection Limit (MDL) is reported, then ND means not detected at or above the MDL.
RPD	Relative Percent Difference
Source	Sample that was matrix spiked or duplicated.

Any remaining sample(s) will be disposed of one month from the final report date unless other arrangements are made in advance.

All results are expressed on wet weight basis unless otherwise specified.

All samples collected by Weck Laboratories have been sampled in accordance to laboratory SOP Number MIS002.

## **Attachment 2D – Receiving Water Field Data Sheets**

---

SURFACE WATER APPEARANCE	<input type="checkbox"/> FOAM	<input type="checkbox"/> FOAM/DECAY	<input type="checkbox"/> MUSTI	<input type="checkbox"/> SEDIMENT	<input type="checkbox"/> NONE	<input type="checkbox"/> AMMONIA	<input type="checkbox"/> GASOLINE/PETROLEUM	<input checked="" type="checkbox"/> NONE
COLOR	<input type="checkbox"/> YELLOW	<input type="checkbox"/> GREEN	<input type="checkbox"/> BLUE	<input checked="" type="checkbox"/> BROWN	<input type="checkbox"/> RED			
FLOATING MATERIALS (ALL THAT APPLY)	<input type="checkbox"/> COLORLESS	<input type="checkbox"/> OTHER	<input type="checkbox"/> ORGANIC MATERIAL	<input type="checkbox"/> SCUM	<input type="checkbox"/> ALGAE	<input checked="" type="checkbox"/> NONE		
TRASH	<input type="checkbox"/> NONE	<input checked="" type="checkbox"/> STYROFOAM	<input checked="" type="checkbox"/> WOOD	<input checked="" type="checkbox"/> PLASTIC (CUPS, BOTTLES, BAGS)	<input type="checkbox"/> OTHER (DESCRIBE)			
TURBIDITY	<input type="checkbox"/> CLEAR	<input checked="" type="checkbox"/> CLOUDY	<input type="checkbox"/> HEAVY CLOUDINESS, OPAQUE					
Water Quality Appearance Comments: No floating trash & lots of bridge. A lot upstream caught up in wrack debris.								
GRAB COLLECTION TIME:	1245				Grab samples to be collected: Bacteria (100 mL Poly)			



**Upper San Marcos Monitoring 2022-2023  
FIELD OBSERVATIONS AND TESTING LOG SHEET**

PROJECT/SURVEY NAME	STATION ID		STATION NAME			
Upper San Marcos Monitoring 2022-2023			SM-TWAS-1a			
DATE	TIME STARTED (AT SITE)		TIME FINISHED (AT SITE)			
2/23/23 - 2/25/23	0315		0800			
FIELD MEASUREMENTS (Taken in duplicate)			YSI Serial # 21F102452			
TEMP (°C)	pH	Salinity (ppt)	CONDUCTIVITY (µS/cm)	Dissolved Oxygen (mg/L)	Turbidity (NTU) <input checked="" type="checkbox"/> FN	
11.605	8.26	0.13	270.1	10.25	85.75	
TEMP (°C)	pH	Salinity (ppt)	CONDUCTIVITY (µS/cm)	Dissolved Oxygen (mg/L)	Turbidity (NTU) <input checked="" type="checkbox"/> FN	
11.002	7.90	0.13	264.1	10.37	90.18	
QA/QC SAMPLES:	<input type="checkbox"/> FIELD DUPLICATE		<input type="checkbox"/> EQUIPMENT BLANK		<input checked="" type="checkbox"/> FLOW METER PRESENT	
Level estimation at time of grab sample  = 36 inches above sensor			Time of flow estimation, if possible 1250			
			DEPTH	36	2 Sensor Inches	
			WIDTH	300	inches	
			VELOCITY (choose one)	1.5	ft/sec in/sec	
SAMPLING ACTIVITIES (DESCRIBE ALL ACTIONS TAKEN AT EACH SITE VISIT AND PROVIDE ADDITIONAL COMMENTS AS NECESSARY)						
See reverse						
PHOTOS TAKEN: <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO						
PHOTO NUMBERS AND NOTES:						
TEAM LEADER'S SIGNATURE <i>Lyn Cloutier</i>						

2/25/23

0315 - program started 10,000 cf pacins

0411 - 1st sample taken

1245 - YSI subs

1309 - last sample bottle 1 60 total

2132 - last sample bottle 2 95 total

2/24/23

1548 - last sample bottle 3 149 total

2/25/23

0426 - last sample bottle 4 155 total

Final bottle

Bottle #4 Last Sample Time: 0426 155 total  
Bottle #5 Last Sample Time: \_\_\_\_\_

2/24/23  
2/25/23

Notes: \_\_\_\_\_  
\_\_\_\_\_

If sampling is paused or ended and re-started, please note.

**Manual Sampling Log**

Site ID: SIM-TWAS-16 Name: KC, AL

Date: 2/23/23 -

**Automated Sampling Log**

2/24/23 -

2/25/23



Sample Interval: 10,000 CF

mins

Sample Volume: 200 mL



Sample Interval: ~111 mins

Sample Volume:    L

Sample Jar #1 Time: \_\_\_\_\_

Sample Jar #7 Time: \_\_\_\_\_

Sample Jar #2 Time: \_\_\_\_\_

Sample Jar #8 Time: \_\_\_\_\_

Sample Jar #3 Time: \_\_\_\_\_

Sample Jar #9 Time: \_\_\_\_\_

Sample Jar #4 Time: \_\_\_\_\_

Sample Jar #10 Time: \_\_\_\_\_

Sample Jar #5 Time: \_\_\_\_\_

Sample Jar #11 Time: \_\_\_\_\_

Sample Jar #6 Time: \_\_\_\_\_

Sample Jar #12 Time: \_\_\_\_\_

Notes: \_\_\_\_\_  
\_\_\_\_\_

