



# California Regional Water Quality Control Board



Matthew Rodriguez  
Secretary for  
Environmental Protection

## Lahontan Region

Edmund G. Brown Jr.  
Governor

2501 Lake Tahoe Boulevard, South Lake Tahoe, California 96150  
(530) 542-5400 • Fax (530) 544-2271  
<http://www.waterboards.ca.gov/lahontan>

December 22, 2011

TO ALL INTERESTED PERSONS AND PARTIES:

**MASTER WATER RECYCLING REQUIREMENTS AND WASTE DISCHARGE  
REQUIREMENTS, COUNTY SANITATION DISTRICT NO. 20 OF LOS ANGELES  
COUNTY (PALMDALE), DISINFECTED TERTIARY RECYCLED WATER, LOS ANGELES  
COUNTY**

Enclosed for your information is a copy of the proposed agenda item for your review and a copy of the January 2012 Agenda Announcement. The Regional Board will be considering adoption of the proposed order during its January 11-12, 2011 meeting in Victorville, California.

If you need further information regarding this meeting, please contact our office at (530) 542-5400.

Amber Wike  
Office Technician

Enclosures

**CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD  
LAHONTAN REGION**

**MEETING OF JANUARY 11 AND 12, 2012  
Victorville**

**ITEM:** 3

**SUBJECT:** MASTER WATER RECYCLING REQUIREMENTS AND WASTE DISCHARGE REQUIREMENTS, COUNTY SANITATION DISTRICT NO. 20 OF LOS ANGELES COUNTY (PALMDALE), DISINFECTED TERTIARY RECYCLED WATER, LOS ANGELES COUNTY

<b>CHRONOLOGY:</b>	<u>Date</u>	<u>Event</u>
	January 7, 2009	The District submitted a complete Report of Waste Discharge requesting expanded Master Water Recycling Requirements for producing and distributing disinfected, tertiary recycled water.
	March 9, 2011	Waste Discharge Requirements (Board Order No. R6V-2011-0012) adopted for the County Sanitation District No. 20 of Los Angeles County-Palmdale (District) Stage V Disinfected Tertiary Treatment Plant.

**ISSUE:** Should the Water Board adopt a Master Water Recycling Permit allowing the District to expand its production and distribution of disinfected, tertiary recycled water throughout the Antelope Valley via the North Los Angeles/Kern County Regional Recycled Water Project?

Is the monitoring and reporting program adequate to detect changes in groundwater quality in the Antelope Valley and ensure that waste discharges are sufficiently monitored?

**DISCUSSION:** The District collects, treats and disposes of domestic wastewater generated in the Palmdale area at its Palmdale Water Reclamation Plant, which is located in northern Los Angeles County. The District is currently permitted to distribute recycled water to a designated Agricultural Site.

The District has requested the Lahontan Water Board to issue Master Water Recycling Requirements to the District for its proposed expansion of recycled water use. The District is

proposing to expand its current permit area for distributing disinfected tertiary recycled water to include the entire City of Palmdale city limits and other portions of the Antelope Valley located within Los Angeles County. The District is also proposing to expand the list of authorized uses of recycled water from landscape irrigation, dust control, and soil compaction to include additional uses that satisfy the Water Recycling Criteria specified by the California Code of Regulations, title 22, division 4, chapter 3 (Title 22) and have undergone project-level CEQA review. The specific allowed uses are listed in the proposed order and generally include non-agricultural irrigation, municipal uses, and industrial uses.

The North Los Angeles/Kern County Regional Recycled Water Project is being constructed to distribute disinfected tertiary recycled water from the Lancaster Water Reclamation Plant, the Palmdale Water Reclamation Plant, and potentially the Rosamond Wastewater Treatment Plant. The North Los Angeles/Kern County Regional Recycled Water Project will be expanded to incorporate the distribution of disinfected tertiary recycled water within the area of Antelope Valley located in Kern County. When completed, flows from all three disinfected tertiary recycled water treatment facilities will be commingled in and distributed from the same distribution system. This Order allows the distribution of disinfected tertiary recycled water produced at the District's Palmdale Water Reclamation Plant throughout the City of Palmdale and, eventually, throughout the entire North Los Angeles/Kern County Regional Recycled Water Project area. This Order also authorizes the District to produce and distribute the above-referenced recycled water to users that operate facilities/systems complying with water recycling requirements contained in State of California laws and regulations. This Order also requires the District to regulate the users of the recycled water to ensure compliance with water recycling requirements contained in State of California laws and regulations.

**RECOMMEN-  
DATION:**

Adoption of the Master Water Recycling Permit and Waste Discharge Requirements as Proposed.

<b>ENCLOSURE</b>	<b>ITEM 3</b>	<b>Bates Number</b>
1	Proposed Board Order	<b>3-5</b>
2	Electronic Mail From Sanitation Districts of Los Angeles County, December 8, 2011	<b>3-233</b>

# **ENCLOSURE 1**

This page is blank intentionally.

**CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD  
LAHONTAN REGION**

**BOARD ORDER NO. R6V-2012-(PROPOSED)  
WDID NO. 6B190901008**

**MASTER WATER RECYCLING REQUIREMENTS AND  
WASTE DISCHARGE REQUIREMENTS  
COUNTY SANITATION DISTRICT NO. 20 OF LOS ANGELES COUNTY  
(PALMDALE)  
DISINFECTED TERTIARY RECYCLED WATER**

\_\_\_\_\_  
Los Angeles County \_\_\_\_\_

The California Regional Water Quality Control Board, Lahontan Region (Lahontan Water Board) finds:

1. Definitions

The following terms, which are used within this Order, are defined by their respective code citations or policy references:

a. **Disinfected Tertiary Recycled Water:** "...filtered and subsequently disinfected wastewater that meets the following criteria:

(a) The filtered wastewater has been disinfected by either:

(1) A chlorine disinfection process following filtration that provides a CT (the product of total chlorine residual and modal contact time measured at the same point) value of not less than 450 milligram-minutes per liter at all times with a modal contact time of at least 90 minutes, based on peak dry weather design flow; or

(2) A disinfection process that, when combined with the filtration process, has been demonstrated to inactivate and/or remove 99.999 percent of the plaque-forming units of F-specific bacteriophage MS2, or polio virus in the wastewater. A virus that is at least as resistant to disinfection as polio virus may be used for purposes of the demonstration.

(b) The median concentration of total coliform bacteria measured in the disinfected effluent does not exceed an MPN of 2.2 per 100 milliliters utilizing the bacteriological results of the last seven days for which analyses have been completed and the number of total coliform bacteria does not exceed an MPN of 23 per 100 milliliters in more than one sample in any 30 day period. No sample shall exceed an MPN of 240 total coliform bacteria per 100 milliliters." [California Code of Regulations, title 22, section 60301.230]

- b. **Incidental Runoff:** "...unintended small amounts (volume) of runoff from recycled water use areas, such as unintended, minimal over-spray from sprinklers that escapes the recycled water use area." [Paragraph 7(a), Recycled Water Policy, State Water Resources Control Board Resolution No. 2009-0011]
- c. **Master Recycling Permit:** "...a permit issued to a supplier or a distributor, or both, of recycled water, that includes waste discharge requirements prescribed pursuant to Water Code section 13263 and water recycling requirements prescribed pursuant to Water Code section 13523.1." [Water Code section 13050(r)]
- d. **Reclaimed Water.** "...wastewater which as a result of treatment is suitable for uses other than potable use." [California Code of Regulations, title 17, section 7583(i)]
- e. **Recycled Water:** "...water which, as a result of treatment of waste, is suitable for a direct beneficial use or a controlled use that would not otherwise occur and is therefore considered a valuable resource." [Water Code section 13050(n)]

## 2. Recycled Water Report

The County Sanitation District No. 20 of Los Angeles County (District) has filed an application with the Lahontan Water Board under Water Code section 13522.5. Pursuant to Water Code section 13523.1, the District's application requests the Lahontan Water Board to issue Master Water Recycling Requirements to the District for supply of disinfected tertiary recycled water as defined in California Code of Regulations, title 22, section 60301.230. The District submitted information on January 21, 2009, that completed the application.

## 3. Facilities and Treatment Process

The District collects and treats domestic wastewater generated in the District's service area, which includes parts of the City of Palmdale and nearby unincorporated areas of northern Los Angeles County.

The District recently completed construction for Phase I of a new tertiary treatment facility (Stage V Plant Expansion) at its Palmdale Water Reclamation Plant. The District had previously provided disinfected secondary treatment of wastewater at the plant. The Stage V Plant Expansion consists of activated sludge treatment, nitrogen removal using nitrification and denitrification processes, and disinfection. Phase I of the Stage V Plant Expansion provides treatment for up to 12 million

gallons per day (mgd). Phase II of the Stage V Plant Expansion will add an additional 3 mgd for a total treatment capacity of 15 mgd for the Stage V Plant Expansion.

Flows from the Stage V Plant Expansion are currently discharged to the Storage Reservoir Site and to the Agricultural Site. However, the District anticipates using disinfected tertiary recycled water from the Stage V Plant Expansion for municipal and industrial reuse projects. The discharge of recycled water to the Agricultural Site is not considered in this master recycling permit since it is covered under Board Order No. R6V-2011-0012.

4. Current Board Orders

Board Order No. R6V-2011-0012 establishes waste discharge requirements and water recycling requirements for the discharge of disinfected secondary treated wastewater and of disinfected tertiary treated wastewater from the District's Palmdale Water Reclamation Plant. Board Order No. R6V-2011-0012 was adopted on March 9, 2011 pursuant to Water Code section 13263.

On December 9, 2009, the Lahontan Water Board adopted Board Order No. R6V-2009-0141 establishing master recycling requirements for the County Sanitation District No. 14 of Los Angeles County (Lancaster). The requirements allow the use of disinfected tertiary recycled water from the Lancaster Water Reclamation Plant at sites located within the portion of the Antelope Valley bounded by the Los Angeles County/Kern County line to the north (north side of Township 8 North, San Bernardino Meridian); the Los Angeles County/San Bernardino County line to the east (east side of Range 8 West, San Bernardino Meridian); south side of Township 5 North, San Bernardino Meridian to the south; and the west side of Range 14 West, San Bernardino Meridian to the west (see Attachment B).

Board Order No. R6V-2009-0141 authorized the distribution of up to 22.6 mgd (annual average) of disinfected tertiary recycled water from the Lancaster Water Reclamation Plant through the proposed North Los Angeles/Kern County Regional Recycled Water Project distribution system. This Order will also authorize the distribution of disinfected tertiary recycled water from the Palmdale Water Reclamation Plant through the same distribution system.

5. Reason for Action

The following uses of disinfected tertiary recycled water (hereinafter, recycled water) have received project-level coverage pursuant to the California Environmental Quality Act (CEQA).

- Irrigation for parks and playgrounds
- Irrigation for school yards
- Irrigation for residential landscaping (non-individually owned common areas)
- Irrigation for golf courses (both restricted and unrestricted-access)
- Irrigation for cemeteries
- Irrigation for freeways and greenbelt landscaping
- Irrigation for landfills
- Consolidation of backfill (around potable and non-potable pipes)
- Fire fighting (both structural and non-structural)
- Mixing concrete
- Soil compaction
- Decorative fountains
- Flushing sanitary sewers
- Flushing toilets and urinals
- Dust control for construction activities (includes demolition)
- Dust control on roads and streets
- Dust control at landfills
- Commercial laundries
- Priming drain traps
- Cleaning roads (street sweeping), sidewalks, and outdoor work areas

Additional uses of recycled water that are not listed above, but are allowed by Title 22, were assessed at the programmatic-level in the adopted environmental impact report. These include:

- a. recycled water use resulting in full consumption (no discharge of any type);
- b. recycled water use at facilities, such as power plants, that results in a discharge that will be regulated by the Lahontan Water Board or the California Energy Commission pursuant to its authority under the Warren-Alquist Act; and
- c. recycled water use resulting in a discharge to a sanitary sewer system.

The total estimated water demand for all proposed recycled water uses at buildout within the Antelope Valley is 21,210 acre-feet per year (19.0 mgd) [Final Program Environmental Impact Report, November, 2008]. The total estimated water demand for the recycled water uses at buildout is less than the 37.6 mgd annual average recycled water flow permitted to be produced (22.6 mgd from the Lancaster Water Reclamation Plant and 15 mgd from the Stage V Expansion at the Palmdale Water Reclamation Plant). This Order provides master water recycling requirements, including a requirement that the District regulate the distributors and users of the recycled water to ensure compliance with water recycling requirements contained in State of California laws and regulations.

6. Sources of Recycled Water

The District recently completed construction of new tertiary treatment facilities (Stage V Plant Expansion), increasing the Palmdale Water Reclamation Plant's average 24-hour design capacity of 12 mgd with a planned expansion to 15 mgd.

The Lancaster Water Reclamation Plant (operated by County Sanitation District No. 14 of Los Angeles County) currently provides recycled water to the North Los Angeles/Kern County Regional Recycled Water Project. Water recycling requirements have been issued to authorize this use (Board Order No. R6V-2009-0141).

The Rosamond Waste Water Treatment Plant (operated by the Rosamond Community Services District) also plans to provide recycled water as future phases of the North Los Angeles/Kern County Regional Recycled Water Project are completed and come on-line. Water recycling requirements for the Rosamond Community Services District will be necessary prior to this district providing recycled water from its facility.

7. Producer, Distributors and Users

Under this Order, the District is the producer of recycled water. Currently, the City of Palmdale, the City of Lancaster, and the Los Angeles County Waterworks District No. 40 are the distributors of the recycled water. As future phases of the North Los Angeles/Kern County Regional Recycled Water Project are completed and come on-line, there may be additional distributors. Distributors may also be users of the recycled water. Other users may include other public agencies and private parties.

8. Recycled Water Distribution and Distribution System

The City of Lancaster previously constructed a large diameter force-main pipeline for transporting recycled water along Division Street (Division Street Pipeline) and steel tanks for storage of recycled water and supplemental water. Supplemental water is currently supplied by existing water supply well No. 4-15, which is owned by the Los Angeles County Waterworks District No. 40. The Division Street Pipeline connects to the County Sanitation District No. 14's existing recycled water force-main pipeline, which is located along Avenue E. Lateral pipelines are constructed for each individual user of recycled water once the site is ready to receive the recycled water.

The proposed North Los Angeles/Kern County Regional Recycled Water Project distribution system includes constructing approximately 70 miles of recycled water conveyance pipelines, four storage reservoirs, two distribution pump stations, and

two booster pump stations. The proposed North Los Angeles/Kern County Regional Recycled Water Project will provide the primary distribution system for providing recycled water to end users in the Antelope Valley.

9. Permit Area

This Order authorizes use of recycled water at sites located within the portion of the Antelope Valley bounded by the Los Angeles County/Kern County line to the north (north side of Township 8 North, San Bernardino Meridian); the Los Angeles County/San Bernardino County line to the east (east side of Range 8 West, San Bernardino Meridian); south side of Township 5 North, San Bernardino Meridian to the south; and the west side of Range 14 West, San Bernardino Meridian to the west (Permit Area). The Permit Area is identified on Attachment B of this Order.

10. Authorized Recycled Water Uses

This Order authorizes recycled water use for those uses identified in Finding No. 5 of this Order. Generally, recycled water will be used for municipal and industrial applications and for non-agricultural irrigation.

11. Authorized Recycled Water Use Sites

The sites authorized for use of recycled water under this Order (Authorized Recycled Water Use Sites) are those:

- a. located within the Permit Area described in Finding No. 9, above; and
- b. where the use is limited to those described in Finding Nos. 5 and 10, above.

12. Topography

The Permit Area is located within the Antelope Valley, which is a closed topographic basin with no outlet to the ocean. The Antelope Valley is bordered by the San Gabriel Mountains to the south and west, by the Tehachapi Mountains to the west and northwest, and by a series of north-south running, low-elevation buttes that form the eastern boundaries of the valley. All water that enters the valley either infiltrates into the groundwater basin, evaporates, or flows toward the three dry lakes located on Edwards Air Force Base: Rosamond Lake, Buckhorn Lake, and Rogers Lake. In general, groundwater flows northeasterly from the mountain ranges to the dry lakes. Due to the relatively impervious nature of the dry lake soil and high evaporation rates, water that collects on the dry lakes eventually evaporates rather than infiltrates into the groundwater.

13. Hydrogeology

Unconsolidated alluvial deposits consisting of inter-bedded gravel, sand, silt and clay underlie the Permit Area. An extensive layer of lacustrine deposits is located at a depth of approximately 500 feet. Its depth and thickness vary.

The Antelope Valley Groundwater Basin is comprised of two primary aquifers: (1) the upper (principal) aquifer, and (2) the lower (deep) aquifer. Historically, the lacustrine deposits have been used to define the boundary between the two aquifers, and the deep aquifer is generally considered to be confined.

The principal aquifer is an unconfined aquifer that historically provided artesian flows due to perched water tables in some areas. These artesian conditions are currently absent due to extensive pumping of groundwater. Depth to groundwater (water table for the principal unconfined aquifer) ranges from approximately 50 to 350 feet below ground surface depending upon the location within the Antelope Valley.

In general, the principal aquifer is thickest in the southern portion of the region near the San Gabriel Mountains, while the deep aquifer is thickest in the vicinity of the dry lakes on Edwards Air Force Base.

14. Groundwater Quality

Groundwater quality is excellent within the principal aquifer but degrades toward the northern portion of the dry lake areas. Considered to be generally suitable for domestic, agricultural, and industrial uses, the water in the principal aquifer has a total dissolved solids (TDS) concentration ranging from 200 to 800 milligrams per liter (mg/l) [Department of Water Resources Bulletin 118, 2004]. The existing groundwater TDS concentration is below and within the maximum contaminant level (MCL) range of 500 to 1,000 mg/l (short term MCL is 1,500 mg/l). The deeper aquifers typically have higher TDS levels. Hardness levels range from 50 to 200 mg/l, and high fluoride, boron, and nitrates are problematic in some areas of the basin.

Arsenic is an emerging contaminant of concern in the region and has been observed in wells owned by Los Angeles County Waterworks District No. 40, Palmdale Water District, and Quartz Hill Water District in concentrations ranging from 2 to 60 micrograms per liter ( $\mu\text{g/l}$ ). The MCL for arsenic is 10  $\mu\text{g/l}$ . Arsenic is a naturally occurring inorganic element often found in groundwater and occasionally in surface water. Research conducted by Los Angeles County Waterworks District No. 40 and the United States Geologic Survey has shown the problem to reside primarily in the deep aquifer, and it is not anticipated that the existing arsenic problem will lead to future loss of groundwater as a water supply resource for the region.

There are also concerns with nitrate levels above the current MCL of 10 mg/l (as Nitrogen [N]) in portions of the basin. Groundwater monitoring data from the mid-to-late 1990s indicate nitrate (as N) concentrations exceeding the primary MCL for drinking water in two areas in the southern portion of the groundwater basin: one is northeast of the Palmdale Water Reclamation Plant and the other is near the community of Littlerock, slightly east of the upper reach of Littlerock Creek. It is estimated both nitrate plumes are similar in size, approximately five to six square miles. Agricultural fertilization practices, historic confined animal facility discharges, septic system disposal, and discharge of treated wastewater have likely contributed to the elevated levels. In the area near the Palmdale Water Reclamation Plant, actions have already been implemented by County Sanitation District No. 20 of Los Angeles County to address the nitrate plume and to minimize any future impacts from treated wastewater discharges, including treatment upgrades, a change in effluent management practices, the implementation of the North Los Angeles/Kern County Regional Recycled Water Project, and performing groundwater remediation activities near the Palmdale Water Reclamation Plant. In the Littlerock area, Littlerock Creek Irrigation District extracts the nitrate-laden groundwater and blends it with other water sources to meet drinking water quality standards. The agricultural and confined animal facilities that are considered to have contributed to the Littlerock nitrate plume are no longer active.

15. Receiving Waters

The receiving waters are the groundwaters of the Antelope Valley Basin.

16. Lahontan Basin Plan

The Lahontan Water Board adopted a Water Quality Control Plan for the Lahontan Region (Basin Plan), which became effective on March 31, 1995. This Order implements the Basin Plan as amended.

17. Beneficial Uses – Groundwater

Groundwater has been, and continues to be, an important resource within the Antelope Valley. Prior to 1972, groundwater provided more than 90 percent of the total water supply. Since 1972, groundwater has provided between 50 and 90 percent of the total water supply. Groundwater pumping in the Antelope Valley peaked in the 1950s, and it decreased in the 1960s and 1970s when agricultural pumping (AGR) declined due to increased pumping costs from greater pumping lifts and higher electric power costs. The rapid increase in urban growth in the 1980s resulted in an increase in the demand for municipal (MUN) and industrial (IND) water and an increase in groundwater use. Projected urban growth and limits on the available local and imported water supply are likely to continue to

increase the reliance on the groundwater. [Section 3.7, Final Program Environmental Impact Report, November, 2008]

The present and potential beneficial uses of the groundwaters of the Antelope Valley Basin as set forth and defined in the Basin Plan are:

- a. Municipal and Domestic Supply (MUN);
- b. Agricultural Supply (AGR);
- c. Industrial Service Supply (IND); and
- d. Freshwater Replenishment (FRSH)

18. State Water Board Recycled Water Policy

State Water Board Resolution No. 2009-0011, "Adoption of a Policy for Water Quality Control for Recycled Water," references and adopts the "State Water Resources Control Board Recycled Water Policy" (Recycled Water Policy). The Recycled Water Policy provides direction to the State and Regional Water Boards regarding the appropriate criteria to be used in issuing permits for recycled water projects. The Recycled Water Policy describes permitting criteria intended to streamline, and provide consistency for, the permitting of the vast majority of recycled water projects. This Order implements the Recycled Water Policy.

Order No. III of this Master Recycling Permit requires the District to develop and/or participate in the development of a salt/nutrient management plan and to control incidental runoff consistent with Paragraphs 6 and 7(a), respectively, of the Recycled Water Policy. Finding No. 22 of this Order describes Lahontan Water Board consistency with the streamlined permitting criteria outlined in Paragraphs 7(b) and 7(c) of the Recycled Water Policy. Finding No. 23 of this Order describes Lahontan Water Board consistency with the antidegradation criteria outlined in Paragraph 9 of the Recycled Water Policy. This permit allows for increased use of recycled water consistent with the mandate established in Paragraph 4 of the Recycled Water Policy to increase the use of recycled water in California.

19. Incidental Runoff of Recycled Water

The Recycled Water Policy defines incidental runoff as unintended small amounts (volume) of runoff from recycled water use areas, such as unintended minimal over-spray from sprinklers that escapes the recycled water use area. Water leaving a recycled water use area is not considered incidental if it is part of the facility design, if it is due to excessive application, if it is due to intentional overflow or application, or if it is due to negligence.

The District must develop and implement an operations and management plan that applies to all landscape irrigation recycled water use areas. This plan must

provide for detection of leaks from landscape irrigation facilities (for example, broken sprinkler heads) and correction within 72 hours of detection or prior to a release of 1,000 gallons, whichever occurs first.

20. Discharges of Recycled Water from Surface Impoundments

The Recycled Water Policy prohibits discharge to surface waters from a surface impoundment containing recycled water unless the discharge is a result of a 25-year, 24-hour storm event or greater. Surface water impoundments used for recycled water storage shall be maintained so that no discharge occurs except as a result of a 25-year, 24-hour storm event or greater.

21. Regulation of Recycled Water

a. California Code of Regulations, Title 22, Department of Public Health

The California Department of Public Health (CDPH), formerly the Department of Health Services, established criteria for using recycled water. These criteria are codified in Title 22 and include such requirements as Sources of Recycled Water, Uses of Recycled Water, and Use Area Requirements. The CDPH adopted revised Water Recycling Criteria that became effective on March 20, 2001. Applicable criteria are prescribed in this Order.

b. Engineering Reports

As required by California Code of Regulations, title 22, section 60323, the District will submit engineering reports for the production and use of recycled water to the CDPH. The content and status of each report is described in the following table.

Engineering report title	Scope	CDPH review status	Water Board Response to CDPH Review and Project Status
Tertiary Treatment Facilities (Stage V Plant Expansion), report expected to be submitted to CDPH prior to project implementation.	Treatment and recycled water production	CDPH comment letter expected 30 days after report submittal to CDPH.	Compliance with CDPH conditions required by this Order upon receipt of CDPH conditions.
North Los Angeles/Kern County Regional Recycled Water Project, report expected to be submitted to CDPH prior to project completion and/or implementation.	Los Angeles/Kern County Regional Recycled Water Project distribution system	CDPH comment letter expected 30 days after report submittal to CDPH.	Compliance with CDPH conditions required by this Order upon receipt of CDPH conditions.

Prior to implementing the North Los Angeles/Kern County Regional Recycled Water Project distribution system, and prior to implementing yet-to-be identified uses, the District (or other responsible agency) will prepare the appropriate engineering reports, obtain acceptance of the project from appropriate agencies, and will implement as applicable the CDPH conditions for project acceptance pursuant to waste discharge requirements and/or water recycling requirements issued by the Lahontan Water Board.

c. Regulation

Water Code section 13523.1, subdivision (a), states:

*“Each regional board, after consulting with, and receiving the recommendations of, the State Department of Health Services and any party who has requested in writing to be consulted, with the consent of the proposed permittee, and after any necessary hearing, may, in lieu of issuing waste discharge requirements pursuant to Section 13263 or water reclamation requirements pursuant to Section 13523 for a user of reclaimed water, issue a master reclamation permit to a supplier or distributor, or both, of reclaimed water.”*

This Order includes water-recycling requirements which require the District to:

- i. comply with waste discharge requirements (see Finding No. 4 and Water Recycling Specification No. I.B.1 of this Order);

- ii. comply with Uniform Statewide Reclamation Criteria (California Code of Regulations, title 22, sections 60301 through 60355) established pursuant to Water Code section 13521 (see Water Recycling Specification No. I.B.2 of this Order);
- iii. establish and enforce rules or regulations for recycled water users (*Requirements for Recycled Water Users, Recycled Water Use Site Inspection Program, and Enforcement Response Plan* provided in Attachment C, which is made a part of this Order), governing the design and construction of recycled water use facilities and the use of recycled water (see Water Recycling Specification No. I.B.3 of this Order);
- iv. submit quarterly reports to the Lahontan Water Board summarizing recycled water use, including the total amount of recycled water supplied, the total number of recycled water use sites, the locations of the recycled water use sites, and the names of the hydrologic areas underlying the recycled water use sites (see Monitoring and Reporting Program No. R6V-2012-PROPOSED, Sections I.D and II.B); and
- v. conduct periodic inspections of recycled water use sites to monitor compliance by users with the Uniform Statewide Reclamation Criteria established pursuant to Water Code section 13521 and the requirements of this Order (see Water Recycling Specifications No. I.B.3 and No. I.B.4 of this Order).

Regarding the requirement identified in Finding No. 21.c.i above, the District is under current requirements to comply with the waste discharge requirements listed in Finding No. 4 of this Order.

Regarding the requirement identified in Finding No. 21.c.ii above, the District, through information contained in its CEQA documents and the District's application, established that the proposed recycled water uses will comply with the Title 22 requirements.

Regarding requirements identified in Finding Nos. 21.c.iii and 21.c.v above, the District has completed and submitted a report to the Lahontan Water Board containing its *Requirements for Recycled Water Users, Recycled Water Use Site Inspection Program, and Enforcement Response Plan* (see Attachment C of this Order). The Lahontan Water Board staff accepted these documents on September 16, 2008.

This Order implements the requirement identified in Finding No. 21.c.iv via adoption of Monitoring and Reporting Program No. R6V-2012-PROPOSED.

## 22. Streamlined Permitting

### a. Eligibility

The landscape irrigation elements of the proposed water recycling project meet the criteria for streamlined permitting (Paragraph 7(c) of the Recycled Water Policy) for the following reasons:

- i. The project complies with Title 22 regulations.
- ii. The proposed landscape irrigation use will not exceed agronomic rates and will not occur when soils are saturated. An operations and management plan will be developed describing how appropriate irrigation amounts and rates will be applied and may include, but not be limited to, developing water budgets for use areas, providing supervisor training, conducting periodic inspections, developing tiered rate structures, and installing smart controllers. An operations and management plan may be developed to cover multiple sites.
- iii. A salt/nutrient management plan has not been prepared for the Antelope Valley groundwater basin. This Order includes a requirement that the District must participate in the development of the salt/nutrient management plan for the Antelope Valley. The District is currently a member of the Salt/Nutrient Management Plan subcommittee to the Antelope Valley Integrated Regional Water Management Group.
- iv. The District will communicate to users the nutrient levels in the recycled water so that users can appropriately evaluate fertilizer needs. Both the Lancaster Water Reclamation Plant and the Palmdale Water Reclamation Plant will be simultaneously providing recycled water to the North Los Angeles/Kern County Regional Recycled Water Project distribution system. When this occurs, the District will use the highest nutrient levels provided from either reclamation plant at any given time when communicating nutrient levels to recycled water users.

### b. Streamlined Permit Requirements

According to Paragraph 7(b)(4) of the Recycled Water Policy, landscape irrigation projects that qualify for streamline permitting are not required to conduct project-specific receiving water and groundwater monitoring unless otherwise required by an applicable salt/nutrient management plan. The District will participate in the development of a salt/nutrient management plan for the Antelope Valley in lieu of performing project-specific monitoring as

allowed by the Recycled Water Policy. This Order includes a requirement that the District must participate in the development of the salt/nutrient management plan for the Antelope Valley.

Additionally, the Recycled Water Policy requires streamlined permits to include monitoring of priority pollutants on a twice-annual basis and annual monitoring of Emerging Constituents/Constituents of Emerging Concern (e.g., endocrine disrupters, personal care products, or pharmaceuticals) (CECs). The Recycled Water Policy recognizes a lack of complete knowledge regarding CECs, and the implementation of CEC monitoring is deferred in order to incorporate the recommendations of a blue-ribbon advisory panel, convened by the State Water Board. On June 25, 2010, CEC Advisory Panel provided recommendations to the State Water Board and California Department of Public Health in its Final Report. The State Water Board has not amended the Recycling Water Policy to incorporate any of the Panel's recommendations, and therefore, this Order includes monitoring for priority pollutants, but no CECs.

23. Maintenance of High Quality Waters in California

The proposed uses of recycled water will not result in a degradation of the existing groundwater quality within the Antelope Valley with respect to nutrients. The Stage V Plant Expansion includes a nitrification/denitrification process, which will result in reduced nitrogen concentrations in the recycled water. Furthermore, recycled water will be applied at agronomic rates to consume all remaining nitrogen.

Some of the proposed uses of recycled water could result in a degradation of the existing groundwater quality within the Antelope Valley with respect to salts (Total Dissolved Solids, or TDS). The Antelope Valley groundwater basin is estimated to have 68 million acre-feet of storage, of which 13 million acre-feet is available. TDS concentrations in the groundwater basin range from 200 to 800 mg/l [Department of Water Resources Bulletin 118, 2004], with an average of 300 mg/l. According to California Code of Regulations, Title 22, the recommended secondary maximum contaminant level (MCL) in the groundwater basin for TDS is 500 mg/l, and the secondary MCL upper limit is 1,000 mg/l. The average TDS concentration in the secondary treated recycled water for 2010 is 524 mg/l, and the expected average TDS concentration in the tertiary treated effluent from the Stage V Plant Expansion facilities is 550 mg/l.

The District provided an analysis (2009) to conservatively calculate the groundwater basin's assimilative capacity for TDS and the proposed project's impact on the remaining assimilative capacity. Subtracting the average TDS concentration of 300 mg/l in the groundwater basin from the recommended MCL of 500 mg/l, the groundwater basin has an assimilative capacity of 200 mg/l. From a

mass balance analysis, the multiple proposed uses of recycled water will not use more than one percent of the available assimilative capacity for TDS within the Antelope Valley groundwater basin over a ten-year period. Extrapolating over a 30-year period where recycled water supply is at its maximum flow level, the Lahontan Water Board projects that the multiple proposed uses of recycled water will not use more than 8.5 percent of the available assimilative capacity for TDS within the Antelope Valley groundwater basin. This level of degradation is consistent with established policies, as discussed below.

State Water Board Resolution No. 68-16, "Statement of Policy with Respect to Maintaining High Quality of Waters in California," states,

- "1. Whenever the existing quality of water is better than the quality established in policies as of the date on which such policies become effective, such existing high quality will be maintained until it has been demonstrated to the State that a change will be consistent with the maximum benefit to the people of the State, will not unreasonably affect present and anticipated beneficial use of such water and will not result in water quality less than that prescribed in the policies.*
- 2. Any activity which produces or may produce a waste...and which discharges or proposes to discharge to existing high quality waters will be required to meet waste discharge requirements which will result in the best practicable treatment or control of the discharge necessary to assure that (a) pollution or nuisance will not occur, and (b) the highest water quality consistent with maximum benefit to the people of the State will be maintained."*

This Order is consistent with Resolution No. 68-16 for the following reasons.

- a. State Water Board, through Resolution No. 77-1, has identified the beneficial use of recycled water for the people for the State, and directs regional water boards to encourage the use of recycled water in water-short areas of the State. The Antelope Valley is located in a water-short area of the State. The current demand for potable water in the Antelope Valley exceeds supply in the region, and by 2035 this demand is expected to double. The people of the State will benefit from the use of recycled water in the Antelope Valley area, where recycled water will supplement and/or replace existing water supplies (e.g., imported surface waters and overdraft of groundwaters).
- b. This Order prohibits the use of recycled water that causes a pollution or nuisance.
- c. This Order requires the District to administer (1) *Requirements for Recycled*

*Water Users, (2) a Recycled Water User Site Inspection Program, and (3) an Enforcement Response Plan (see Attachment C), as previously accepted by the Lahontan Water Board. The requirements and the compliance inspection and enforcement programs are the mechanisms for ensuring that appropriate control measures are identified, implemented, and maintained. The control measures generally identified include (1) applying irrigation within agronomic rates to reduce the potential for runoff and increased nutrients into the groundwater; and (2) developing and implementing a salt/nutrient management plan to reduce the potential for salt and nutrient loading, thereby minimizing the impacts to groundwater quality within the Antelope Valley. The control measures will ensure that the discharge will result in the best practicable control for the maximum benefit of the people of the State to assure that a pollution or nuisance will not occur and that the highest water quality consistent with maximum benefit to the people of the State will be maintained.*

The waste discharge requirements adopted as part of this Order will ensure that the discharge will result in the best practicable control for the maximum benefit of the people of the State to assure that a pollution or nuisance will not occur and that the highest water quality consistent with maximum benefit to the people of the State will be maintained. The control measures will prevent the groundwater quality within the Antelope Valley from exceeding the standards established in existing applicable policies.

- d. The use of recycled water as authorized by this Order will not result in water quality less than that prescribed in applicable policies.

24. Consideration of Water Code Section 13241 Factors

Section 13523.1, subdivision (b)(1) of the Water Code requires master reclamation requirements to include waste discharge requirements adopted pursuant to Article 4 (commencing with section 13260) of Chapter 4. Section 13263(a) of the Water Code requires that such waste discharge requirements take into consideration the provisions of section 13241 of the Water Code. The Lahontan Water Board has considered these factors as follows:

- a. Past, present, and probable future beneficial uses of water.

This Order identifies existing groundwater quality as described in Finding No. 14. This Order also identifies past, present, and probable future beneficial uses of the Antelope Valley groundwater as described in Finding No. 17. The proposed uses of recycled water will not adversely affect present or probable future beneficial uses of water, including municipal and domestic supply, agricultural supply, industrial service supply, and freshwater replacement.

b. Environmental characteristics of the hydrographic unit under consideration, including the quality of water available thereto.

Finding Nos. 13 and 14 describe the environmental characteristics and quality of available groundwater. Finding No. 14 details groundwater issues related to TDS, arsenic, and nitrate concentrations.

TDS concentrations range from 200 to 800 mg/L, with higher concentrations in the deeper aquifer. These levels are below and within the MCL range of 500 to 1,000 mg/L.

Arsenic has been observed in concentrations ranging from 2 to 60 µg/L and the MCL for arsenic is 10 µg/L. Arsenic is a naturally occurring inorganic element often found in groundwater and occasionally in surface water. Anthropogenic sources of arsenic include agricultural, industrial and mining activities. Research conducted by Los Angeles County Waterworks District No. 40 and the United States Geologic Survey has shown the problem to reside primarily in the deep aquifer, and it is not anticipated that the existing arsenic problem will lead to future loss of groundwater as a water supply resource for the region.

Nitrate concentrations exceed the primary MCL for drinking water of 10 mg/L (as N) in two areas in the southern portion of the groundwater basin. Agricultural fertilization practices, septic system disposal, and discharge of treated wastewater have likely contributed to the elevated levels.

c. Water quality conditions that could reasonably be achieved through the coordinated control of all factors, which affect water quality in the area.

The requirements of the Order, including application of recycled water at agronomic rates, will result in the protection of existing and probable future beneficial uses to the maximum benefit to the people of the State of California. The requirements of this Order will also result in the protection of water quality to continue to meet the standards prescribed in applicable existing policies.

d. Economic considerations.

The Antelope Valley is faced with serious challenges with respect to management of water and wastewater resources in the region. The population in the Antelope Valley is expected to increase by 161 percent by 2035. Currently, the demand for potable water exceeds supply in the region, and by 2035 this demand is expected to double. Wastewater discharges also will increase in the future as the population increases. Existing demand for potable water is met largely by water imported through the State Water Project and groundwater pumped from the Antelope Valley Basin. Imported water supplies

are becoming less reliable, the Antelope Valley Basin is facing overdraft conditions, and the water rights of overlying landowners of the Antelope Valley Basin have not yet been adjudicated. The Regional Water Management Group prepared an integrated water management plan for the Antelope Valley, and the proposed North Los Angeles/Kern County Regional Recycled Water Project is identified in the plan as a project that addresses the need for both increased water supplies and wastewater effluent management. [Section 1.5, Final Program Environmental Impact Report, November, 2008]

This Order authorizes the District to expand the list of authorized recycled water uses to include the uses identified by Title 22 and Finding No. 5. Use of recycled water will replace supplied groundwater and imported water for landscape irrigation, and potentially in the future, agricultural irrigation, groundwater recharge, and other Title 22 approved uses not listed in Finding No. 5. The potable water that is being replaced by this recycled water would be available for other uses.

The proposed North Los Angeles/Kern County Regional Recycled Water Project also provides a management strategy for wastewater effluent by creating a system to distribute recycled water for beneficial use. The proposed North Los Angeles/Kern County Regional Recycled Water Project will eventually enable the District to produce, sell, and distribute disinfected, tertiary-treated effluent to local water purveyors.

e. The need for developing housing within the region.

The District is not responsible for developing housing within the Antelope Valley. The Final Program Environmental Impact Report, November, 2008, identified that the proposed project would not have an impact on housing and population. The proposed project is limited to the provision of water supply infrastructure, as opposed to housing and commercial development that would directly affect the number of residents or employees within the area. Therefore, the proposed North Los Angeles/Kern County Regional Recycled Water Project would not directly contribute to the creation of additional housing or jobs within the Antelope Valley and thus would not result in direct growth inducement.

The proposed North Los Angeles/Kern County Regional Recycled Water Project would reduce the area's existing and future demand for imported water through recycling. The imported water conserved through implementation of the proposed project would be available to serve potable water demands of planned growth. The Antelope Valley Regional Urban Water Management Plan projects that eight percent of the water demand in 2030 would be met with recycled water, although substantially more would be available as additional end use demand develops. The proposed project would not directly or indirectly

induce growth or remove an obstacle to growth, since the increased population would occur in any case based on the cities' and counties' approved build-out growth control policies. The recycled water that would be made available as a result of the proposed project would be used to meet a small percentage of projected demand in 2030 that would otherwise be met with imported water.

f. The need to develop and use recycled water.

This Order authorizes the District to expand the list of authorized recycled water uses to include the uses identified in Finding No. 5.

25. California Environmental Quality Act Compliance (CEQA)

The Los Angeles County Waterworks District 40, Antelope Valley, prepared a Final Program Environmental Impact Report (PEIR) dated November 2008, for the North Los Angeles/Kern County Regional Recycled Water Project. The Los Angeles County Waterworks District 40, Antelope Valley, prepared a Findings of Fact, Statement of Overriding Considerations, Mitigation Monitoring and Reporting Program (Overriding Considerations) dated November 2008, for the same project. The Overriding Considerations addressed unavoidable noise and ground-vibration impacts that would result from construction activities. The Los Angeles County Board of Supervisors approved the PEIR on December 9, 2008, and a Notice of Determination was filed on December 15, 2008.

Mitigation measures that will be implemented as part of the project include control measures to ensure:

- a. Application of recycled water at agronomic rates to reduce the potential for irrigation to adversely impact the quality of groundwater in terms of salts and nutrients (including nitrates),
- b. There is adequate erosion control so soil is not released into stormwater runoff and surface waters, and
- c. Fertilizer application does not adversely impact waters of the State.

The Lahontan Water Board, acting as a CEQA Responsible Agency in compliance with California Code of Regulations, title 14, section 15096, evaluated the impacts to water quality addressed in the PEIR. As a result of the analysis, the Lahontan Water Board finds the mitigation measures in the PEIR, combined with compliance with the requirements specified by this Order, to be adequate to reduce water quality impacts to levels that are less than significant for the uses identified in Finding No. 5.

Furthermore, the use of recycled water for those uses identified in Finding Nos. 5.a through 5.c were assessed at the programmatic level within the PEIR. Those additional recycled water uses are for: (1) those that result in full consumption without a discharge of any type; (2) those for facilities, such as power plants, that result in a discharge that will be regulated by the Lahontan Water Board or the California Energy Commission pursuant to its authority under the Warren-Alquist Act; and (3) those that result in a discharge to a sanitary sewer system. Based on the evaluation of the potential impacts from these specific uses that were assessed at the programmatic level within the PEIR, the Lahontan Water Board concludes that there is no possibility that the issuance of this Order will have a significant effect on the environment. Therefore, the use of recycled water for those uses identified in Finding Nos. 5.a through 5.c is exempt from the provisions of the California Environmental Quality Act pursuant to California Code of Regulations, title 14, section 15061, subdivision (b)(3).

26. Notification of Interested Parties

The Lahontan Water Board has notified the District and interested persons of its intent to prescribe master water recycling requirements.

27. Consideration of Public Comments

The Lahontan Water Board, in a public meeting, heard and considered all comments pertaining to the use of recycled water.

**IT IS HEREBY ORDERED** that the District must comply with the following:

I. WATER RECYCLING SPECIFICATIONS

A. Effluent Limitations

1. Recycled water production at the Palmdale Water Reclamation Plant must not exceed 12 mgd (maximum average 24-hour flow). Flow in excess of this limitation shall not be considered a violation of this provision unless one or more of the Water Recycling Specifications I.B through I.C is also exceeded.

When expanded in accordance with the provisions of Board Order No. R6V-2011-0012, recycled water production at the Palmdale Water Reclamation Plant must not exceed 15 mgd (maximum average 24-hour flow). Flow in excess of this limitation shall not be considered a violation of this provision unless one or more of the Water Recycling Specifications I.B through I.C is also exceeded.

2. All disinfected tertiary recycled water supplied to the recycled water distribution system must at some point following the treatment process meet the requirements specified in California Code of Regulations, Title 22.

**B. Regulation and Enforcement**

1. Pursuant to Water Code section 13523.1, subdivision (b)(1), the District must comply with all waste discharge requirements previously adopted by the Lahontan Water Board and are in effect for regulating the production of the disinfected tertiary recycled water.
2. Pursuant to Water Code section 13523.1, subdivision (b)(2), the District must comply with the Uniform Statewide Reclamation Criteria, which are contained in California Code of Regulations, title 22, sections 60301 through 60355 and are established pursuant to Water Code section 13521.
3. Pursuant to Water Code section 13523.1, subdivision (b)(3), the District must implement and enforce its *Requirements for Recycled Water Users, Recycled Water Users Site Inspection Program, and Enforcement Response Plan* (Attachment C, which is made a part of this Order) governing the design and construction of recycled water use facilities and the use of recycled water.
4. Pursuant to Water Code section 13523.1, subdivision (b)(5), the District must conduct periodic inspections of the facilities of the recycled water users to monitor compliance by the users with the Uniform Statewide Reclamation Criteria and the District's *Requirements for Recycled Water Users, Recycled Water Users Site Inspection Program, and Enforcement Response Plan* (Attachment C, which is made a part of this Order). During the inspections, the District shall also monitor compliance with Water Recycling Specifications No. I.C.1 through I.C.15 of this Order. At a minimum, the District must inspect each recycled water use facility at least once every three years if there are no reported violations, and at least annually if there are prior violations at the facility.
5. The District must inspect recycled water use facilities and ensure users' compliance with these master water recycling requirements.

**C. General Requirements and Prohibitions**

1. The discharge of recycled water to surface waters including excessive application, intentional overflow or application, or negligence, is prohibited. However, incidental runoff of recycled water, such as unintended, minimal

over-spray from sprinklers that escapes the recycled water use area is not a violation of this Order.

2. Discharge of untreated or partially treated recycled water to the recycled water distribution system is prohibited.
3. The use of recycled water must not cause a pollution or threaten to cause a pollution as defined in Water Code Section 13050.
4. The use of recycled water must not cause a nuisance as defined in Water Code Section 13050.
5. The use of recycled water under this Order must be limited to the Authorized Recycled Water Use Sites defined in Finding No. 11 of this Order.
6. The uses of recycled water authorized under this Order are limited to those described in Finding No. 10 of this Order.
7. The source of recycled water must be limited to that described in Finding No. 6 of this Order.
8. Recycled water used to irrigate landscape areas must not be applied at a rate and amount that exceeds agronomic rates. The District must communicate to recycled water users the nutrient levels in the recycled water at least monthly so that the recycled water users can appropriately evaluate fertilizer needs prior to application of fertilizers. Both the Lancaster Water Reclamation Plant and the Palmdale Water Reclamation Plant will be simultaneously providing recycled water to the North Los Angeles/Kern County Regional Recycled Water Project distribution system. When this occurs, the District shall use the highest nutrient levels provided from either reclamation plant at any given time when communicating nutrient levels to recycled water users.
9. Recycled water must not be applied at a rate and amount that causes ponding or runoff that is other than incidental runoff.
10. Pipelines must be maintained so as to prevent leakage.
11. The use of recycled water that causes a violation of any narrative water quality objective contained in the Basin Plan is prohibited.
12. The use of recycled water that causes a violation of any numeric water quality objective contained in the Basin Plan is prohibited.

13. Where any numeric or narrative water quality objective contained in the Basin Plan is already being exceeded, the use of recycled water that causes further degradation or pollution is prohibited.
14. The District must ensure the implementation of an operation and maintenance plan for all recycled water use sites that includes the following practices:
  - a. detection of leaks from landscape irrigation facilities and implementation of corrective action within 72 hours of learning of the leak, or prior to the release of 1,000 gallons, whichever occurs first;
  - b. proper design and aim of sprinkler heads to ensure recycled water application at agronomic rates;
  - c. refraining from recycled water application during precipitation events; and
  - d. adequate protection of all facilities used to transport and store recycled water against overflow, structural damage, or a reduction in efficiency resulting from a 25-year, 24-hour storm or flood.
15. The District must not supply recycled water to parties who distribute, store, or use recycled water in a manner that is in violation of the Uniform Statewide Reclamation Criteria (as identified within California Code of Regulations, title 22) and the requirements of the Master Recycling Requirements.

## II. PROVISIONS

- A. The District may continue providing recycled water from its existing secondary treatment reclamation plant to the Agricultural Site.
- B. The District must:
  1. prior to supplying recycled water under this Order from the Stage V Plant Expansion facilities, submit to the Lahontan Water Board a copy of the final engineering report for the Stage V Plant Expansion with written confirmation from the CDPH that it has reviewed the report and finds the report to be acceptable (Review and Acceptance Letter).
  2. following receipt of the CDPH's Review and Acceptance Letter for the Stage V Plant Expansion Final Engineering Report, comply with the CDPH's

conditions as specified in the Review and Acceptance Letter.

3. prior to supplying recycled water under this Order to the North Los Angeles/Kern County Regional Recycled Water Project, submit to the Lahontan Water Board a copy of the final engineering report for the North Los Angeles/Kern County Regional Recycled Water Project with written confirmation from the CDPH that it has reviewed the report and finds the report to be acceptable (Review and Acceptance Letter).
  4. following receipt of the CDPH's Review and Acceptance Letter for the North Los Angeles/Kern County Regional Recycled Water Project Final Engineering Report, comply with the CDPH's conditions as specified in the Review and Acceptance Letter.
  5. prior to providing recycled water to new users, have received, reviewed and approved a completed *Report of Proposed Recycled Water Use*, which contains information demonstrating the user will comply with the Uniform Statewide Reclamation Criteria and the District's *Requirements for Recycled Water Users*. Copies of all approved *Reports of Proposed Recycled Water Use* and approval letters shall be maintained on file by the District.
- C. Pursuant to California Code of Regulations, title 22, section 60316, subdivision (b), the District shall notify the Lahontan Water Board, California Department of Public Health and County of Los Angeles Department of Health Services of any incidence of backflow from a recycled water system into the potable water system within 24 hours of discovery of the incident.
- D. Pursuant to Water Code section 13267, subdivision (b), the District shall comply with Monitoring and Reporting Program R6V-2012-PROPOSED (Attachment E which is made a part of this Order) as specified by the Executive Officer.
- E. The District shall comply with the "Standard Provisions for Waste Discharge Requirements," dated September 1, 1994, in Attachment D, which is part of this Order, with the exception that recycled water storage facilities shall be designed for protection against overflow during a 25-year, 24-hour storm.

### III. RECYCLED WATER POLICY IMPLEMENTATION

- A. The District must develop and/or participate in the development of a salt/nutrient management plan for the Antelope Valley that is consistent with Paragraph 6 of the Recycled Water Policy. The salt/nutrient management plan must be submitted to, or an extension to submit the salt/nutrient management plan must be approved by, the Lahontan Water Board by **May 14, 2014**, in

accordance with the Recycled Water Policy.

- B. Before supplying recycled water to new users for landscape irrigation under this Order, the District must develop and implement an operations and management plan to control incidental runoff that is consistent with Paragraph 7(a) of the Recycled Water Policy.

I, Harold J. Singer, Executive Officer, do hereby certify that the foregoing is a full, true, and correct copy of an Order adopted by the California Regional Water Quality Control Board, Lahontan Region, on January 11, 2012.

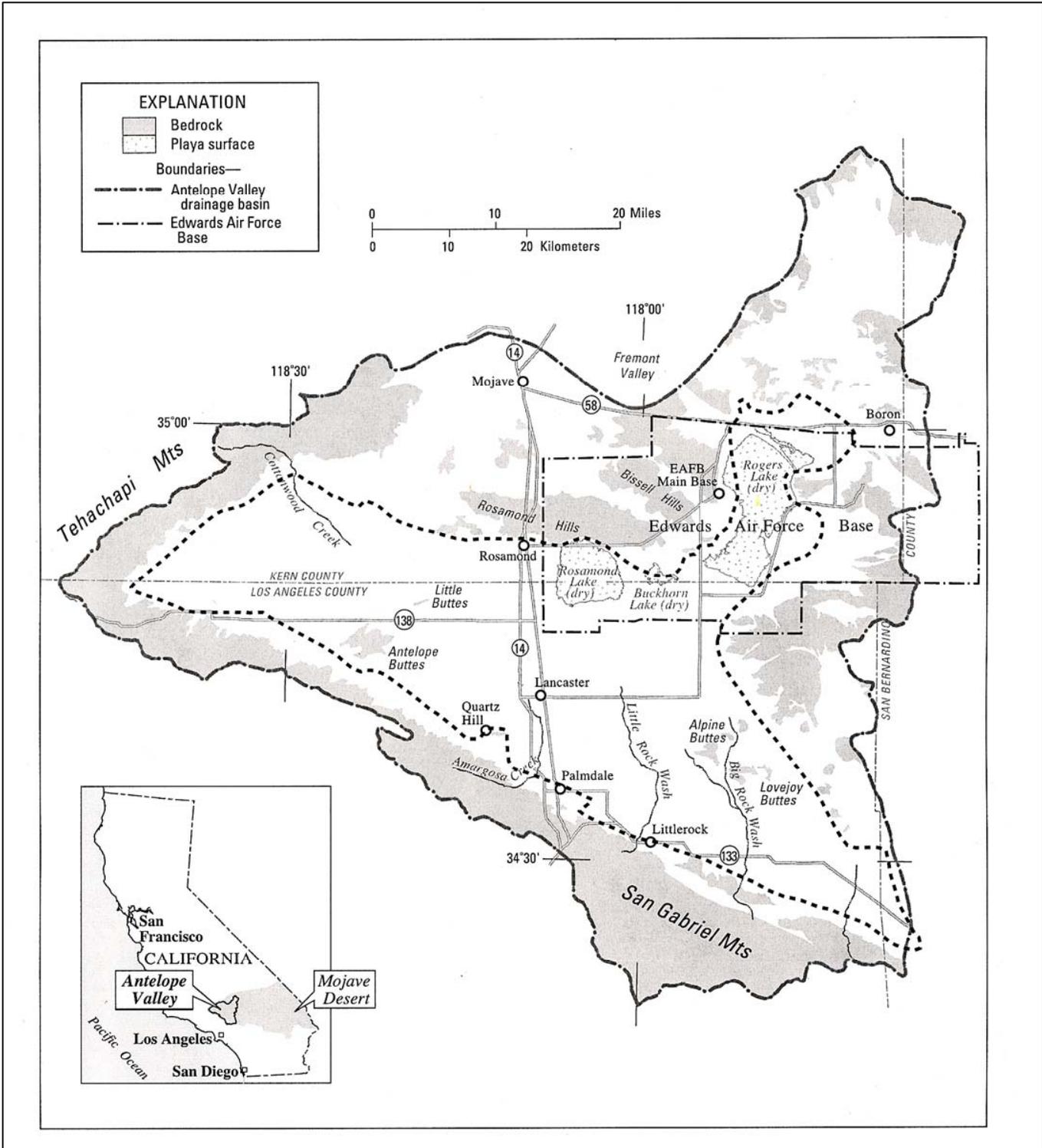
---

HAROLD J. SINGER  
EXECUTIVE OFFICER

- Attachments:
- A. General Location Map
  - B. Permit Area Map
  - C. District Recycled Water Program
    - 1. Requirements for Recycled Water Users
    - 2. Recycled Water Use Site Inspection Program
    - 3. Reuse Site Inspection Report
    - 4. Enforcement Response Plan
  - D. Standard Provisions for Waste Discharge Requirements

This page is blank intentionally.

# ATTACHMENT A General Location Map



Modified from Figure 1, *Simulation of Groundwater Flow and Land Subsidence, Antelope Valley Groundwater Basin*, USGS, 2003

This page is blank intentionally.

ATTACHMENT B  
Permit Area Map

PROPOSED

This page is left blank intentionally.

PROPOSED

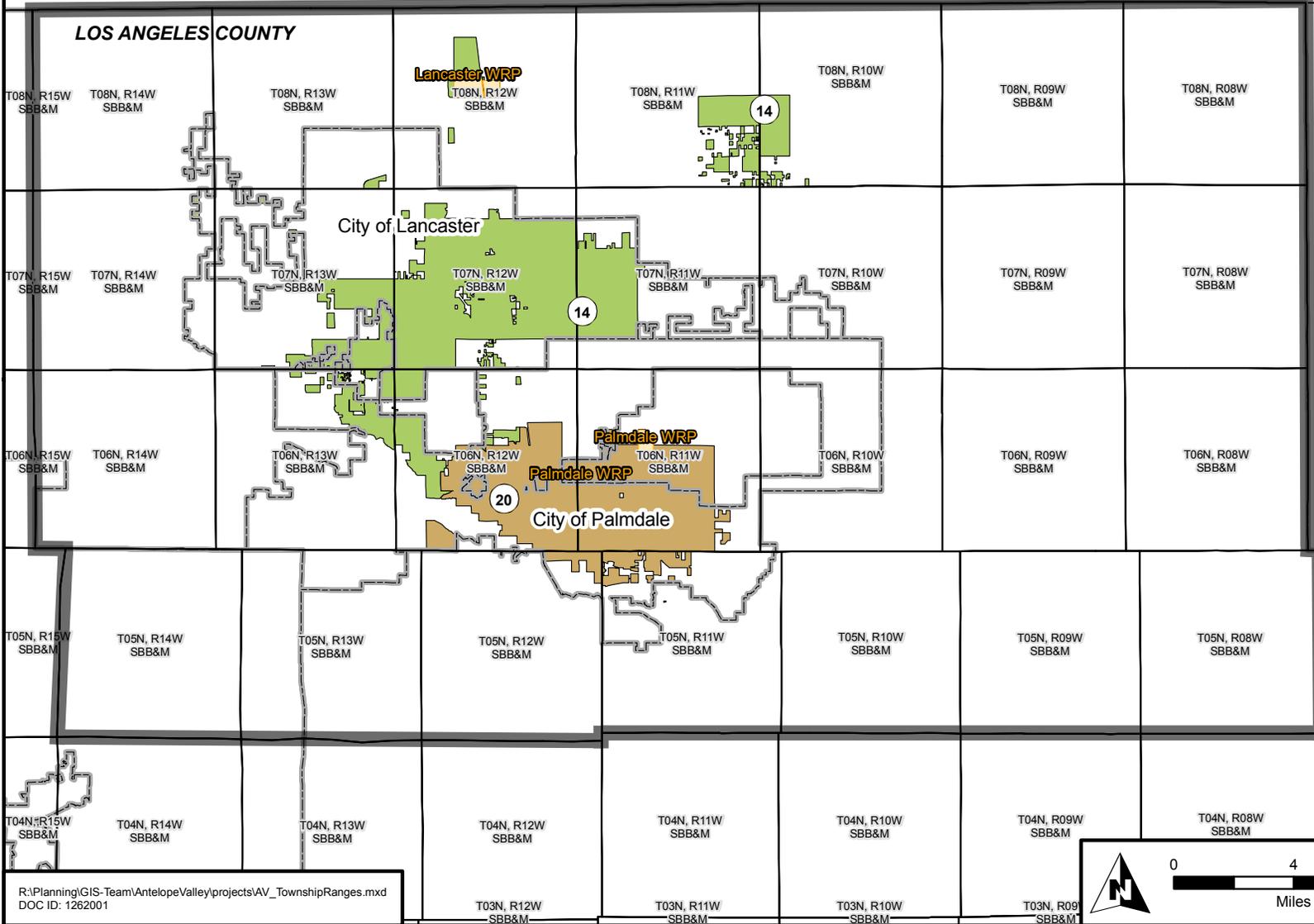
# ANTELOPE VALLEY: LOS ANGELES COUNTY SANITATION DISTRICTS NO. 14 AND 20

KERN COUNTY

 Permit Area Boundary

LOS ANGELES COUNTY

SAN BERNARDINO COUNTY



R:\Planning\GIS-Team\AntelopeValley\projects\AV\_TownshipRanges.mxd  
DOC ID: 1262001

This page is blank intentionally.

ATTACHMENT C  
District Recycled Water Program

1. Requirements for Recycled Water Users
2. Recycled Water Use Site inspection Program
3. Reuse Site Inspection Report
4. Enforcement Response Plan

PROPOSED

This page is blank intentionally.

REQUIREMENTS FOR RECYCLED WATER USERS

PROPOSED

This page is blank intentionally.

**Requirements for Recycled Water Users  
County Sanitation Districts of Los Angeles County  
District Nos. 14 and 20**

**1. Introduction**

These Requirements for Recycled Water Users (Requirements) establish regulations pursuant to California Water Code (Water Code) section 13523.1(b), and permits issued to the County Sanitation Districts of Los Angeles County (Districts) by the California Regional Water Quality Control Board, Lahontan Region (LRWQCB). These permits include waste discharge requirements (WDRs) issued pursuant to Water Code section 13263, water reclamation requirements (WRRs) issued pursuant to Water Code section 13523, or a master reclamation permit (Master Permit) issued pursuant to Water Code section 13523.1. The Requirements are in conformance with ordinances adopted by County Sanitation District No. 14 of Los Angeles County and by County Sanitation District No. 20 of Los Angeles County (Ordinances).

**2. Background**

Water Code section 13523.1(a) authorizes the issuance of Master Permits to suppliers or distributors, or both, of recycled water in lieu of issuing individual water reclamation requirements to each recycled water user. Water Code section 13523.1(b) sets forth the requirements for Master Permits issued by the Regional Water Quality Control Boards (RWQCBs), including a condition that the permittee establish and enforce rules or regulations for recycled water users governing the design and construction of recycled water use facilities and the use of recycled water, in accordance with the uniform Statewide Reclamation Criteria established pursuant to Water Code section 13521.

A Master Permit has been adopted by the LRWQCB for the Lancaster Water Reclamation Plant (WRP). Should the LRWQCB issue individual WDRs or WRRs to the Districts for the use of tertiary recycled water for non-potable reuse applications from the Lancaster WRP or Palmdale WRP, it is the Districts' intent that the Requirements established herein will apply to those uses. These Requirements may be updated, as necessary, to comply with revisions to this permit or applicable laws and regulations.

**3. Findings**

The Requirements are in conformance with the following:

- Provisions established by the WDRs, WRRs, or Master Permits issued by the LRWQCB to the Districts.
- Applicable portions of the Water Code, including Water Code section 13523.1.
- Applicable portions of the Health and Safety Code.
- California Code of Regulations (CCR), Title 22, Division 4, Chapter 3, Uniform Statewide Reclamation Criteria.
- CCR, Title 17, Division 1, Chapter 5, Subchapter 1, Group 4, Article 1 & 2.
- Regulations established by the County of Los Angeles Department of Public Health (LACDPH) for the use of recycled water.

The Requirements are consistent with the following:

- The Guidelines for the *Preparation of an Engineering Report for the Production, Distribution and Use of Recycled Water*, California State Department of Public Health (CDPH).

- Any measures that are deemed necessary for protection of public health, such as the American Water Works Association (AWWA) California/Nevada section, *Guidelines for the Distribution of Non-Potable Water* and *Guidelines for the On-Site Retrofit of Facilities Using Disinfected Tertiary Recycled Water* or alternate measures that are acceptable to CDPH.
- Relevant user manuals such as the Los Angeles County Recycled Water Advisory Committee's, 2005, *Recycled Water User Manual*.
- Relevant guidance issued by LACDPH for the use of recycled water.

#### **4. Definitions that Apply to these Requirements**

- 4.1. Authorized Recycled Water Use Site (Site) is a site authorized for use of recycled water; the uses of recycled water and the site location must comply with Permits as issued by the LRWQCB to the Districts.
- 4.2. Direct User is any person to whom the Districts directly distribute recycled water under the Permits issued to the Districts by the LRWQCB.
- 4.3. Incidental Runoff is any small amount of recycled water that leaves the Site as a result of over-spray or leakage from sprinklers, over watering, breaks in lines, or overflow of impoundments that contain recycled water during storms.
- 4.4. Master Reclamation Permit (Master Permit) contains requirements established by the LRWQCB for the Districts pursuant to Water Code section 13523.1.
- 4.5. Permit means any LWRQCB issued WDRs, WRRs, or Master Permit.
- 4.6. Person is any individual, partnership, corporation, governmental subdivision or unit of a governmental subdivision, or public or private organization or entity of any character.
- 4.7. Purveyor is any public, private, investor-owned, or other water utility that is legally permitted to distribute water and that obtains recycled water from the Districts for distribution to Users.
- 4.8. Recycled water is water produced by a municipal water reclamation facility that is suitable for a beneficial use.
- 4.9. User is any person to whom the Districts distribute recycled water under the Permits issued to the Districts by the LRWQCB, including end users to whom recycled water is conveyed through an intermediate party. User does not include persons who have been independently issued Permits by the LRWQCB.
- 4.10. User Agreement is a contractual agreement between the User and/or Purveyor and the Districts that establishes the conditions for recycled water service and use.
- 4.11. Waste Discharge Requirements (WDRs) are requirements established for the Districts by the LRWQCB pursuant to Water Code section 13263.
- 4.12. Water Recycling Criteria are the criteria established by the CDPH generally dealing with the levels of constituents in recycled water and the means for assurance of reliability under the design concept, which will result in safe recycled water from the standpoint of public health. The criteria are established pursuant to Water Code Section 13521, and are contained in the CCR, Title 22, Division 4, Chapter 3; also referred to as the "Uniform Statewide Reclamation Criteria."
- 4.13. Water Recycling Requirements (WRRs) are requirements established for the Districts by the LRWQCB pursuant to Water Code section 13523.

## **5. Requirements for Recycled Water Users**

### **5.1 Effective Date**

The effective date of the Requirements is July 1, 2008.

### **5.2 Applicability**

- 5.2.1 Unless otherwise stated, these Requirements shall apply to any and all Users to whom the Districts distribute tertiary recycled water, either directly or through an intermediate party. These Requirements shall also apply to Purveyors that act as intermediate parties in delivering recycled water to Users. User does not include persons who have been independently issued Permits by the LRWQCB.
- 5.2.2 These Requirements do not apply to the Districts, when the Districts are both the Purveyor and/or the User, receiving WDRs or WRRs issued by the LRWQCB for the use of tertiary recycled water.

### **5.3 General Requirements**

Use of recycled water must comply with all applicable state laws, regulations, Districts' Permits, and any amendments thereto, the Ordinances, and these Requirements.

### **5.4 General Prohibitions**

- 5.4.1 Use of recycled water for any purposes other than those explicitly approved in the effective User Agreement is strictly prohibited.
- 5.4.2 The User shall insure that the treatment, storage, distribution or use of recycled water shall not create a nuisance as defined in Water Code section 13050(m).
- 5.4.3 The User shall not discharge recycled water from treatment facilities, irrigation holding tanks, storage ponds, or other containment, other than for permitted reuse, except in accordance with other LRWQCB issued Permits, contingency plans authorized by the LRWQCB or for an approved discharge to a municipal sewage treatment system.

### **5.5 Process to Obtain Permission to Use Recycled Water**

- 5.5.1 Except as provided by the Ordinances, any Direct User or Purveyor who wishes to receive recycled water produced by the Districts must enter into a User Agreement with District No. 14 or No. 20 depending on the location of the reuse project before the use of recycled water can begin. The User Agreement shall include the Districts' terms and conditions for the use of recycled water.
- 5.5.2 Any Direct User, or Purveyor with a User, who intends to utilize recycled water produced by the Districts for an authorized use at a Site must file a User Application Form (Application) with the Districts and receive approval in writing from the Districts before the use of recycled water can begin for that use and Site.
- 5.5.3 The Application filed by the Direct User or Purveyor shall include:
  - .3.1. A detailed description of the proposed Site with:
    - (a) A map showing the specific boundaries of the proposed Site;
    - (b) The person or persons responsible for operation and maintenance of the site (O&M Staff), including the person designated as the Site Supervisor and contact information;

- (c) Evidence that the O&M Staff and Site Supervisor have received appropriate training from the Districts or an equivalent training program or the date by which training will occur prior to delivery of recycled water such that the Site is operated and maintained in compliance with applicable laws and regulations, the Districts' Permits, and these Requirements;
  - (d) The specific use to be made of the recycled water at each Site.
- .3.2. Design plans and a description of best management practices that show that the quality of waters of the State will be protected (see Section 5).
  - .3.3. Plans and specifications describing:
    - (a) Proposed piping systems to be used;
    - (b) Pipe locations for both recycled and potable systems;
    - (c) Type and location of the outlets and plumbing fixtures that will be accessible to the public;
    - (d) The methods and devices to be used to prevent backflow of recycled water into the potable water system.
  - .3.4. The Recycled Water System Operations Manual or the date by which a Recycled Water System Operations Manual will be submitted prior to the delivery of recycled water.
  - .3.5. Emergency Cross-Connection Response Plan in accordance with the guidelines established by LACDPH or the date by which the Emergency Cross-Connection Response Plan will be submitted prior to delivery of recycled water.
- 5.5.4 Any User or Purveyor who wishes to receive recycled water produced by the Districts must follow the process presented in Tables 1 and 2 that shows the various agencies involved in the process, documents that must be completed, how documents are routed, etc. Table 1 outlines the process for Direct Users or Purveyors. Table 2 outlines the process for Users receiving water from Purveyors

## **5.6 Operational Requirements and Best Management Practices**

- 5.6.1 Each User shall designate a Site Supervisor who is responsible for the recycled water system at Site(s) under the User's control. Specific responsibilities of the Site Supervisor include the proper installation, operation and maintenance of the recycled water system; compliance with the Districts' Permits, applicable laws and regulations, local health department guidelines, and these Requirements; prevention of potential hazards; coordination with the cross-connection control program in accordance with CCR, Title 17 and LACDPH or local health department guidelines; preservation of the recycled water system in "as-built" form.
- 5.6.2 The User's Site Supervisor and O&M staff shall receive appropriate training to assure proper operation of the recycled water facilities, worker protection, and compliance with all applicable laws and regulations, the Districts' Permits, and these Requirements.
- 5.6.3 The Site Supervisor shall instruct any person at the Site involved with the use of recycled water on its proper use and precautions.
- 5.6.4 All recycled water facilities and control systems shall be maintained in good working order and operated as efficiently as possible to achieve compliance with all applicable laws and regulations, the Districts' Permits, and these Requirements.

- 5.6.5 Except as allowed under CCR, Title 17, section 7604, no physical connection shall be made nor shall a connection be allowed to exist between any recycled water system and potable water system.
- 5.6.6 Cross-connection test shall be performed as necessary to ensure the absolute separation of the recycled water system and potable water system, in accordance with the requirements of LACDPH or local health department.
- .6.1. A cross-connection test shall be performed following any significant modifications to the recycled water system or potable water system, construction of new buildings, or any activity that may impact, or has impacted these systems.
  - .6.2. An initial cross-connection test shall be performed to determine if there are any unknown connections between potable piping and existing piping to be used for recycled water prior to construction or retrofit work.
  - .6.3. Prior to connection with the recycled water system, a final cross-connection test shall be performed to verify that construction or retrofit work was performed correctly.
  - .6.4. Cross-connection testing shall be performed by a specialist who has been certified by AWWA or a group with equivalent certification requirements.
- 5.6.7 The potable water supply shall not be used as a backup or supplemental source of water for a recycled water system unless the connection between the two systems is protected by an air gap separation which complies with the requirements of CCR, Title 17, section 7602, Subdivision (a) and CCR, Title 17, section 7603, Subdivision (a), and that such connection has been approved by CDPH and/or its delegated local agency.
- 5.6.8 Any backflow prevention device installed to protect the potable water system shall be annually inspected and maintained in accordance with CCR, Title 17, section 7605.
- .8.1. Backflow inspections shall be conducted by a person who has demonstrated competency in testing to the User, Purveyor, and/or LACDPH or local health department.
- 5.6.9 Hose bibs shall not be used in the recycled water system, except in the recycled water system for Sites for which there is restricted public access. Quick couplers that are different from that used on the potable water system may be used.
- 5.6.10 All recycled water piping and appurtenances in new installations and appurtenances in retrofit installations shall be colored purple or distinctively marked with purple tape in accordance with Health and Safety Code section 116815 and LACDPH or local health department requirements.
- 5.6.11 All sites shall be designed and operated to prevent direct human consumption of recycled water, or use of recycled water for processing of food or drink intended for human consumption.
- .11.1. Where recycled water could potentially be accessed for human consumption, conspicuous signs shall be posted that include the following wording: "RECYCLED WATER – DO NOT DRINK."
  - .11.2. The prescribed wording included on the sign(s) shall also be translated into Spanish and other appropriate languages.
  - .11.3. Each sign shall display an international symbol similar to that shown in CCR, Title 22, section 60310, subdivision (g), Figure 60310-A.
  - .11.4. The sign(s) shall be of a size easily readable by the public; no less than 4 inches high by 8 inches wide.

- 5.6.12 Irrigation with disinfected tertiary recycled water shall not take place within 50 feet of any domestic water supply well.
- 5.6.13 Irrigation with disinfected tertiary recycled water shall not take place within 50 feet of any uncovered reservoir or stream currently used as a source of domestic water.
- 5.6.14 Impoundment of disinfected tertiary recycled water shall not occur within 100 feet of any domestic water supply well.
- 5.6.15 All recycled water impoundments shall be adequately protected from erosion, washout and flooding from a 24-hour rainfall event having a predicted frequency of once in 100 years.
- 5.6.16 Vehicles used for distributing recycled water for soil compaction and dust control or other uses shall have an adequate tank and plumbing systems to ensure that leaks and ruptures will not occur in the course of normal use.
- .16.1. Control valves shall be provided and configured such that recycled water can be applied in a controlled fashion on the Site and completely retained during transit.
  - .16.2. Spray heads or nozzles shall be provided and configured such that recycled water is applied to prevent runoff, ponding, or windblown spray conditions.
  - .16.3. Each tank shall be equipped with an approved air-gap separation between the filler tube and the tank to prevent back-siphonage.
  - .16.4. Each tank used to store and/or transport recycled water must be flushed and disinfected prior to storage and/or transport of potable water or recycled water of better quality.
  - .16.5. The vehicles shall be clearly labeled in accordance with the requirements specified in Section 5.6.11.
- 5.6.17 Sites shall be designed and operated using best management practices (BMPs) to protect waters of the state and prevent public contact with recycled water.
- 5.6.18 The Sites shall be designed and operated using BMPs to prevent recycled water spray, mist, or surface flow from either leaving the Site or reaching:
- (a) Any perennial surface waters located adjacent to the Site;
  - (b) Areas where the public has access (e.g., dwellings, designated outdoor eating areas, or food handling facilities);
  - (c) Drinking fountains unless specifically protected with a shielding device.
- 5.6.19 BMPs shall include, but not be limited to:
- (a) Use of buffer zones;
  - (b) Discontinuation of application of recycled water during precipitation events, which are of sufficient magnitude to generate surface flow or significant ponding within the Site;
  - (c) Use of devices that protect drinking water fountains against contact with recycled water spray, mist, or surface flow;
  - (d) Irrigation with recycled water during periods of minimal human use of the irrigated area and timing of irrigation to allow an adequate dry-out time before the irrigated area will be used by the public.
- 5.6.20 Any storage facility or impoundment containing recycled water for reuse applications shall be managed in a manner to control odors, nuisance conditions or vectors such as

mosquitoes. Should such problems develop, a management plan shall be devised and implemented to monitor, correct, and control future occurrences.

5.6.21 Sites shall be designed and operated using BMPs so that application of recycled water occurs at agronomic rates whereby irrigation does not promote downward migration of salts (including nitrates), which could unreasonably affect present and anticipated beneficial uses of water, or result in water quality less than that prescribed in water quality control plans or policies.

.21.1. To demonstrate whether irrigation is at agronomic rates, the User shall provide information to the Districts including a tabular comparison of the volume of water required for plant growth in the landscape area to the volume of recycled water (and supplemental water) applied to the area.

5.6.22 Fertilizer application shall:

.22.1. Not unreasonably affect present and anticipated beneficial uses of water, or result in water quality less than that prescribed in water quality control plans or policies.

.22.2. Occur at agronomic rates. To demonstrate whether fertilizer application is at agronomic rates, the User shall provide information to the Districts including a tabular comparison of the amount of fertilizer needed for plant growth in the landscape area to the amount applied to the area.

.22.3. Occur if the levels of nitrogen in the recycled water are not sufficient for plant growth. If levels are not sufficient, the Site Supervisor shall calculate how much fertilizer needs to be applied by subtracting the level in recycled water from the level needed for plant growth.

5.6.23 Sites shall be designed and operated using BMPs so that adequate erosion control is implemented so that soil is not released into storm water runoff or surface waters.

5.6.24 Each User shall demonstrate to the Districts the means by which all applicable use area requirements as specified in the Districts' Permits and these Requirements will be complied with.

## **6. Site Inspections and Site Access**

6.1 The Purveyor shall conduct periodic site inspections and prepare a report for each Site inspection pursuant to Section 8.3.

.1.1. Site inspections must be conducted at a minimum once every three (3) years per site or more frequently at the request of the Districts.

.1.2. In the event of identification of violation(s) during site inspections, corrective actions must be taken pursuant to Section 7 and notification shall be provided pursuant to Section 8.3.

6.2 The User shall allow an authorized representative of any of the following agencies the right to enter, inspect the Site, and conduct testing upon presentation of proper credentials: the Districts, LRWQCB, CDPH, and LACDPH or local health department.

6.3 In cooperation with the User or Purveyor, the Districts will make periodic inspections of the Site.

## **7. Corrective Action**

- 7.1 The Site Supervisor shall immediately initiate corrective action to eliminate violation of any applicable laws or regulations, the Districts' Permits, or these Requirements, and make the appropriate notifications pursuant to Section 8.2.
- 7.2 The Purveyor or Direct User must verify the corrective action(s) and report to the Districts pursuant to Section 8.2.
- 7.3 In the event of contamination of a potable water system due to a cross-connection with the recycled water system, the Site Supervisor shall immediately invoke the Emergency Cross-Connection Response Plan and make the appropriate notifications pursuant to Section 8.1.

## **8. Notification and Reporting**

### **8.1 Public Health, Spills, Unauthorized Discharges**

- 8.1.1 Upon being notified or determining that one of the following events has occurred, the Site Supervisor shall immediately notify the Districts by telephone, and the LRWQCB, CDPH and LACDPH by telephone or electronic means. Written confirmation must be provided to all agencies within three (3) business days from the day of notification.
  - .1.1. There is a complaint (or other source of information) concerning recycled water use that may involve illness.
  - .1.2. An unauthorized discharge of more than 50,000 gallons of tertiary recycled water. Information provided shall include: the date and time the spill began and ended; the location of the spill; if the spill entered a storm drain or receiving water; the estimated volume of the spill or flow if the spill is ongoing; the estimated time of repair; the cause of the spill; the agencies involved with repair and clean-up; and corrective actions taken or plans for corrective actions.
  - .1.3. The potable water system has been contaminated due to a cross-connection with recycled water.
- 8.1.2 Upon being notified or determining that a spill or other release of recycled water from a Site, other than incidental runoff, including, but not limited to, breaks in the recycled water irrigation or distributions systems has occurred, the Site Supervisor shall immediately notify the Districts by telephone. Information provided shall include: the date and time the spill began and ended; the location of the spill; if the spill entered a storm drain or receiving water; the estimated volume of the spill or flow if the spill is ongoing; the estimated time of repair; the cause of the spill; the agencies involved with repair and clean-up; and corrective actions taken or plans for corrective actions. Written confirmation shall be provided within three (3) business days from the date of notification.

### **8.2 Non-compliance with Regulations**

- 8.2.1 The Site Supervisor shall notify the Districts by telephone or electronic means upon knowledge of any noncompliance of applicable laws and regulations, the Districts' Permits, and these Requirements. Written confirmation shall be provided within three (3) business days from the date of notification.

8.2.2 The Purveyor or Direct User shall provide written verification to the Districts within ninety (90) days from the date of knowledge of the violation that corrective actions have been implemented.

### 8.3 Site Inspections

8.3.1 The site inspection report shall be signed and dated by the Site Supervisor and the inspector, and provided to the Districts within thirty (30) days following the end of the quarter in which the inspection was conducted.

8.3.2 The inspector shall immediately notify the Site Supervisor of violation(s) identified during site inspections and what corrective actions must be taken.

8.3.3 The Purveyor or Direct User shall notify the Districts by electronic means at least one (1) week prior to conducting a site inspection.

### 8.4 Miscellaneous Information

8.4.1 If someone other than the User is responsible for applying the recycled water (e.g., a truck hauler), then the User shall inform them of these Requirements in a written permit or other suitable manner.

8.4.2 The Site Supervisor is required to provide the Districts with an address and phone number(s) where he or she can be contacted at all times. The Site Supervisor is responsible for maintaining current pertinent information regarding the Site and Districts' contacts.

8.4.3 The Districts shall be notified in writing of any proposed changes in the individual designated as the Site Supervisor.

8.4.4 The Districts shall be notified in writing of any planned modifications or additions to the recycled water system. Any proposed significant modifications or additions to the recycled water system shall be reviewed and approved by the Districts before being made.

8.4.5 The User or Purveyor shall provide information as requested by the Districts in order for the Districts to comply with monitoring and reporting requirements issued by the LRWQCB.

## 9. Record Keeping

9.1 Current as-built drawings and other design plans of the recycled water system and potable water system, and any forms or reports as required by the Districts including, but not limited to, inspection reports, cross-connection tests, etc., shall be maintained by the Site Supervisor or Purveyor.

9.2 A copy of these Requirements, the Districts' Permits, the Emergency Cross-Connection Response Plan, and the Recycled Water System Operations Manual shall be maintained by the Site Supervisor so that they are available to operating personnel at all times.

9.3 For each site, the Site Supervisor or Purveyor must keep operation and maintenance logs that are available to the Districts. The logs shall include information that will be required for compliance with Permit requirements. This information, such as the monthly volumes of recycled water used at each site, dates of inspections and tests, etc, will be specified by the Districts in the approval letter.

**Table 1. Process to Obtain Recycled Water for Direct Users or Purveyors**

<b>Process</b>	<b>Applicable Documents or Actions Required</b>	<b>Responsible Entity</b>
<i>Step 1</i> – Consult with Districts and review Recycled Water Users Handbook	Districts' Recycled Water Users Handbook	Direct User or Purveyor
<i>Step 2</i> - Prepare draft plans and specifications	California Department of Public Health (CDPH) requirements in California Code of Regulations (CCR) Title 17 and 22 <sup>1</sup> , Los Angeles County Department of Public Health (LACDPH) Guidelines	Direct User or Purveyor
<i>Step 3</i> - Draft User Agreement or amendment (if site is not covered under existing agreement)	Districts' User Agreement	Districts / Direct User or Purveyor
<i>Step 4</i> - Approve User Agreement or Amendment	Present Agreement or Amendment to Districts' Board and governing body of Direct User or Purveyor for approval	Districts / Direct User or Purveyor
<i>Step 5</i> - Submit Application for recycled water use	Districts' User Application Form	Direct User or Purveyor
<i>Step 6</i> - Identify distribution issues, verify allowed uses, estimate quantity of water and delivery schedule	Verification of information provided in the Application Form. Send conditional approval in writing with caveat that project commencement is contingent upon Direct User or Purveyor receiving all regulatory approvals.	Districts
<i>Step 7</i> – Complete California Environmental Quality Act (CEQA) Process	Make sure there is proper CEQA documentation for the site	Direct User or Purveyor
<i>Step 8</i> – Consult with health agencies ( <i>recommended</i> )	Describe project and show draft plans to CDPH and LACDPH	Direct User or Purveyor
<i>Step 9</i> – Finalize and submit plans and specifications	Plans and specifications submitted to LACDPH; LACDPH Cross-Connection Plan Approval Application and fee.	Direct User or Purveyor
<i>Step 10</i> - Provide materials and/or training to User on proper operation of a recycled water system	Districts' Recycled Water Users Handbook to be provided by Districts; training to be provided by Districts and/or Purveyor (or an other equivalent program can be substituted)	Districts or Purveyor
<i>Step 11</i> – Consult with Lahontan Regional Water Quality Control Board (LRWQCB) ( <i>recommended</i> )	Describe project and discuss Engineering Report needs	Direct User or Purveyor
<i>Step 12</i> – Final plans and specifications	Obtain approval of final plans and specifications from LACDPH	Direct User or Purveyor

<sup>1</sup> <http://www.cdph.ca.gov/healthinfo/environhealth/water/Pages/Waterrecycling.aspx>.

**Table 1. Process to Obtain Recycled Water for Direct Users or Purveyors**

Process	Applicable Documents or Actions Required	Responsible Entity
Step 13 – Prepare / amend Engineering Report	CDPH <i>Guidelines for Preparation of an Engineering Report for the Production, Distribution and Use of Recycled Water</i> <sup>2</sup> ; Districts' information on water reclamation plants; Direct User or Direct User or Purveyor completes the Engineering Report; the Districts provide information related to treatment facilities; the report must be prepared and stamped by a professional engineer registered in California.	Direct User or Purveyor and Districts
Step 14 – Submit Engineering Report to CDPH and LRWQCB, with copy to Districts	Completed Engineering Report	Direct User or Purveyor
Step 15 – If applicable, submit revised Engineering Report, with copy to Districts	Revisions/additional information may be requested by CDPH and/or the LRWQCB	Direct User or Purveyor
Step 16 – Authorization of project under existing or new LRWQCB permit	Letter or permit	LRWQCB; possibly CDPH and/or LACDPH
Step 17 – Notify Districts of Final Regulatory Approvals	Direct User or Purveyor sends copy of LRWQCB letter or permit to Districts and any other applicable CDPH or LACDPH documents	Direct User or Purveyor
Step 18 – Pre- and post-construction inspections	Contact LACDPH prior to construction to arrange for site inspections, initial cross-connection and backflow prevention device testing; LACDPH Guidelines and Recycled Water System Inspection Report.	Direct User or Purveyor
Step 19 – Approval of final construction	By LACDPH	Direct User or Purveyor
Step 20 – Begin project implementation		Direct User or Purveyor
Step 21 – Submit revised as-built drawings of recycled water distribution system if necessary	Must be provided to LACDPH and Districts if any modifications have been made to original drawings	Direct User or Purveyor

<sup>2</sup> <http://www.cdph.ca.gov/certlic/drinkingwater/Documents/Recharge/ERGUIDE2001.PDF>.

**Table 2. Process to Obtain Recycled Water for Users Receiving Water From Purveyors**

<b>Process</b>	<b>Applicable Documents or Actions Required</b>	<b>Responsible Entity</b>
<i>Step 1</i> – Consult with Purveyor and review Recycled Water Users Handbook	Districts’ Recycled Water Users Handbook	User and Purveyor
<i>Step 2</i> – Prepare draft plans and specifications	California Department of Health Services (CDPH) requirements in California Code of Regulations (CCR) Title 17 and 22 <sup>3</sup> , Los Angeles County Department of Public Health (LACDPH) Guidelines.	User or Purveyor
<i>Step 3</i> – Request for recycled water service	Use recycled water Purveyor’s application process	User
<i>Step 4</i> – Draft User Agreement or amendment (if site is not covered under existing agreement)	Districts’ User Agreement or Amendment	Districts / Purveyor
<i>Step 5</i> – Approve User Agreement or Amendment	Present Agreement or Amendment to Districts’ Board and governing body of Purveyor for approval	Districts / Purveyor
<i>Step 6</i> – Submit Application for recycled water use to Districts	Districts’ User Application Form	Purveyor
<i>Step 7</i> – Identify distribution issues, verify allowed uses, estimate quantity of water and delivery schedule	Verification of information provided in the Districts’ User Application Form. Send conditional approval in writing with caveat that project commencement is contingent upon Direct User or Purveyor receiving all regulatory approvals.	Districts
<i>Step 8</i> – Draft contract or amendment or other legal control mechanism (if site is not covered under existing contract or control mechanism)	Contract, contract amendment, or control mechanism between Purveyor and User	Purveyor and User
<i>Step 9</i> – Approve contract or amendment or other legal control mechanism (if site is not covered under existing contract or control mechanisms)	Purveyor and User authorize contract, contract amendment, or control mechanism	Purveyor and User
<i>Step 10</i> – Complete California Environmental Quality Act (CEQA) Process	Make sure there is proper CEQA documentation for the site	Purveyor and User
<i>Step 11</i> – Consult with health agencies ( <i>recommended</i> )	Describe project and show draft plans to CDPH and LACDPH	Purveyor
<i>Step 12</i> – Finalize and submit plans and specifications	Plans and specifications submitted to LACDPH; LACDPH Cross-Connection Plan Approval Application and fee	Purveyor

<sup>3</sup> <http://www.cdph.ca.gov/healthinfo/environhealth/water/Pages/Waterrecycling.aspx>.

**Table 2. Process to Obtain Recycled Water for Users Receiving Water From Purveyors**

<b>Process</b>	<b>Applicable Documents or Actions Required</b>	<b>Responsible Entity</b>
<i>Step 13</i> – Provide materials and/or training to User on proper operation of a recycled water system	Districts' Recycled Water Users Handbook and training to be provided by Purveyor (the Districts' training program or another equivalent program can be substituted)	Purveyor
<i>Step 14</i> – Consult with Lahontan Regional Water Quality Control Board (LRWQCB) ( <i>recommended</i> )	Describe project and discuss Engineering Report needs	Purveyor
<i>Step 15</i> – Final plans and specifications	Obtain approval of final plans and specifications from LACDPH	Purveyor
<i>Step 16</i> – Prepare / amend Engineering Report	CDPH <i>Guidelines for Preparation of an Engineering Report for the Production, Distribution and Use of Recycled Water</i> <sup>4</sup> ; Districts' information on water reclamation plants; Purveyor completes the Engineering Report; the Districts provide information related to treatment facilities; the report must be prepared and stamped by a professional engineer registered in California.	Purveyor and Districts
<i>Step 17</i> – Submit Engineering Report to CDPH and LRWQCB, with copy to Districts	Completed Engineering Report	Purveyor
<i>Step 18</i> – If applicable, submit revised Engineering Report, with copy to Districts	Revisions/additional information may be requested by CDPH and/or the LRWQCB	Purveyor
<i>Step 19</i> – Authorization of project under existing or new LRWQCB permit	Letter or permit	LRWQCB; possibly CDPH and/or LACDPH
<i>Step 20</i> – Notify Districts of Final Regulatory Approvals	Purveyor sends copy of LRWQCB letter or permit to Districts and any other applicable CDPH or LACDPH documents	Purveyor
<i>Step 21</i> – Pre- and post-construction inspections	Contact LACDPH prior to construction to arrange for site inspections, initial cross-connection and backflow prevention device testing; LACDPH <i>Guidelines and Recycled Water System Inspection Report</i>	Purveyor
<i>Step 22</i> – Approval of final construction	By LACDPH	Purveyor
<i>Step 23</i> – Begin project implementation		Purveyor and User
<i>Step 24</i> – Submit revised as-built drawings of recycled water distribution system if necessary	Must be provided to LACDPH and Districts if any modifications have been made to original drawings	Purveyor

<sup>4</sup> <http://www.cdph.ca.gov/certlic/drinkingwater/Documents/Recharge/ERGUIDE2001.PDF>.

This page is blank intentionally.

RECYCLED WATER USE SITE INSPECTION PROGRAM

PROPOSED

This page is blank intentionally.

**Recycled Water Use Site Inspection Program  
County Sanitation Districts of Los Angeles County  
District Nos. 14 and 20**

**1. Introduction**

County Sanitation District Nos. 14 and 20 of Los Angeles County (Districts) have developed Requirements for Recycled Water Users (Requirements). The Requirements, which are mandated by the Water Code, have been developed to ensure that recycled water users comply with all applicable statutes, regulations, and the Districts' Master Permits. A Master Permit has been adopted by the California Regional Water Quality Control Board, Lahontan Region (LRWQCB) for the Lancaster Water Reclamation Plant (WRP). The Districts expect that a Master Permit for the Palmdale WRP will also be adopted in the future. For Master Permits, the Water Code specifies that the permittee conduct "periodic" inspections of the recycled water use sites (Sites) to monitor compliance with the uniform statewide recycling criteria established by California Department of Public Health (CDPH) and the Requirements of the Master Permit. The Requirements address Site inspections in Sections 6, 7, 8 and 9. This document summarizes the requirements pertaining to Site inspections and describes specific implementation procedures.

**2. Inspection Program**

The inspection program will consist of the following elements:

- 2.1. The Districts' inspection program consists of inspections conducted by both the Districts and the Purveyors, currently the City of Lancaster and the Los Angeles County Waterworks District No. 40. These inspections are in addition to inspections conducted by the Los Angeles County Department of Public Health (LACDPH) or other regulatory agencies.
- 2.2. The Districts will conduct an initial baseline inspection of new Sites during their first year of operation. The LACDPH will also conduct inspections during Site construction and prior to a Site's initial operation.
- 2.3. Upon completion of the baseline inspections, the Districts will conduct periodic site inspections once every three years. The Districts may conduct more frequent inspections depending on factors such as compliance record, potential for human exposure to recycled water and Site retrofits.
- 2.4. For Sites out of compliance, the Districts will conduct annual follow-up inspections.
- 2.5. The Purveyors must also conduct periodic inspections once every three years at a minimum. These inspections will be independent of the Districts' inspections. The Districts may require more frequent inspections by the Purveyors depending on factors such as compliance record, potential for human exposure to recycled water and Site retrofits.
- 2.6. The Districts will work with the Purveyors and users to ensure that the periodic inspections address the Master Permits, the Requirements, applicable laws and regulations, and LACDPH or local health department guidelines.
- 2.7. The Districts require Purveyors to develop and initiate an inspection program within the first year of a Site's operation.
- 2.8. A Site Inspection Report will be completed for each inspection. The Districts' Site Inspection Report Form is attached. The Purveyors may elect to use the Districts' Site Inspection Report

Form for adopt their own. In the latter case, the Districts will work with the Purveyors to ensure all regulatory requirements are addressed in the Site Inspection Report.

- 2.9. The Site Inspection Report shall be signed and dated by the Site Supervisor and the inspector, and provided to the Districts (if the Districts are not the inspector) within thirty (30) days following the end of the quarter in which the inspection was conducted.
- 2.10. The inspector shall immediately notify the Site Supervisor of violation(s) identified during Site inspections and what corrective actions and follow up actions must be taken.
- 2.11. The Site Supervisor shall notify the Districts by telephone or electronic means upon knowledge of any noncompliance with applicable laws and regulations, the Districts' Permits, and the Requirements. Written confirmation shall be provided within three (3) business days from the date of notification.
- 2.12. The Purveyor or Direct User shall provide written verification to the Districts within ninety (90) days from the date of knowledge of the violation that corrective actions have been implemented.
- 2.13. Site Inspection Reports shall be maintained by the Site Supervisor or Purveyor.
- 2.14. The Purveyor shall notify the Districts by electronic means at least one (1) week prior to conducting a Site inspection.
- 2.15. The Districts will maintain a database of Sites, inspections, and compliance actions.
- 2.16. The recycled water user shall allow an authorized representative of any of the following agencies the right to enter and conduct an inspection of the Site upon presentation of proper credentials: the Districts, LRWQCB, CDPH, LACDPH or local health department.

REUSE SITE INSPECTION REPORT

PROPOSED

This page is blank intentionally.

**COUNTY SANITATION DISTRICTS OF LOS ANGELES COUNTY**  
**REUSE SITE INSPECTION REPORT**  
Sanitation District No.s 14 and 20

Recycled Water User/Site Name:
Location of Site:
Purveyor (If Known):
Type of Use: <b>Irrigation</b> other: _____
Date & Time of Inspection:
Site Supervisor:
Site Supervisor Contact Info:
Name of User Representative/Title:
Name of Inspector: <b>Gary Salva</b>
GPS Coordinates:

**Verification of Compliance Inspection and Enforcement Program**

No.	Factor	Com ment	Yes	No
1	Is recycled water used for any purposes not listed in the Regional Water Quality Control Board permit(s)? If yes, please provide an explanation in the space below.		<input type="checkbox"/> Yes	<input type="checkbox"/> No
2	Have there been any changes or modifications to the recycled water system? If yes, please provide an explanation in the space below.		<input type="checkbox"/> Yes	<input type="checkbox"/> No
3	Has there been a change in the Site Supervisor? If yes, please provide updated information in the space below.		<input type="checkbox"/> Yes	<input type="checkbox"/> No
4	Has on-site staff received appropriate training? If no, please explain in the space below when training will be provided.		<input type="checkbox"/> Yes	<input type="checkbox"/> No
5	Are copies of the site operation manual, Emergency Cross-Connection Response Plan, and Districts' <i>Requirements for Recycled Water Users</i> available to employees at all times? If no, please explain in the space below how and when this will be corrected.		<input type="checkbox"/> Yes	<input type="checkbox"/> No
6	Are there complete and up-to-date O&M records for the recycled water system? If no, please explain in the space below how and when this will be corrected.		<input type="checkbox"/> Yes	<input type="checkbox"/> No

**INSPECTION OF USER OPERATIONS**

7	Is irrigation limited to the authorized use areas? If no, please explain in the space below how and when this will be corrected.	<input type="checkbox"/> Yes	<input type="checkbox"/> No
8	Is recycled water running off from the authorized use area through surface runoff or windblown spray? If yes, please explain in the space below how and when this will be corrected, and make note of the source, volume, and destination of the runoff.	<input type="checkbox"/> Yes	<input type="checkbox"/> No
9	Are any unusual odors associated with the recycled water use, supply, or storage? If yes, please explain in the space below how and when this will be corrected.	<input type="checkbox"/> Yes	<input type="checkbox"/> No
10	Is there any evidence of ponding of recycled water? If yes, please explain in the space below how and when this will be corrected.	<input type="checkbox"/> Yes	<input type="checkbox"/> No
11	Is there any evidence of mosquito breeding? If yes, please explain in the space below how and when this will be corrected.	<input type="checkbox"/> Yes	<input type="checkbox"/> No
12	Are signs properly placed and legible with regard to not drinking recycled water? If no, please explain in the space below how and when this will be corrected.	<input type="checkbox"/> Yes	<input type="checkbox"/> No
13	Are tags visible and legible? If no, please explain in the space below how and when this will be corrected.	<input type="checkbox"/> Yes	<input type="checkbox"/> No
14	Is there any evidence of overflows, erosion, or improper management of impoundments? If yes, please explain in the space below how and when this will be corrected	<input type="checkbox"/> Yes	<input type="checkbox"/> No
15	Are there any leaks or breaks in the irrigation system piping or evidence of plugged, broken, or otherwise faulty irrigation components? If yes, please explain in the space below how and when this will be corrected.	<input type="checkbox"/> Yes	<input type="checkbox"/> No
16	Is recycled water being sprayed directly on people, dwellings, food-handling facilities, or drinking fountains? If yes, please explain in the space below how and when this will be corrected.	<input type="checkbox"/> Yes	<input type="checkbox"/> No
17	Is irrigation system being operated during periods of minimal human use with adequate time to dry-out before public use? If no, please explain in the space below how and when this will be corrected.	<input type="checkbox"/> Yes	<input type="checkbox"/> No
18	Does irrigation take place within 50 feet of any domestic water supply well? If yes, please explain in the space below how and when this will be corrected.	<input type="checkbox"/> Yes	<input type="checkbox"/> No

**INSPECTION OF USER OPERATIONS**

19	Does impoundment of disinfected tertiary recycled water occur within 100 feet of any domestic water supply well? If yes, please explain in the space below how and when this will be corrected.	<input type="checkbox"/> Yes	<input type="checkbox"/> No
20	Does irrigation take place within 50 feet of any uncovered reservoir or stream currently used as a source of domestic water? If yes, please explain in the space below how and when this will be corrected.	<input type="checkbox"/> Yes	<input type="checkbox"/> No
21	Are all impoundments adequately protected from erosion, washout, and flooding from a 24-hour rainfall event having a predicted frequency of once in 100 years? If no, please explain in the space below how and when this will be corrected.	<input type="checkbox"/> Yes	<input type="checkbox"/> No
22	Are there any hose bibs in the recycled water system? If yes, please explain in the space below how and when this will be corrected.	<input type="checkbox"/> Yes	<input type="checkbox"/> No
23	Are pipes properly marked? If no, please explain in the space below how and when this will be corrected.	<input type="checkbox"/> Yes	<input type="checkbox"/> No
24	Are valves and controllers properly marked? If no, please explain in the space below how and when this will be corrected.	<input type="checkbox"/> Yes	<input type="checkbox"/> No
25	Are points of connection properly marked? If no, please explain in the space below how and when this will be corrected.	<input type="checkbox"/> Yes	<input type="checkbox"/> No
26	Is backflow prevention in place? If no, please explain in the space below how and when this will be corrected.	<input type="checkbox"/> Yes	<input type="checkbox"/> No
27	Is there a schedule for testing backflow prevention and is testing up to date? If no, please explain in the space below how and when this will be corrected.  Date of Last Test: _____	<input type="checkbox"/> Yes	<input type="checkbox"/> No
28	Is there a need for cross-connection testing due to major modifications to the system? If yes, in the space below explain when the testing will be conducted.	<input type="checkbox"/> Yes	<input type="checkbox"/> No

**REQUIRED ACTION/FOLLOW-UP ACTION**

<input type="checkbox"/> None		
<input type="checkbox"/> Yes by District – List	Compliance Date	Date Achieved
<input type="checkbox"/> Yes by User – List	Compliance Date	Date Achieved

**COMMENTS**

No. __

**SIGNATURES**

Inspector's signature:	Date:
Site Supervisor's signature:	Date:

ENFORCEMENT RESPONSE PLAN

PROPOSED

This page is blank intentionally.

**Enforcement Response Plan for Requirements for Recycled Water Users (ERP)  
County Sanitation Districts of Los Angeles County  
District Nos. 14 and 20**

**1. Introduction**

In 2006 and 2007, County Sanitation District Nos. 14 and 20 of Los Angeles County (Districts) adopted Ordinances to govern the permitting, enforcement, and inspection activities associated with the use of recycled water to ensure that the Districts had the authority to take action to correct inappropriate uses of recycled water, revoke water users' sales agreements if inappropriate uses persisted, and cease deliveries of recycled water. In conformance with the Ordinances, the Districts have also established *Requirements for Recycled Water Users* (Requirements) to ensure that recycled water users comply with all applicable statutes, regulations, and the Districts' Master Reclamation Permits. The Requirements contain rules governing the use of recycled water, procedures for obtaining permission to use recycled water, requirements for the operation and management of sites, information on site inspection and site access, corrective actions, notification and reporting, and record keeping.

Timely and consistent enforcement of the Ordinances and Requirements is critical to the success of the Districts' water recycling program. Thus, the Districts have developed this ERP to create a framework for identifying and investigating instances of noncompliance, and for taking enforcement actions that are appropriate in relation to the nature and severity of the violation. It is the Districts' intent to respond to violations as soon as they are discovered and to encourage users to achieve compliance as soon as possible. The overall goal of the ERP is to promote and ensure compliance among recycled water users.

**2. Progressive Enforcement**

The ERP is founded on the principle of progressive enforcement. Progressive enforcement is an escalating series of actions that allows for the efficient and effective use of enforcement resources to: 1) assist users in achieving compliance; 2) compel compliance for repeat violations; and 3) provide a disincentive for noncompliance.

While the Districts consider each violation to be a priority that needs to be corrected immediately, the Districts intend to tailor the type of enforcement response to the severity of the violation. For example, for very serious violations, a user's recycled water service may be terminated. For less serious violations, the response may be a verbal notification or a written notice or compliance letter. Also, if a violation continues, the enforcement response may be escalated until compliance is achieved.

Examples of more serious types of violations may include, but are not limited to:

- Unauthorized discharges of recycled water, including discharge to surface water.
- Spraying of food prep areas or drinking fountains.
- Creating a nuisance condition, which would include any action that is injurious to health, is indecent or offensive to the senses, obstructs the use of property, or otherwise adversely affects an individual or community.

- Allowing for, or creating, cross-connections between a recycled water line and a potable water line.
- Allowing for backflow between a recycled water system and a potable water system or failure to install backflow prevention devices.
- Failure to prevent recycled water from leaving the site.
- Allowing the use of recycled water outside of an approved area.
- Unauthorized use of recycled water.
- Failure to conduct cross-connection or backflow prevention testing.
- Failure to allow access for inspections.
- Failure to take or complete corrective actions.
- Failure to report spills greater than 50,000 gallons, and incidents of illness, cross-connections or backflow.
- Failure to notify the Districts of violations.

Examples of less serious violations may include, but are not limited to:

- Failure to maintain the recycled water system in good working condition.
- Allowing ponding or pooling of recycled water.
- Improper signage or marking of reuse facilities.
- Improper pipe, valves, valve boxes, etc.
- Improper operation or application of best management practices at reuse sites.
- Irrigation above agronomic rate or fertilizer needs.
- Failure to provide training for recycled water system by personnel.
- Failure to report minor releases of recycled water from the site.
- Failure to provide the Districts with required or requested information.
- Failure to keep records.
- Failure to appoint and maintain a Site Supervisor.

Violations may be found during routine inspection by purveyors or during routine operations by users. Once a violation is discovered, the Site Supervisor must take actions in accordance with Sections 7 (Corrective Action) and 8 (Notification and Reporting) of the Requirements. Such actions include: 1) immediately notifying the Districts and regulatory agencies; 2) providing written confirmation to the Districts and regulatory agencies within 3 business days from the date of notification; 3) providing follow-up documentation that the necessary corrections have been made.

If violations are found during a Districts' inspection, they will be noted on the Districts' inspection form with required follow-up actions and compliance dates. Verification of the corrective action must be made by the purveyor within 90 days of the initial inspection and reported to the Districts.

ATTACHMENT D  
Standard Provisions for Waste Discharge Requirements

PROPOSED

This page is blank intentionally.

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD  
LAHONTAN REGION

**STANDARD PROVISIONS**  
FOR WASTE DISCHARGE REQUIREMENTS

1. Inspection and Entry

The discharger shall permit Regional Board staff:

- a. to enter upon premises in which an effluent source is located or in which any required records are kept;
- b. to copy any records relating to the discharge or relating to compliance with the waste discharge requirements;
- c. to inspect monitoring equipment or records; and
- d. to sample any discharge.

2. Reporting Requirements

- a. Pursuant to California Water Code 13267(b), the discharger shall immediately notify the Regional Board by telephone whenever an adverse condition occurred as a result of this discharge; written confirmation shall follow within two weeks. An adverse condition includes, but is not limited to, spills of petroleum products or toxic chemicals, or damage to control facilities that could affect compliance.
- b. Pursuant to California Water Code Section 13260 (c), any proposed material change in the character of the waste, manner or method of treatment or disposal, increase of discharge, or location of discharge, shall be reported to the Regional Board at least 120 days in advance of implementation of any such proposal. This shall include, but not be limited to, all significant soil disturbances.
- c. The owner(s) of, and discharger upon, property subject to waste discharge requirements shall be considered to have a continuing responsibility for ensuring compliance with applicable waste discharge requirements in the operations or use of the owned property. Pursuant to California Water Code Section 13260(c), any change in the ownership and/or operation of property subject to the waste discharge requirements shall be reported to the Regional Board. Notification of applicable waste discharge requirements shall be furnished in writing to the new owners and/or operators and a copy of such notification shall be sent to the Regional Board.
- d. If a discharger becomes aware that any information submitted to the Regional Board is incorrect, the discharger shall immediately notify the Regional Board, in writing, and correct that information.

- e. Reports required by the waste discharge requirements, and other information requested by the Regional Board, must be signed by a duly authorized representative of the discharger. Under Section 13268 of the California Water Code, any person failing or refusing to furnish technical or monitoring reports, or falsifying any information provided therein, is guilty of a misdemeanor and may be liable civilly in an amount of up to one thousand dollars (\$1000) for each day of violation.
- f. If the discharger becomes aware that their waste discharge requirements are no longer needed (because the project will not be built or the discharge will cease) the discharger shall notify the Regional Board in writing and request that their waste discharge requirements be rescinded.

3. Right to Revise Waste Discharge Requirements

The Board reserves the privilege of changing all or any portion of the waste discharge requirements upon legal notice to and after opportunity to be heard is given to all concerned parties.

4. Duty to Comply

Failure to comply with the waste discharge requirements may constitute a violation of the California Water Code and is grounds for enforcement action or for permit termination, revocation and reissuance, or modification.

5. Duty to Mitigate

The discharger shall take all reasonable steps to minimize or prevent any discharge in violation of the waste discharge requirements which has a reasonable likelihood of adversely affecting human health or the environment.

6. Proper Operation and Maintenance

The discharger shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) that are installed or used by the discharger to achieve compliance with the waste discharge requirements. Proper operation and maintenance includes adequate laboratory control, where appropriate, and appropriate quality assurance procedures. This provision requires the operation of backup or auxiliary facilities or similar systems that are installed by the discharger, when necessary to achieve compliance with the conditions of the waste discharge requirements.

7. Waste Discharge Requirement Actions

The waste discharge requirements may be modified, revoked and reissued, or terminated for cause. The filing of a request by the discharger for waste discharge requirement modification, revocation and reissuance, termination, or a notification of planned changes or anticipated noncompliance, does not stay any of the waste discharge requirements conditions.

8. Property Rights

The waste discharge requirements do not convey any property rights of any sort, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of federal, state or local laws or regulations.

9. Enforcement

The California Water Code provides for civil liability and criminal penalties for violations or threatened violations of the waste discharge requirements including imposition of civil liability or referral to the Attorney General.

10. Availability

A copy of the waste discharge requirements shall kept and maintained by the discharger and be available at all times to operating personnel.

11. Severability

Provisions of the waste discharge requirements are severable. If any provision of the requirements is found invalid, the remainder of the requirements shall not be affected.

12. Public Access

General public access shall be effectively excluded from treatment and disposal facilities.

13. Transfers

Providing there is no material change in the operation of the facility, this Order may be transferred to a new owner or operation. The owner/operator must request the transfer in writing and receive written approval from the Regional Board Executive Officer.

14. Definitions

- a. "Surface waters" as used in this Order, include, but are not limited to, live streams, either perennial or ephemeral, which flow in natural or artificial water courses and natural lakes and artificial impoundments of waters. "Surface waters" does not include artificial water courses or impoundments used exclusively for wastewater disposal.
- b. "Ground waters" as used in this Order, include, but are not limited to, all subsurface waters being above atmospheric pressure and the capillary fringe of these waters.

15. Storm Protection

All facilities used for collection, transport, treatment, storage, or disposal of waste shall be adequately protected against overflow, washout, inundation, structural damage or a significant reduction in efficiency resulting from a storm or flood having a recurrence interval of once in 100 years.

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD  
LAHONTAN REGION

**MONITORING AND REPORTING PROGRAM NO. R6V-2012-(PROPOSED)  
WDID NO. 6B190901008**

**MASTER WATER RECYCLING REQUIREMENTS AND  
WASTE DISCHARGE REQUIREMENTS  
COUNTY SANITATION DISTRICT NO. 20 OF LOS ANGELES COUNTY  
(PALMDALE)  
DISINFECTED TERTIARY RECYCLED WATER**

\_\_\_\_\_  
Los Angeles County \_\_\_\_\_

I. MONITORING

A. Flow Monitoring

1. County Sanitation District No. 20 of Los Angeles County (District) shall record the total volume, in million gallons, and the average flow rate, in million gallons per day (mgd), of recycled water provided by the District to each Authorized Water Use site. This information must be recorded and reported for each calendar month.
2. The District shall record the total volume, in million gallons, and the monthly average 24-hour flow rate, in mgd, of recycled water supplied by the Activated Sludge/Nitrification-Denitrification Plant (Stage V Plant Expansion facilities) into the North Los Angeles/Kern County Regional Recycled Water Project distribution system. This information must be recorded and reported for each calendar month.

B. Agronomic Application Rate Monitoring for Fertilizers and Recycled Water

1. For each calendar month, the District shall record, and provide a tabular comparison of, the:
  - a. agronomic rate (volume of water) of each irrigated area;
  - b. volume of recycled water (and non-recycled supplemental water) applied to each irrigated area; and
  - c. number of acres for each irrigated area.
2. For each calendar month, the District shall record, and provide a tabular comparison of, the:
  - a. agronomic rate of nitrogen (N) for each landscape and agricultural area;
  - b. total amount of N applied to each area, including the amount of N in the recycled water and the amount of N in any fertilizer applied;

- c. total amount of N applied to each area, including the amount of N in the recycled water and the amount of N in any fertilizer applied; and
- d. number of acres for each area.

Both the Lancaster Water Reclamation Plant and the Palmdale Water Reclamation Plant will be simultaneously providing recycled water to the North Los Angeles/Kern County Regional Recycled Water Project distribution system. When this occurs, the District shall use the highest nutrient levels provided from either reclamation plant at any given time when reporting agronomic rate and total amounts of N, above.

**C. Recycled Water Quality Monitoring**

The District must collect and analyze samples of the recycled water supplied by the Stage V Plant Expansion facilities for reuse by recycled water users in accordance with the following table:

<b>Parameter</b>	<b>Units</b>	<b>Type</b>	<b>Minimum Frequency</b>
Turbidity <sup>1</sup>	NTU	Recorder	Continuous
Total Chlorine Residual	mg/L	Recorder	Continuous (When chlorine is used as disinfectant)
Modal Contact Time <sup>2</sup>	minutes	Calculated	Daily (When chlorine is used as disinfectant)
CT Value <sup>3</sup>	mg-minutes/L	Calculated	Daily (When chlorine is used as disinfectant)
Total Coliform	MPN/100mL	Grab	Daily
Kjeldahl Nitrogen	mg/L	Composite	Monthly
Ammonia Nitrogen	mg/L	Composite	Monthly
Nitrate Nitrogen	mg/L	Composite	Monthly
Total Dissolved Solids	mg/L	Composite	Quarterly
Sulfate	mg/L	Composite	Quarterly
Chloride	mg/L	Composite	Quarterly
Total Trihalomethanes	µg/L	Grab	Quarterly
n-nitrosodimethylamine	µg/L	Composite	Quarterly
Priority Pollutants, excluding asbestos (Appendix A to 40 CFR part 423)	as specified	Grab or composite	Semi Annually

<sup>1</sup>For each 24-hour period, record and report the following: Stage V Tertiary Plant Expansion facilities: average turbidity, amount of time (minutes) the turbidity exceeded five (5) NTUs (if any), and the maximum turbidity.

<sup>2</sup>The modal contact time at the highest and lowest flows must be recorded and reported for each 24-hour period, where there is production of disinfected tertiary recycled water. The "modal contact time" is the amount of time elapsed between the time that a tracer, such as salt or dye, is injected into the influent at the entrance to a chamber and the time that the highest concentration of the tracer is observed in the effluent from the chamber. For the purpose of this determination, modal contact time shall be derived from a predetermined plot correlating modal contact times to varying flow conditions. (CCR, title 22, sec 60301.600)

<sup>3</sup>When chlorine is used as the disinfectant in production of disinfected tertiary recycled water, the lowest CT value must be calculated for each 24-hour period.  $CT \text{ (mg-minutes per liter)} = \text{chlorine residual (mg/L)} \times \text{modal contact time (minutes)}$ . To calculate the lowest value, first record the following data for the 24-hour period:

- a. Modal contact time under highest flow and corresponding total chlorine residual at that time.
  - b. Lowest total chlorine residual and corresponding modal contact time.
  - c. Highest total chlorine residual and corresponding modal contact time.
  - d. Modal contact time under lowest flow and corresponding total chlorine residual at that time.
- Next, calculate CT values for each of the four conditions, above. The lowest of the four calculated CT values is the lowest CT for the period.

#### D. Quarterly Recycled Water Use Monitoring

The District must record the following information each quarter (quarters defined in Requirement No. II.B, below) in accordance with Water Code section 13523.1, subdivision (b)(4):

1. Total amount of recycled water supplied into the North Los Angeles/Kern County Regional Recycled Water Project distribution system during the quarter.
2. The total number of sites that received recycled water during the quarter.
3. A list of all recycled water use sites. For each site, the list must include:
  - a. site name,
  - b. site location
  - c. name of underlying hydrologic area
  - d. user name
  - e. type of use
  - f. site area (acres)
  - g. date of District recycled water use approval
4. A map of suitable scale showing the boundary of the Permit Area (as defined by Finding No. 9 of Board Order R6V-2012-PROPOSED and showing the approved recycled water use site locations.

#### E. Inspections and Enforcement Monitoring

1. The District must provide in its annual report (see Requirement No. II.D, below) an inspection schedule for all recycled water use facilities. The inspection schedule shall document the date of each facility's prior

inspection and its respective compliance status. Any facility with a reported incidence of noncompliance in its most recent inspection report must be re-inspected no later than one year from its prior inspection. Any facility that was in compliance during its most recent inspection must be scheduled for a re-inspection no later than three years from its prior inspection.

2. The District must record and report on a quarterly basis all recycled water use sites inspected pursuant to Requirement No. I.B.4 of Board Order No. R6V-2012-PROPOSED during each respective quarter (See Requirement No. II.B, below). The list of sites inspected must include the following information for each recycled water use site:
  - a. Date of inspection, name of recycled water use site, user name, and type of use.
  - b. A description of all noted violations (including compliance with Requirement Nos. I.C.1 through I.C.15 of Board Order No. R6V-2012-PROPOSED
  - c. The date compliance was achieved and the respective corrective action taken, if applicable.
  - d. A description of enforcement action taken (if any), including any schedule for achieving compliance.
  - e. Date of prior compliance inspection.
3. The District must ensure that monthly inspections of all Best Management Practices (BMPs) in place to prevent contamination of potable water supplies (including groundwater) are completed. The results of such inspections and measures taken to maintain and repair these BMPs must be reported by the District in its quarterly report (see Requirement No. II.B, below).
4. The District must ensure that annual visual inspections of the recycled water distribution system for cross connections with the potable water supply are completed.
5. The District must ensure that the recycled water distribution system is annually inspected for leaks or drops in pressure, and that pressure tests are conducted at a minimum once every three years.

#### F. Operation and Maintenance Monitoring

The District must record and maintain records of all actions and analytical results necessary to demonstrate compliance with California Department of Public Health conditions identified in Board Order No. R6V-2012-PROPOSED Requirement No. II.B. and to document any operational problems and maintenance activities with the recycled water treatment facilities, distribution

system, and user sites. The District must submit a brief summary of its findings to the California Regional Water Quality Control Board, Lahontan Region (Lahontan Water Board) with each quarterly monitoring report. This summary must discuss the elements listed below.

1. All modifications or additions to the recycled water treatment facilities, distribution systems, and user sites;
2. Test results of all backflow prevention devices at each recycled water use site.
3. The results of cross connection inspections at each authorized recycled water use site.
4. Test results of the recycled water distribution system pressure testing.
5. Any non-routine maintenance conducted on the recycled water treatment facilities, distribution system, and user systems.
6. Any major problems occurring to the recycled water treatment facilities, distribution system, and user systems.
7. Calibration results of any recycled water flow measuring devices.

## II. REPORTING

### A. General Provisions

1. The District must comply with the "General Provisions for Monitoring and Reporting," dated September 1, 1994, which is attached to and made part of this Monitoring and Reporting Program (Attachment A).
2. The District must comply with the Sampling and Analysis Plan that was submitted on April 14, 2011, which is attached to and made part of this Monitoring and Reporting Program (Attachment B).

### B. Quarterly Reports

Beginning on **June 1, 2012**, quarterly monitoring reports including the preceding information must be submitted to the Lahontan Water Board by the first day of the third month following each quarterly monitoring period [Water Code section 13523.1, subdivision (b)(4)].

Quarterly monitoring periods are defined as follows:

First Quarter	January 1 - March 31
Second Quarter	April 1 - June 30
Third Quarter	July 1 - September 30
Fourth Quarter	October 1 - December 31

C. Semi-Annual Report

Beginning on **September 1, 2012**, semi-annual monitoring data including the preceding information must be submitted to the Lahontan Water Board by the first day of the third month following each semi-annual monitoring period [Water Code section 13523.1, subdivision (b)(6)]. Data that are required on a semi-annual basis will be incorporated into the quarterly report that coincides with the period for which the analyses are required.

Semi-annual monitoring periods are defined as follows:

First half	January 1 - June 30
Second half	July 1 – December 31

D. Annual Report

Beginning on **April 1, 2013** and continuing thereafter, the District must submit an annual report to the Lahontan Water Board with the information listed.

1. Documentation of the District's compliance status with Board Order No. R6V-2012-PROPOSED, including progress made towards developing the salt/nutrient management plan that is required by Board Order No. R6V-2012-PROPOSED, Requirement No. III.A.
2. The compliance record and the corrective actions taken or scheduled/planned to return the District into full compliance with Board Order No. R6V-2012- PROPOSED.
3. The District's time schedule for completing corrective actions needed to achieve compliance.

Ordered by: \_\_\_\_\_ Dated: \_\_\_\_\_  
HAROLD J. SINGER  
EXECUTIVE OFFICER

Attachment A: General Provisions for Monitoring and Reporting Program  
Attachment B: Sampling and Analysis Plan

ATTACHMENT A  
General Provisions for Monitoring and Reporting

This page is blank intentionally.

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD  
LAHONTAN REGION

**GENERAL PROVISIONS**  
FOR MONITORING AND REPORTING

1. SAMPLING AND ANALYSIS

- a. All analyses shall be performed in accordance with the current edition(s) of the following documents:
  - i. Standard Methods for the Examination of Water and Wastewater
  - ii. Methods for Chemical Analysis of Water and Wastes, EPA
- b. All analyses shall be performed in a laboratory certified to perform such analyses by the California State Department of Health Services or a laboratory approved by the Regional Board Executive Officer. Specific methods of analysis must be identified on each laboratory report.
- c. Any modifications to the above methods to eliminate known interferences shall be reported with the sample results. The methods used shall also be reported. If methods other than EPA-approved methods or Standard Methods are used, the exact methodology must be submitted for review and must be approved by the Regional Board Executive Officer prior to use.
- d. The discharger shall establish chain-of-custody procedures to insure that specific individuals are responsible for sample integrity from commencement of sample collection through delivery to an approved laboratory. Sample collection, storage, and analysis shall be conducted in accordance with an approved Sampling and Analysis Plan (SAP). The most recent version of the approved SAP shall be kept at the facility.
- e. The discharger shall calibrate and perform maintenance procedures on all monitoring instruments and equipment to ensure accuracy of measurements, or shall insure that both activities will be conducted. The calibration of any wastewater flow measuring device shall be recorded and maintained in the permanent log book described in 2.b, below.
- f. A grab sample is defined as an individual sample collected in fewer than 15 minutes.
- g. A composite sample is defined as a combination of no fewer than eight individual samples obtained over the specified sampling period at equal intervals. The volume of each individual sample shall be proportional to the discharge flow rate at the time of sampling. The sampling period shall equal the discharge period, or 24 hours, whichever period is shorter.

## 2. OPERATIONAL REQUIREMENTS

### a. Sample Results

Pursuant to California Water Code Section 13267(b), the discharger shall maintain all sampling and analytical results including: strip charts; date, exact place, and time of sampling; date analyses were performed; sample collector's name; analyst's name; analytical techniques used; and results of all analyses. Such records shall be retained for a minimum of three years. This period of retention shall be extended during the course of any unresolved litigation regarding this discharge, or when requested by the Regional Board.

### b. Operational Log

Pursuant to California Water Code Section 13267(b), an operation and maintenance log shall be maintained at the facility. All monitoring and reporting data shall be recorded in a permanent log book.

## 3. REPORTING

a. For every item where the requirements are not met, the discharger shall submit a statement of the actions undertaken or proposed which will bring the discharge into full compliance with requirements at the earliest time, and shall submit a timetable for correction.

b. Pursuant to California Water Code Section 13267(b), all sampling and analytical results shall be made available to the Regional Board upon request. Results shall be retained for a minimum of three years. This period of retention shall be extended during the course of any unresolved litigation regarding this discharge, or when requested by the Regional Board.

c. The discharger shall provide a brief summary of any operational problems and maintenance activities to the Board with each monitoring report. Any modifications or additions to, or any major maintenance conducted on, or any major problems occurring to the wastewater conveyance system, treatment facilities, or disposal facilities shall be included in this summary.

d. Monitoring reports shall be signed by:

i. In the case of a corporation, by a principal executive officer at least of the level of vice-president or his duly authorized representative, if such representative is responsible for the overall operation of the facility from which the discharge originates;

ii. In the case of a partnership, by a general partner;

iii. In the case of a sole proprietorship, by the proprietor; or

- iv. In the case of a municipal, state or other public facility, by either a principal executive officer, ranking elected official, or other duly authorized employee.
- e. Monitoring reports are to include the following:
  - i. Name and telephone number of individual who can answer questions about the report.
  - ii. The Monitoring and Reporting Program Number.
  - iii. WDID Number.
- f. Modifications

This Monitoring and Reporting Program may be modified at the discretion of the Regional Board Executive Officer.

#### 4. NONCOMPLIANCE

Under Section 13268 of the Water Code, any person failing or refusing to furnish technical or monitoring reports, or falsifying any information provided therein, is guilty of a misdemeanor and may be liable civilly in an amount of up to one thousand dollars (\$1,000.00) for each day of violation.

T:\FORMS\GENPROV.MRP.doc

This page is blank intentionally.

ATTACHMENT B  
Sampling and Analysis Plan

This page is blank intentionally.



## COUNTY SANITATION DISTRICTS OF LOS ANGELES COUNTY

1955 Workman Mill Road, Whittier, CA 90601-1400  
Mailing Address: P.O. Box 4998, Whittier, CA 90607-4998  
Telephone: (562) 699-7411, FAX: (562) 699-5422  
www.lacsd.org

STEPHEN R. MAGUIN  
Chief Engineer and General Manager

November 10, 2011  
File No. 20-04.01-55

Harold Singer  
California Regional Water Quality Control Board  
Lahontan Region - Victorville Branch Office  
14440 Civic Drive, Suite 200  
Victorville, CA 92392-2359

Dear Mr. Singer:

**Submittal of the Revised Sampling and Analysis Plan (SAP) for the  
Palmdale Water Reclamation Plant (PWRP), WDID No. 6B190107069**

In compliance with the requirements set forth in the Monitoring and Reporting Program No. R6V-2011-0012 (MRP), issued by the California Regional Water Quality Control Board, Lahontan Region (Regional Board) and transmitted to County Sanitation District No. 20 of Los Angeles County (Sanitation District) in a letter dated April 8, 2011, the Sanitation District submits the enclosed Revised Sampling and Analysis Plan (SAP) for the Palmdale Water Reclamation Plant (PWRP). This SAP is submitted to reflect altered sampling requirements in anticipation of start-up operations of the PWRP tertiary treatment facilities.

If you have any questions or comments, please contact the undersigned at (562) 908-4288 extension 2855 or Peter Navas at extension 2847.

Very truly yours,  
Stephen R. Maguin

Thomas E. Weiland  
Supervising Engineer  
Monitoring Section

TW:pnn  
Enclosure  
cc: Linda Stone  
Mike Coony



**REVISED SELF-MONITORING  
SAMPLING AND ANALYSIS PLAN (SAP)**

**Palmdale Water Reclamation Plant  
County Sanitation District No. 20 of Los Angeles County**

**November 2, 2011**

CONTENTS

Overview ..... 1  
Reasons for Updating the SAP ..... 1  
Sampling Schedule ..... 1  
Sampling Constituents and Analytical Methods ..... 2  
Quality Assurance/Quality Control ..... 2  
Sampling Procedures ..... 3  
Sample Chain of Custody ..... 3  
Groundwater Monitoring Network ..... 3  
Results Reporting ..... 3  
  
Table 1 – Flow Monitoring Schedule ..... 4  
Table 2 – Schedule for Self-Monitoring of Constituents ..... 5  
Table 3 – Schedule for Additional Self-Monitoring ..... 7  
Table 4 – Sample Handling and Analytical Methods ..... 8  
  
Appendix A – Sample Locations: Maps, Diagrams, and Photographs  
Appendix B – Sample Collection Standard Operating Procedures  
Appendix C – Chain of Custody / Login Sheet  
Appendix D – Minimum Levels for Priority Pollutants

## Overview

This document describes the self-monitoring plan prepared by the County Sanitation District No. 20 of Los Angeles County (Sanitation District) for the Palmdale Water Reclamation Plant (PWRP) to satisfy the conditions specified in Board Order No. R6V-2011-0012, WDID No. 6B190107069, which delineates the Waste Discharge Requirements (WDR) and the Monitoring and Reporting Program (MRP). This order was adopted by the California Regional Water Quality Control Board, Lahontan Region (Regional Board) on March 9, 2011.

Constituent concentrations will be monitored at the following locations<sup>(1)</sup> in accordance to the requirements of the MRP and WDR as well as additional sampling requirements stated within this SAP:

- a) Influent to the treatment facilities
- b) Disinfected secondary – treated effluent <sup>(2)</sup>
- c) Disinfected tertiary – treated effluent
- d) Groundwater monitoring wells
- e) Groundwater supply wells
- f) Groundwater extraction wells
- g) Vadose zone lysimeters

Flows will be monitored or calculated at a frequency described in Table 1 according to conditions specified in the WDR and the MRP:

- a) Influent to the treatment facilities
- b) Effluent from the treatment facilities
- c) Recycled water flow sent to the Agricultural Site
- d) Recycled water flow to the Storage Reservoirs
- e) Recycled water flow to each center irrigation pivot or other irrigation system
- f) Recycled water flow utilized for reuse purposes (other than internally-recycled process water) at Reclamation Plant and Storage Reservoir Sites
- g) Extraction well flow

In addition to flow metering, freeboard in each storage reservoir will be monitored weekly.

An overview of the plant treatment process as well as illustrations, diagrams, and/or photos of selected monitoring locations can be found in Appendix A.

## Reason for Updating the SAP

The SAP has been updated to reflect altered sampling requirements due to the completion and operation of the activated sludge and tertiary treatment facilities.

<sup>1</sup> Biosolids and sludge disposal offsite will be managed and monitored in accordance with applicable Federal, State, and Local permits and regulations (e.g., 40CFR503 for land application)

<sup>2</sup> Samples for Disinfected Secondary-Treated Effluent will only be taken when secondary treatment is the final level of treatment.

### **Sampling Schedule**

The complete self-monitoring schedule is shown in Tables 1, 2 and 3. Tables 1 and 2 list the compiled monitoring requirements as outlined in the MRP and WDR. Table 3 lists additional monitoring not required by the MRP or WDR but these analyses will be completed whenever samples can be obtained. Typically, annual, semiannual, or quarterly monitoring events will be conducted concurrently with monthly events.

### **Sampling Constituents and Analytical Methods**

Table 4 provides a compilation of the sampling and analytical protocols for all constituents requiring self-monitoring, as accepted in the MRP. The analytical methods and sampling techniques used may change if alternative methods are found to provide better results. The Sanitation District will seek Regional Board approval for any changes in analytical methods and sampling techniques prior to implementation.

### **Quality Assurance/Quality Control (QA/QC)**

The Quality Assurance (QA) Group of the Sanitation Districts of Los Angeles County (Sanitation Districts) Laboratories Section is responsible for ensuring the validity and quality of analytical data produced in all laboratories operated by the Sanitation Districts. In order to accomplish this goal, a quality assurance plan prepared by the QA Group is strictly followed. The plan includes routine QA activities that are performed in the laboratories in order to assure the defensibility of data reported.

1. A routine practice of running laboratory control samples, duplicates and matrix spikes or duplicate spikes for every ten samples, or every analytical batch of less than ten samples, is maintained. Control limits have been established for both precision and accuracy, and quality control data are plotted on control charts for trend analyses. For situations where the data are outside of the control limits, corrective action is initiated and maintained at the bench level until the problems are solved.
2. A reagent or method blank is routinely run with each batch of samples as a contamination check.
3. Calibration standards are analyzed as required. For some tests, a daily calibration verification standard is used to check the initial calibration curve. For other tests, a multi-point calibration curve is prepared on each day of analysis.
4. For some organic constituents, surrogate standards are added to every sample, duplicate, spike, and blank. The results are compared to established acceptance limits. When unacceptable QA results are obtained, corrective action is performed.
5. Instrument QA is also performed (e.g., mass calibration and tuning are performed on gas chromatography-mass spectrometry (GC/MS) equipment to meet ion abundance criteria).
6. The Sanitation Districts' San Jose Creek and Joint Water Pollution Control Plant (JWPCP) Water Quality Laboratories participate in the United States Environmental Protection Agency's (EPA) Discharge Monitoring Report (DMR) QA by analyzing chemistry samples purchased from one of the EPA certified suppliers. Overall performance is satisfactory.
7. The Lancaster Treatment Plant Laboratory participates in the California Department of Public Health (CDPH) Environmental Laboratory Accreditation Program Branch (ELAPB) Performance Evaluation studies. Overall performance is satisfactory.

8. Any subcontract commercial laboratories are required to participate in the CDPH ELAPB Performance Evaluation studies. Overall performance must be satisfactory.
9. Quality control samples in the form of QC check standards, either prepared in-house or purchased from commercial sources, are issued by the QA Group to all Sanitation Districts' laboratories. In situations where the results are not acceptable, the analysts and their supervisors are informed and error resolutions are performed. This consists of checking calculations, data transcription, instrumentation, methodology, etc. Follow-up check samples are issued to verify that the analyses are back in control.
10. The QA Group also issues split samples collected from one of the water reclamation plants to assess analysis in a real environmental matrix. Results of these analyses are also submitted to the QA Group for statistical evaluation.

### Sampling Procedures

Samples are collected and handled in the manner specified in the appropriate analytical method, as described in 40 Code of Federal Regulations (CFR) Part 136. Table 4 provides additional sampling information, including sample bottle material, holding times, and type of sample preservation.

Flow-weighted 24-hour composite samples are currently utilized by PWRP and are preferred whenever possible. However, there are situations where grab samples are more appropriate or specified by standard procedures (e.g., oil & grease monitoring, groundwater sampling). Standard Operating Procedures (SOPs) for the applicable sampling procedures can be found in Appendix B.

### Sample Chain of Custody

With the names of specific individual staff, chain of custody (COC) forms are used to track the handling of samples. The COC forms also contain the complete analytical request and full documentation of the sample origin including sample date, sample time, sample location, preservation method, and the sampling staff individual's name. An example of the COC form can be found in Appendix C. This paper trail is archived along with the sample analytical results.

### Groundwater Monitoring Network

Survey and completion information for the monitoring wells and lysimeters, which make up the existing ground water monitoring system, are provided in Appendix A. Groundwater monitoring is performed according to the MRP.

Low flow sampling of monitoring wells is of utmost importance in order to maintain the integrity and representative nature of the sample. Two procedures are provided in the appendices to guide the samplers in proper techniques. The Sanitation District has developed a standard operating procedure entitled *Low-Flow Purging and Sampling for Groundwater*, which is based on the more detailed Cal/EPA guidance. The Cal/EPA Department of Toxic Substances Control issued a revised (Feb 2008) sampling methodology entitled *Representative Sampling of Groundwater for Hazardous Substances*. Both documents can be found in Appendix B. Upon any disagreement between the two documents, the Cal/EPA guidance shall be considered correct. If more reference material is required, see the USEPA document, *Ground-Water Sampling Guidelines for Superfund and RCRA Project Managers* ([http://www.epa.gov/tio/tsp/download/gw\\_sampling\\_guide.pdf](http://www.epa.gov/tio/tsp/download/gw_sampling_guide.pdf)). The recommended allowable drawdown of any well being sampled is 0.33 feet.

As required by Section I.F.2 of the MRP, the Sanitation District's *Revised Groundwater Delineation and Monitoring Plan for Proposed Storage Reservoir Site*, dated May 30, 2008 (Doc #1042486) has been incorporated into this SAP by reference, except that monitoring for total dissolved solids (TDS) has been

replaced with monitoring of conductivity per the MRP due to the volume requirements for TDS sample analysis. This document describes the intended soil moisture monitoring system and sampling lysimeters at the recycled water storage reservoirs site. The system has since been installed and sampling operations have commenced.

As noted in the *Revised Groundwater Delineation and Monitoring Plan for Proposed Storage Reservoir Site*, Section 5.4 (page 24), when sufficient water is obtained from a lysimeter, the sample collection will be prioritized in order of the following chemical analyses: nitrate (as nitrogen), conductivity, nitrite (as nitrogen), total Kjeldahl nitrogen (TKN), and ammonia-nitrogen. Analysis for conductivity has replaced the TDS analysis as noted above.

**Results Reporting**

Analytical results are reported following a review of the QA/QC data. Monitoring reports are to be submitted according to the due dates specified in the permit.

**Table 1. Flow Monitoring Schedule<sup>a</sup>**

Parameter	Units	Facility Influent <sup>b</sup>	Facility Effluent <sup>c</sup>	To Storage Reservoirs	Reuse at WRP Site & SRS	To AS <sup>d</sup>	Individual Center Pivot	Extraction Wells <sup>e</sup>
Average Daily Flow Rate	MGD	D	D	D	D	D <sup>e</sup>		D
Total Volumetric Flow	MG	D	D	M	M	M	M	M
Max. Inst. Flow Rate	MGD	D						D

**Where:** AS = Agricultural Site  
 D = Daily monitoring  
 M = Monthly monitoring  
 MG = million gallons  
 MGD = million gallons per day  
 SRS = Storage Reservoir Site

**Notes:**

- a) Flow monitoring and recording shall be conducted at a frequency according to R6V-2011-0012. Symbols in the table represent recording frequency, which may or may not be the same as reporting frequency.
- b) Facility influent flows are measured in the influent pump force main.
- c) Facility effluent refers to flows produced from the facility only. These flows will be calculated if a portion of the effluent produced is diverted to the SRS or if flow from the SRS is mixed with plant effluent before the combined flow is measured at the AS pump station.
- d) Total flow to the AS is metered on the effluent line of the AS pump station, which sends flow to all irrigation pivots.
- e) For extraction well pumping, average daily flow rate and maximum instantaneous flow rate to be reported in gallons per minute (gpm).

**Table 2. Schedule for Self-Monitoring of Constituents as Required by the MRP**

Parameter	Influent	Disinfected Secondary-Treated Effluent	Disinfected Tertiary Treated Effluent	Monitoring Wells <sup>a,b</sup>	Extraction Wells <sup>c</sup>	Lysimeters <sup>d</sup>
Flow			C			
Modal contact time			D			
CT Value			D			
Turbidity			C	Q		
Static water depth				Q		
Electrical conductivity				Q		Q
Color				Q		
Total chlorine residual		W	C			
Total coliform		D	D			
Dissolved oxygen		W	W	Q		
pH		W	W	Q		
Temperature		W	W	Q		
Biochemical oxygen demand (BOD)	W	W	M			
Total suspended solids		W				
Chemical oxygen demand (COD)	W	W	M			
Ammonia nitrogen	M	M	M	Q	Q	Q
Kjeldahl nitrogen	M	M	M	Q	Q	Q
Nitrate nitrogen	M	M	M	Q	Q	Q
Nitrite nitrogen			M			Q
Chloride		M	Q	Q		
Sodium		M	Q	Q		
Sulfate		M	Q	Q		
Calcium			Q			
Magnesium			Q			
MBAS		M	Q	Q		
Total organic carbon (TOC)		Q <sup>e</sup>	Q	Q		
Total dissolved solids (TDS)	S	M	Q	Q	Q	
Total trihalomethanes	S	Q	Q	T		
Bromodichloromethane	S	Q	Q	T		A (AS only)
Bromoform	S	Q	Q	T		A (AS only)
Chloroform	S	Q	Q	T		A (AS only)
Dibromochloromethane	S	Q	Q	T		A (AS only)
Haloacetic acids <sup>f</sup>			Q	T		
monochloroacetic acid			Q	T		
dichloroacetic acid			Q	T		
trichloroacetic acid			Q	T		
monobromoacetic acid			Q	T		
dibromoacetic acid			Q	T		
N-nitrosodimethylamine			Q			

## Palmdale Water Reclamation Plant Monitoring and Reporting Program

Parameter	Influent	Disinfected Secondary-Treated Effluent	Disinfected Tertiary Treated Effluent	Monitoring Wells <sup>a,b</sup>	Extraction Wells <sup>c</sup>	Lysimeters <sup>d</sup>
bis(2diethylhexyl)phthalate (DEHP)			Q	Q <sup>i</sup>		
TPH - Gasoline range	Q	Q	Q	Q		
TPH - Diesel range	Q	Q	Q	Q		
Oil and grease		Q				
Total chromium			A			
Hexavalent chromium			A			
Total phenols	A	A	A	T		
Inorganics <sup>g,h</sup>	A	A	A	T		
Total cyanides, (cyanide)	A	A	A	T		
Volatile organics <sup>g</sup>	A	A	A	T		
Semi-volatile organics <sup>g</sup>	A	A	A	T		
Pesticides-PCBs <sup>g,h</sup>	A	A	A	T		
Methyl tertiary butyl ether (MTBE)		A	A	T		

**Where:**

C = Continuous monitoring

D = Daily monitoring

W = Weekly monitoring

M = Monthly monitoring

Q = Quarterly monitoring

S = Semiannual monitoring

PCB = polychlorinated biphenyls

A = Annual monitoring

T = Tri-Annual (sampling once every three years)

AS = Agricultural Site vadose zone lysimeters

SRS = Storage Reservoir Site vadose zone lysimeters

MBAS = methylene blue active substances

TPH = total petroleum hydrocarbons

**Notes:**

- Monitoring wells included in the sampling schedule are as follows: MW1, MW2, MW4, MW15R, MW16, W18R, MW19, MW21, MW22, MW23, MW24R, MW25, MW26, MW27, MW28, MW29, MW31, MW32, MW33, MW40, MW46, MW51, MW52, MW53, MW54, MW55, MW56, MW57, and MW58. Monitoring wells MW17, MW20, and MW37 shall be sampled quarterly for depth to water only. Monitoring wells MW38 and MW39 shall be sampled tri-annually for the constituents marked with either "Q" or "T."
- Supply wells included in the sampling schedule are as follows: DW4-2, 17D1, LAWA-7, and SW2.
- Extraction wells included in the sampling schedule are as follows: EW-1(R-10), EW-2(R-2), EW-3(R-3), EW-4(R-4), EW-5(R-9), and EW-6(R-8).
- Monitoring at site(s) indicated (AS or SRS lysimeters). Lysimeters may not yield enough sample volume to perform all the specified analyses. In such situations, the Sanitation Districts will analyze for as many constituents as possible.
- Monitor dissolved organic carbon in filtered sample of effluent.
- Sum of five haloacetic acids – monochloroacetic acid, dichloroacetic acid, trichloroacetic acid, monobromoacetic acid, and dibromoacetic acid.
- Refer to Appendix D for a complete list of constituents, based on the priority pollutants listed in Attachment E of the MRP. Semi-volatile Organics include Base/Neutral Extractable Organics & Acid Extractable Organics.
- Monitoring for Arochlors (PCBs) 1016, 1221, 1232, 1242, 1248, 1254, 1260; Dioxin (2,3,7,8-TCDD); and asbestos is not required per Section I.K.4 of the MRP.
- Quarterly monitoring for DEHP [bis(2diethylhexyl)phthalate] is only required in the following monitoring wells: MW2, MW4, MW16, MW22, MW28, and MW32. After a minimum of four quarters of groundwater monitoring for DEHP, the Discharger may present the findings and recommendations regarding whether to continue, modify, or cease DEHP monitoring.

**Table 3. Schedule for Additional Self-Monitoring**

<b>Constituent</b>	<b>MW17, MW20, and MW37</b>
Color	S
Dissolved oxygen	S
pH	S
Temperature	S
Depth to water	S
Electrical conductivity	S
Turbidity	S
Sodium	S
Chloride	S
<b>Sulfate</b>	S
Kjeldahl nitrogen (TKN)	S
Ammonia nitrogen	S
Nitrate nitrogen	S
Nitrite nitrogen	S
Total nitrogen	S
Total dissolved solids (TDS)	S
Total organic carbon (TOC)	S
Nethylene blue active substances (MBAS)	S

Where: S = Semiannual monitoring

**Table 4. Sample Handling and Analytical Methods**

Constituent	Method	Preservative	Holding Time <sup>a</sup>	Units	Sample Type	Sample Bottle <sup>b</sup>	Analytical Lab <sup>c</sup>
Ammonia Nitrogen	SM 4500-NH <sub>3</sub>	H <sub>2</sub> SO <sub>4</sub> to pH<2; Cool, 4°C	28 days	mg/L	composite	P/G	LACSD
Bis(2-diethylhexyl)phthalate	EPA 625	sodium thiosulfate in presence of chlorine; Cool, 4°C	7 days; 40 days	µg/L	composite	Amber G, TFE lined cap	LACSD
BOD	SM 5210B	Cool, 4°C	48 hours	mg/L	composite	P/G	LACSD
Calcium	EPA 200.7	HNO <sub>3</sub> to pH<2; Cool, 4°C	6 months	µg/L	composite	P/G	LACSD
Chloride	EPA 300.0	Cool, 4°C	28 days	mg/L	composite	P/G	LACSD
Chlorine Residual	SM 4500-CLC	None	immediately	mg/L	grab	P/G, zero headspace	LACSD
COD	SM 5220D	Analyze ASAP, or add H <sub>2</sub> SO <sub>4</sub> to pH<2; Cool, 4°C	28 days	mg/L	composite	P/G	LACSD
Color	N/A	N/A	N/A	N/A	N/A	N/A	Field
Dissolved Organic Carbon (DOC)	SM 5310 C	Filtered, H <sub>3</sub> PO <sub>4</sub> to pH<2; Cool to 4°C	28 days	mg/L	composite	G, TFE lined cap	LACSD
Dissolved Oxygen	SM 4500-OG	None	immediately	mg/L	grab	G- BOD bottle	LACSD
Electrical Conductivity	N/A	N/A	N/A	N/A	N/A	N/A	Field
Haloacetic acids (five)	EPA 552.2	Ammonium chloride, Cool, 4°C	14 days	µg/L	grab	G, TFE lined cap	commercial lab
Monochloroacetic acid	EPA 552.2	Ammonium chloride, Cool, 4°C	14 days	µg/L	grab	G, TFE lined cap	commercial lab
Dichloroacetic acid	EPA 552.2	Ammonium chloride, Cool, 4°C	14 days	µg/L	grab	G, TFE lined cap	commercial lab
Trichloroacetic acid	EPA 552.2	Ammonium chloride, Cool, 4°C	14 days	µg/L	grab	G, TFE lined cap	commercial lab
Monobromoacetic acid	EPA 552.2	Ammonium chloride, Cool, 4°C	14 days	µg/L	grab	G, TFE lined cap	commercial lab
Dibromoacetic acid	EPA 552.2	Ammonium chloride, Cool, 4°C	14 days	µg/L	grab	G, TFE lined cap	commercial lab
Inorganics (Heavy Metals) <sup>d</sup>	EPA 200.8 et al <sup>e</sup>	HNO <sub>3</sub> to pH<2; Cool, 4°C	6 months	µg/L	composite	P/G	LACSD
Hexavalent Chromium	EPA 218.6	Cool, 4°C	24 hours	µg/L	grab	P/G	commercial lab <sup>f</sup>
Kjeldahl Nitrogen	SM 4500-NORGB	H <sub>2</sub> SO <sub>4</sub> to pH<2; Cool, 4°C	28 days	mg/L	composite	P/G	LACSD
Magnesium	EPA 200.7	HNO <sub>3</sub> to pH<2; Cool, 4°C	6 months	µg/L	composite	P/G	LACSD
MBAS	SM 5540C	Cool, 4°C	48 hours	mg/L	composite	P/G	LACSD
Mercury	EPA 245.1	HNO <sub>3</sub> to pH<2; Cool, 4°C	28 days	µg/L	composite	G	LACSD
Mercury	EPA 1631	Acidified in laboratory clean room	90 days	ng/L	composite	G	commercial lab

Revised Self-Monitoring Sampling and Analysis Plan  
 Palmdale Water Reclamation Plant Monitoring and Reporting Program

Constituent	Method	Preservative	Holding Time <sup>a</sup>	Units	Sample Type	Sample Bottle <sup>b</sup>	Analytical Lab <sup>c</sup>
Methyl tertiary-Butyl Ether	EPA 624	sodium thiosulfate in presence of chlorine; Cool, 4°C	14 days	µg/L	grab	G, TFE lined cap	LACSD
Nitrate Nitrogen	SM 4500 NO <sub>3</sub> -E	Cool, 4°C	48 hours	mg/L	composite	P/G	LACSD
Nitrite nitrogen	SM4500-NO <sub>2</sub> -B	Cool, 4°C	48 hours	mg/L	composite	P/G	LACSD
N-nitrosodimethylamine	EPA 1625	sodium thiosulfate in presence of chlorine; Cool, 4°C	7 days; 40 days	ng/L	composite	Amber G, TFE lined cap	LACSD
Oil & Grease	EPA 1664A	HCl to pH<2; Cool, 4°C	28 days	mg/L	grab	G	LACSD
pH	SM 4500-HB	None	2 hours	pH unit	grab	P/G	LACSD
Sodium	EPA 200.7	HNO <sub>3</sub> to pH<2; Cool, 4°C	6 months	mg/L	composite	P/G	LACSD
Static Water Depth	N/A	N/A	N/A	N/A	N/A	N/A	Field
Sulfate	EPA 300.0	Cool, 4°C	28 days	mg/L	composite	P/G	LACSD
Temperature	SM 2550B	None	immediately	°C	grab	P/G	LACSD
Total Coliform	SM 9221B	sodium thiosulfate in presence of chlorine	6 hours	MPN/100 mL	grab	Sterile plastic	LACSD
Total Cyanides	SM 4500-CNC, E	Sodium thiosulfate in presence of chlorine; NaOH pH>12; Cool, 4°C	14 days	µg/L	grab	P/G	LACSD
Total Dissolved Solids	SM 2540C	Cool, 4°C	7 days	mg/L	composite	P/G	LACSD
Total Organic Carbon (TOC)	SM 5310 C	Filter sample to measure dissolved organic carbon, H <sub>3</sub> PO <sub>4</sub> to pH<2; Cool, 4°C	28 days	mg/L	composite	G, TFE lined cap	LACSD
Total Petroleum Hydrocarbons: Diesel Range	EPA 8015B	HCl to pH<2; Cool, 4°C	7 days	mg/L	composite	G, TFE lined cap	commercial lab
Total Petroleum Hydrocarbons: Gasoline Range	EPA 8015B	HCl to pH<2; Cool, 4°C	7 days	mg/L	composite	G, TFE lined cap	commercial lab
Total Phenols	EPA 420.1	H <sub>3</sub> PO <sub>4</sub> to pH<4; Cool, 4°C	28 days	µg/L	composite	P/G	LACSD
Total Suspended Solids	SM 2540D	Cool, 4°C	7 days	mg/L	composite	P/G	LACSD
Total trihalomethanes	EPA 624	sodium thiosulfate in presence of chlorine; Cool, 4°C	14 days	µg/L	grab	G, TFE lined cap	LACSD
Bromoform	EPA 624	sodium thiosulfate in presence of chlorine; Cool, 4°C	14 days	µg/L	grab	G, TFE lined cap	LACSD
Chloroform	EPA 624	sodium thiosulfate in presence of chlorine; Cool, 4°C	14 days	µg/L	grab	G, TFE lined cap	LACSD

Constituent	Method	Preservative	Holding Time <sup>a</sup>	Units	Sample Type	Sample Bottle <sup>b</sup>	Analytical Lab <sup>c</sup>
Dibromochloromethane	EPA 624	sodium thiosulfate in presence of chlorine; Cool, 4°C	14 days	µg/L	grab	G, TFE lined cap	LACSD
Dichlorobromomethane	EPA 624	sodium thiosulfate in presence of chlorine; Cool, 4°C	14 days	µg/L	grab	G, TFE lined cap	LACSD
Turbidity	N/A	N/A	N/A	N/A	N/A	N/A	Field
Volatile Organics <sup>d</sup>	EPA 624	sodium thiosulfate in presence of chlorine; Cool, 4°C	14 days	µg/L	grab	G, TFE lined cap (zero headspace)	LACSD
Semivolatile Organics: Acid Extractable Organics <sup>a</sup>	EPA 625	sodium thiosulfate in presence of chlorine; Cool, 4°C	7 days; 40 days	µg/L	composite	Amber G, TFE lined cap	LACSD
Semivolatile Organics: Base/Neutral Extractable Organics <sup>d</sup>	EPA 625	sodium thiosulfate in presence of chlorine; Cool, 4°C	7 days; 40 days	µg/L	composite	Amber G, TFE lined cap	LACSD
Pesticides and PCBs <sup>d</sup>	SM6630B, EPA 608, EPA 8081 & 8082	sodium thiosulfate in presence of chlorine; Cool, 4°C	7 days; 40 days	µg/L	composite	Amber G, TFE lined cap	LACSD

Notes:

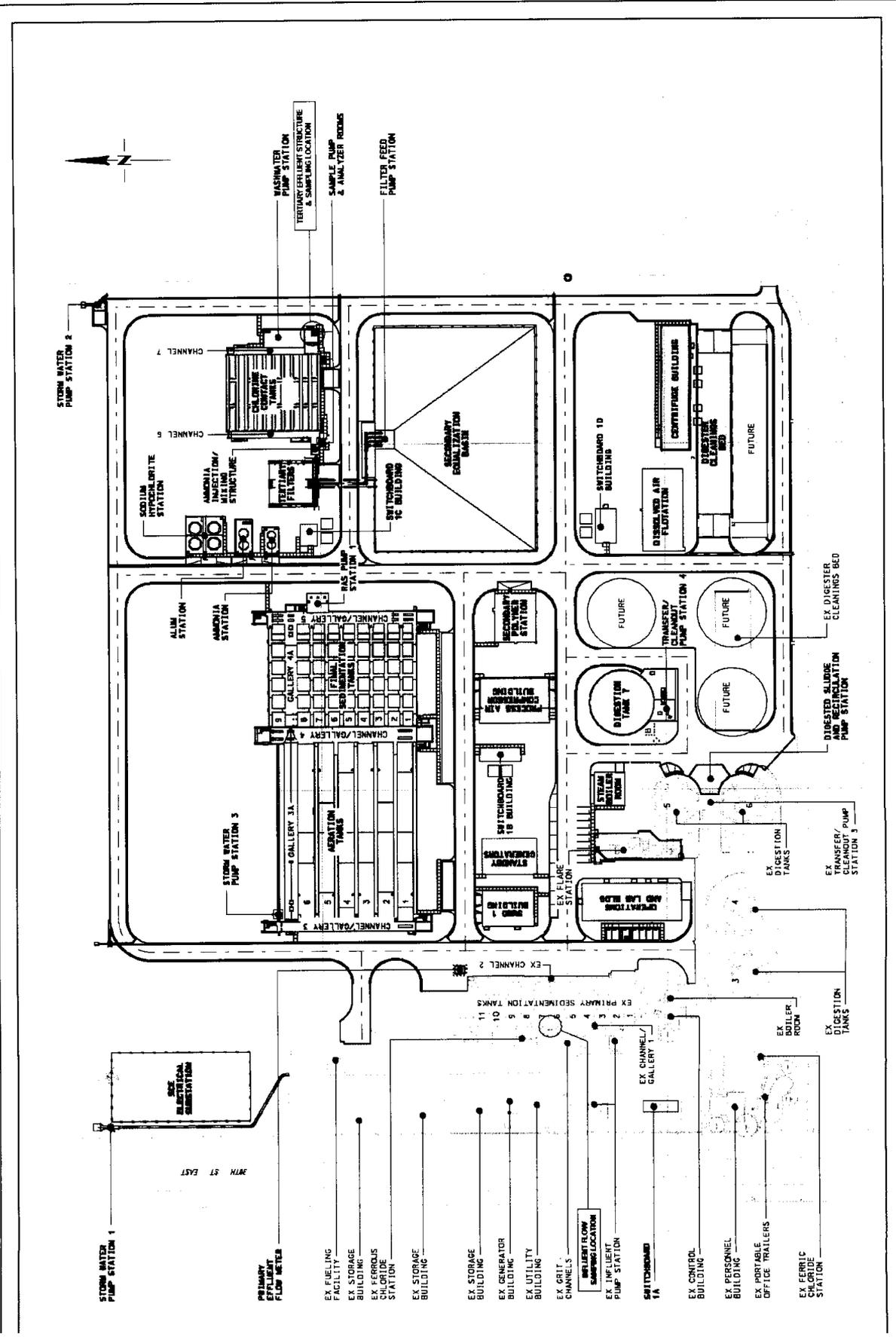
- NA = Not Applicable
- a) Maximum holding times, per Standard Methods/EPA specifications
- b) G = Glass, P = Plastic; Types of glass/plastic containers and rinsing techniques will vary depending on types of constituents being analyzed.
- c) In general, the Sanitation Districts (LACSD) laboratories will perform all analyses. However, the Sanitation Districts will occasionally send samples to commercial laboratories for analysis.
- d) Please see Appendix D for specific individual parameters.
- e) Other methods are: antimony by EPA SW-846 Method 7062, arsenic by SM 3114 B 4,d, and selenium by SM 3114B.
- f) Upon completion of the new laboratory facilities at Palmdale, hexavalent chromium analysis is planned to be performed in-house.

## **Appendix A**

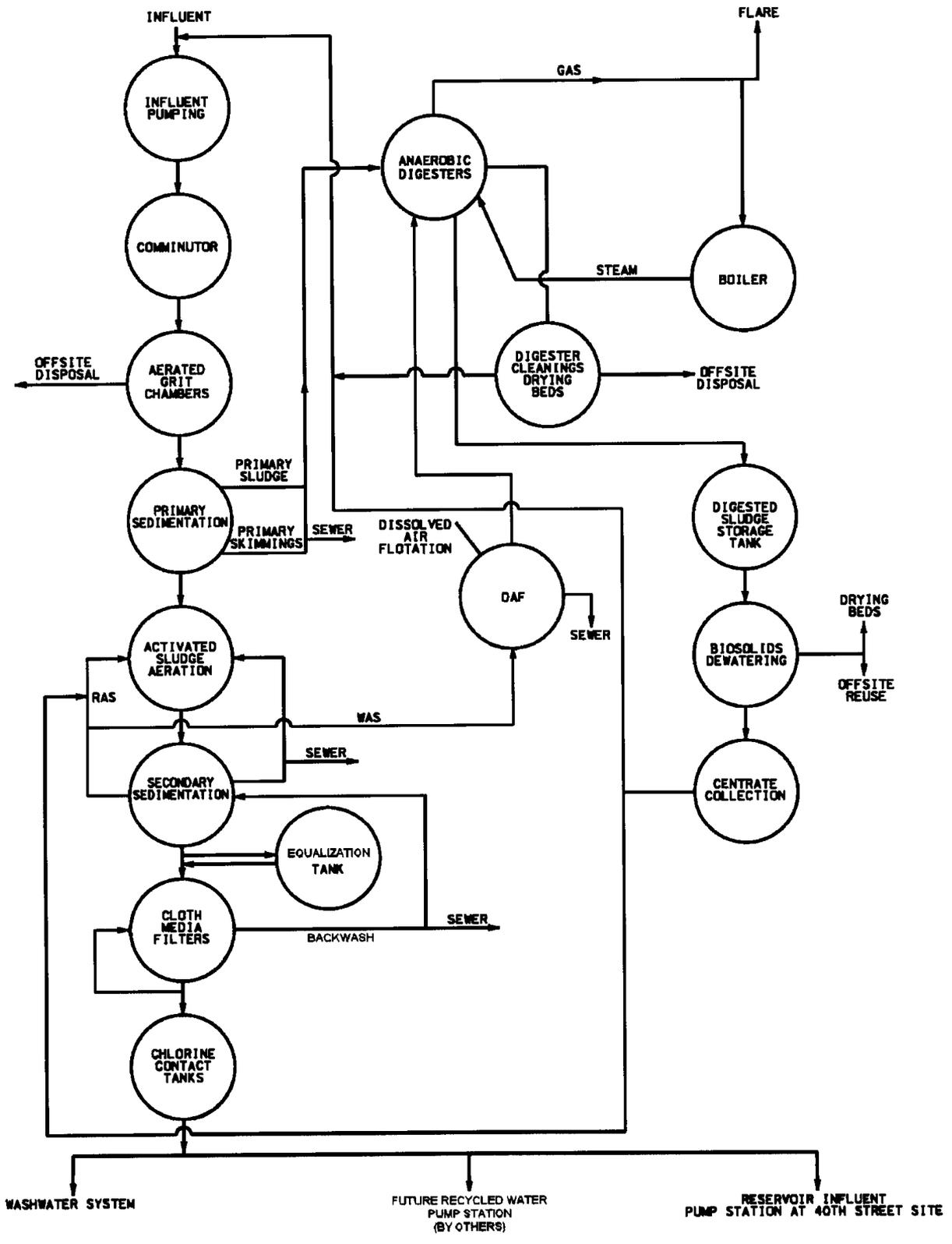
---

### **Sample Locations: Maps, Diagrams, and Photographs**

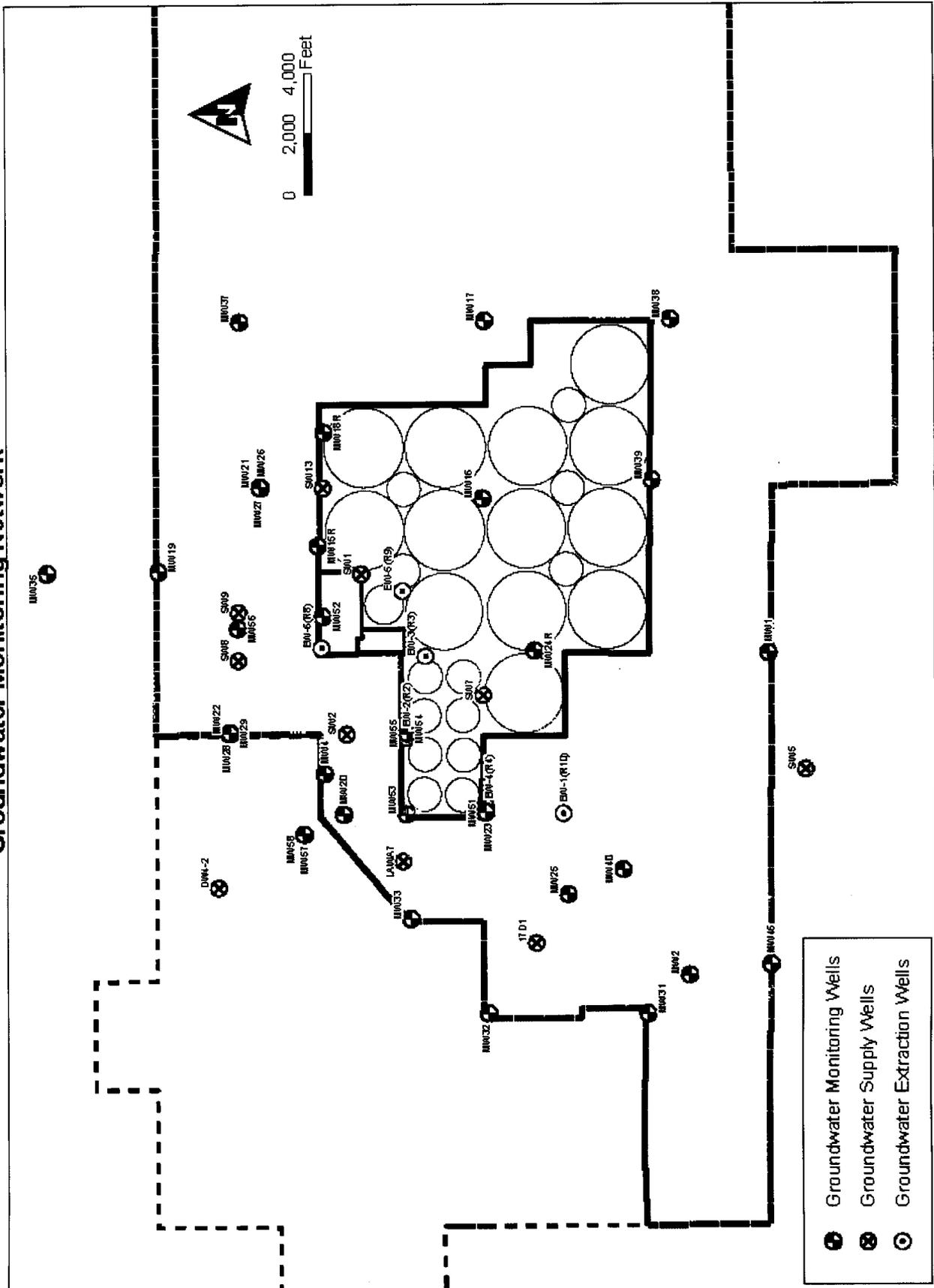
# Palmdale Water Reclamation Plant Upgraded Facilities and Sampling Locations



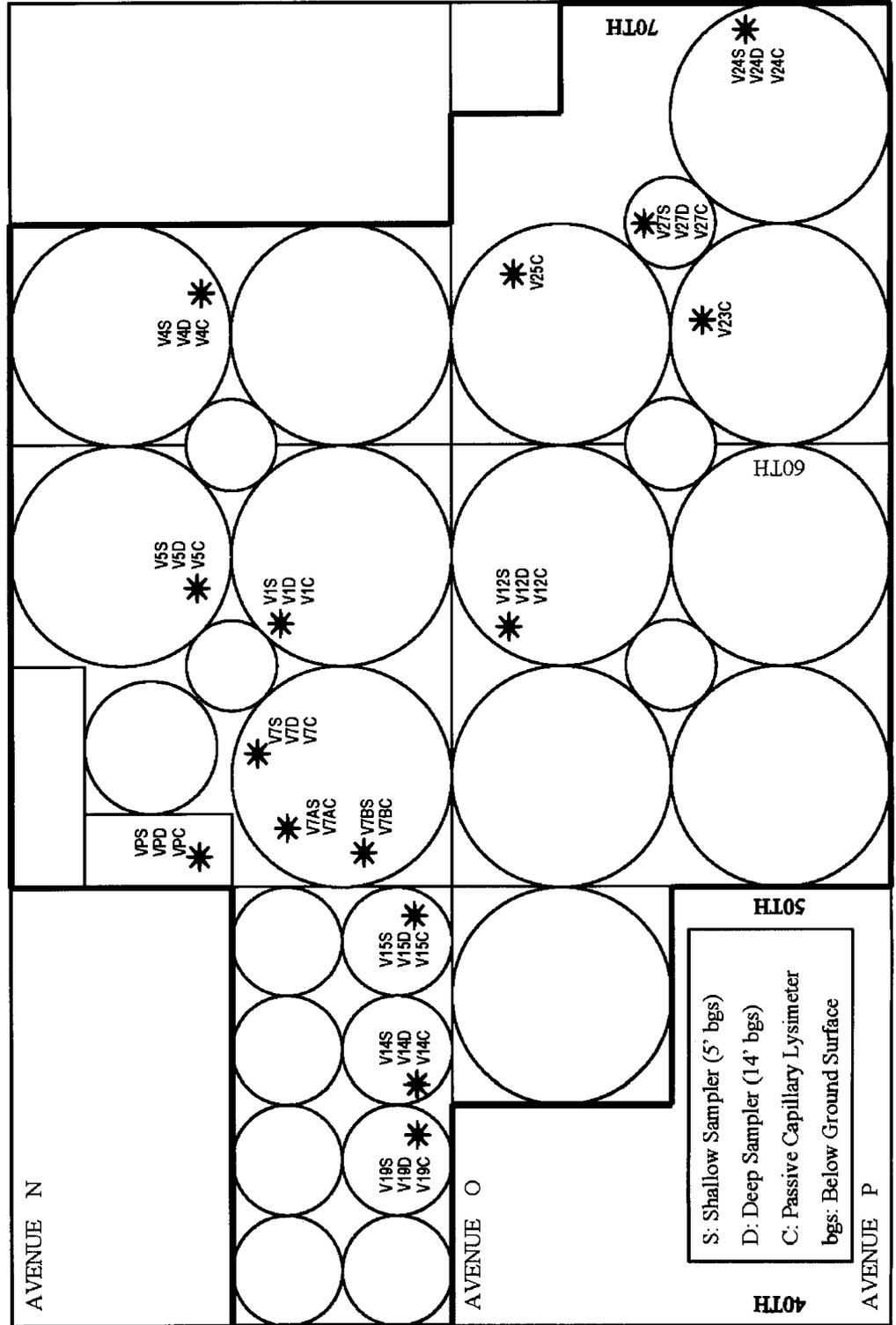
# Tertiary Treatment Facilities Process Schematic



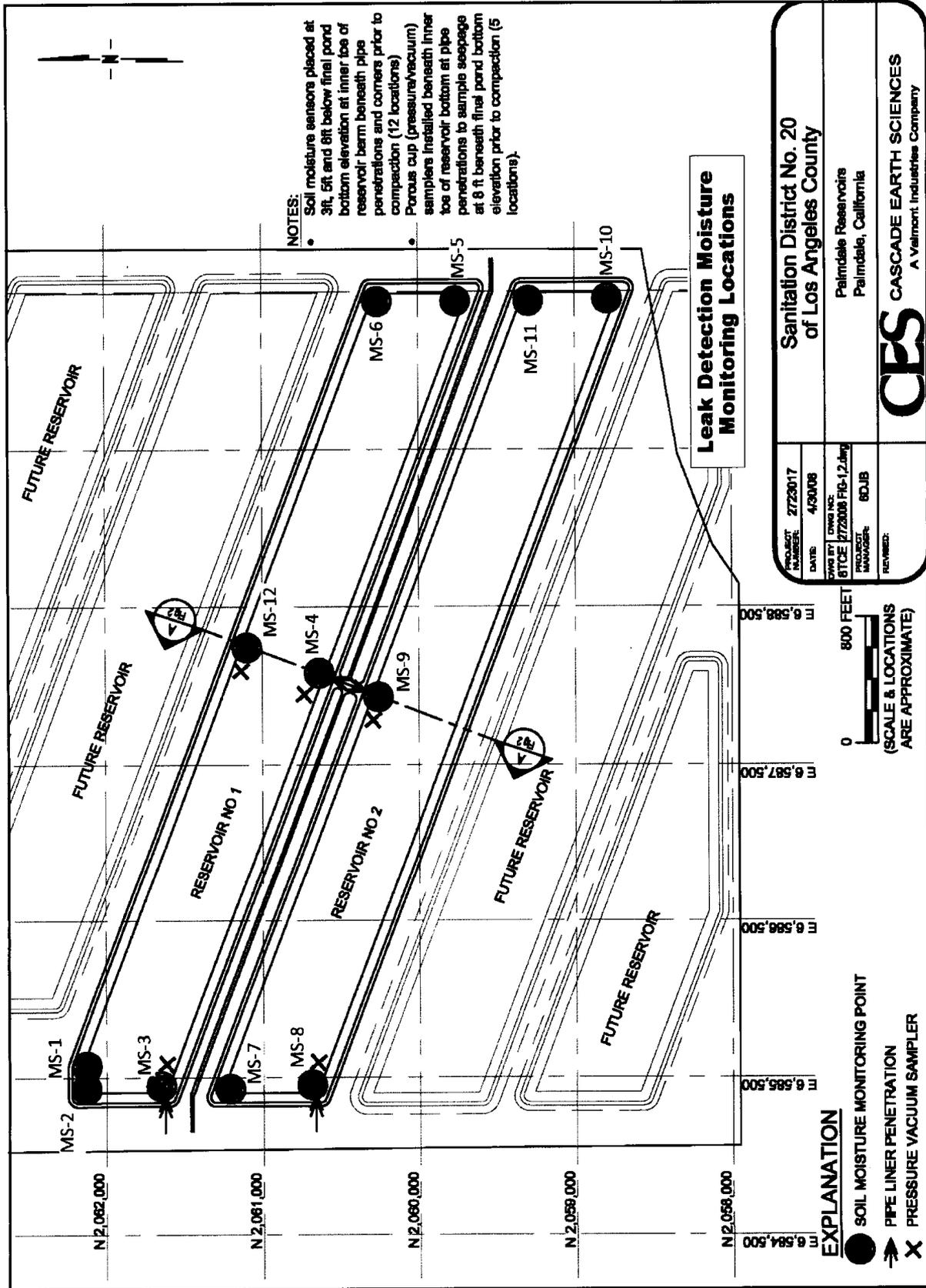
# Groundwater Monitoring Network



# Palmdale Agricultural Site Vadose Zone Monitoring Locations



Palmdale Storage Reservoir Soil Moisture and Lysimeter Locations



**NOTES:**

- Soil moisture sensors placed at 3ft, 5ft and 8ft below final pond bottom elevation at inner toe of reservoir berm beneath pipe penetrations and corners prior to compaction (12 locations)
- Porous cup (pressure/vacuum) samplers installed beneath inner toe of reservoir bottom at pipe penetrations to sample seepage at 8 ft beneath final pond bottom elevation prior to compaction (5 locations).

**Leak Detection Moisture Monitoring Locations**

PROJECT NUMBER: 2723017	DATE: 4/30/08	PROJECT: 80JUB	REVIEWED:
DRAWN BY: JTM/MS		PROJECT NUMBER: 80JUB	
CHECKED BY: GTCE		PROJECT: 80JUB	
Sanitation District No. 20 of Los Angeles County Palmdale Reservoirs Palmdale, California			
CASCADE EARTH SCIENCES A Veinmont Industries Company			

800 FEET  
 0  
 (SCALE & LOCATIONS ARE APPROXIMATE)

**EXPLANATION**

- SOIL MOISTURE MONITORING POINT
- ➔ PIPE LINER PENETRATION
- X PRESSURE VACUUM SAMPLER

## Monitoring Well Survey Data & Specifications

Palmdale Water Reclamation Plant  
Palmdale, California

Well Name	Total Depth	Northing	Easting	Ground Surface Elevation	Well Screen Interval
MW-1	400	2037502.70	6549335.03	2590.70	360-400
MW-2	540	2040118.68	6538766.67	2560.61	480-540
MW-4	334	2052029.08	6545407.39	2500.78	292-336
MW-15R	373	2052219.40	6552858.10	2507.92	333-363
MW-16	333	2046854.80	6554373.48	2540.62	281-315
MW-17	290	2046767.52	6560141.64	2545.70	245-290
MW-18R	363	2052021.13	6556537.67	2515.04	326-356
MW-19	337	2057425.72	6552019.87	2488.75	290-335
MW-20	296	2051414.25	6544089.47	2501.66	257-295
MW-21	340	2054123.00	6554750.62	2506.27	300-340
MW-22	322	2055081.45	6546743.43	2487.28	282-320
MW-23	398	2046777.79	6544147.63	2525.42	369-397
MW-24R	358	2045155.50	6549411.66	2541.24	325-350
MW-25	350	2044080.79	6541437.49	2541.10	321-349
MW-26	373	2054081.84	6554746.34	2506.14	361-370
MW-27	401	2054101.23	6554747.28	2506.34	390-399
MW-28	436	2055132.47	6546744.10	2487.85	421-431
MW-29	510	2055109.47	6546744.01	2487.59	491-500
MW-31	520	2041476.81	6537512.68	2557.89	484-518
MW-32	403	2046690.83	6537504.06	2533.85	372-395
MW-33	379	2049208.24	6540626.73	2514.33	363-377
MW-37	359	2054760.76	6560134.16	2508.82	318-353
MW-38	320	2040685.28	6560198.38	2575.19	281-316
MW-39	350	2041306.44	6554954.21	2570.70	307-346
MW-40	364	2042274.80	6542261.12	2551.64	330-360
MW-46	551	2037457.67	6539111.68	2574.42	511-550
MW-51	458	2046787.89	6544376.40	2525.47	331-340
MW-52	353	2052075.29	6550543.03	2506.05	317-347
MW-53	340	2049363.46	6544090.92	2511.59	295-330
MW-54	364	2049395.84	6546871.91	2513.66	331-356
MW-55	483	2049332.46	6546718.30	2513.89	465-475
MW-56	500	2054844.72	6550164.18	2493.86	325-365
MW-57	359	2052690.05	6543446.04	2495.47	339-349
MW-58	440	2052709.35	6543438.26	2495.20	375-390

## **Appendix B**

---

# **Sample Collection Standard Operating Procedures**

# **Standard Operating Procedure**

## **Palmdale Water Reclamation Plant**

### **Daily Sample Collection**

#### **(Without Custody Transfer)**

#### **Introduction**

This procedure is to be used when there is no custody transfer and the analyses are performed by the same person(s) responsible for collection of the sample(s). Typically, this type of operation is associated with laboratories located at the water reclamation plant (WRP) site and defined as Treatment Plant Laboratories. Samples collected in this manner are securely maintained on site until analyses have been completed, after which the same person(s) discard the sample(s).

#### **Equipment, Materials and Supplies**

- Automated samplers with programmable controls to allow for flow weighted compositing. (SIGMA 900 Max or similar samplers)
- Paddle made of polypropylene for mixing collected sample.
- Large mouth glass sample container for sampler
- Sample bottles which have been pre-cleaned and are compatible with constituents to be analyzed.
- Ice to be used in sampler if it is not refrigerated.
- Sample log book.

#### **Setting & Initiating Sampling**

1. Position the sampler at a location representative of effluent being discharged from the WRP after completion of all treatment processes or before treatment processes, if influent untreated wastewater is desired.
2. Obtain typical plant flow data for influent or effluent streams covering a 24-hour period.
3. Establish numerical values that correspond to sample volumes to be collected at intervals that result in a flow weighted composite sample.
4. Enter sampling parameters along with numerical values into the sampler programming unit using the manufacturer's guidelines.
5. Install a clean sample collection container in the sampler and ice if it is not refrigerated.
6. Initiate the start of the sampler program (and confirm the first sample in the sequence is collected).
7. Let it run.

#### **Retrieval & Collection**

- At the end of the sample collection period check the sampler to confirm that there was no malfunction and that the appropriate volume of sample was collected.

- Visually inspect the area around the sample collection point to determine if any conditions exist that may lead to unusual analytical results. If the sampler malfunctioned or other conditions prevail that may contribute to unusual results, then record these observations in the sample log book.
- Pre-label clean bottles designated for specific constituent analyses. Sample dates, times, location & type are to be recorded along with the name of the individual collecting the sample.
- Take out sample container from sampler, and in a mix-pour manner, pour aliquots of the sample into pre-labeled bottles that are compatible with constituents to be analyzed.
- Bottles are to be iced from this point till arrival at the laboratory.
- Upon return to the laboratory, immediately commence with analysis of the samples or proper preservation if the sample is to be held.

### **Sampler Maintenance**

- The sampler and its container are to be cleaned with water, detergent, acid, and a solvent as necessary for its next use.
- If batteries are used, they are to be re-charged.

**Sanitation Districts of Los Angeles County  
Laboratories Section**

**METHOD APPROVAL FORM**

*Method Number*      Not Applicable

*Method Name*        Sigma Composite Sampling

*Version*              10.1.0

*Method Date*        February 18, 2010

*Reasons for  
Method Revision*    Annual Review; no revisions were made

*Reviewed by:*

Kelly Lechuga  
Laboratory Technician II  
Lancaster Sampling Receiving

  
Signature

3/24/10  
Date

*Approved by:*

Lavern Tamoria  
Supervising Chemist  
QA/Sample Receiving

  
Signature

3/24/10  
Date

*Final Approval:*

Maria Pang  
Assistant Manager of  
the Laboratories

  
Signature

4/22/10  
Date

## SIGMA COMPOSITE SAMPLING PROCEDURE

### INTRODUCTION

The Sample Receiving group collects influent and effluent samples for priority pollutants and other regulated constituents. The dedicated stationary samplers used by this group are Sigma 900 MAX All Weather Refrigerated Sampler manufactured by the HACH Company and we, therefore, refer to our samplers as Sigmas. Because it is impractical to study the entire body of water treated by a water reclamation plant, a sample is taken that represents the entire body. The Sigma sampler achieves this by collecting either a flow-weighted composite over a 24 hr period for the constantly fluctuating Raw Influent or a time-weighted composite for the Secondary Final Effluent due to its static flow rate. Sample Receiving field crews program the Sigma to collect fixed volumes at designated times based on the average daily flow of the reclamation plant being sampled. The aliquots are combined into a single container during sampling. Once sampling has been completed, the single large volume is divided into smaller containers for transport back to the lab for analysis.

The flow-weighted sample times are created using a flow calculation spreadsheet specific to each plant. The calculations are based on the average daily flow per hour of the reclamation plant's raw influent over a period of 3 days. The days used are typically weekdays which do not immediately follow weekends or holidays. These days are selected to record data that will be most representative of a typical day's influent into the plant. The hourly flows are then averaged into 2 hr increments and entered into a spreadsheet to generate 12 sample times for collection over a 24 hr period. Calculations are updated on a semi-annual basis following the time change for Daylight Savings Time. Time-weighted samples times are programmed into the Sigma at 2 hr intervals based on the start time, usually from 6:00 am to 6:00 am, in a 24 hr period.

Some samples require low-level analysis (e.g., Hg and NDMA). In these cases it is necessary to take further steps in preparing the Sigma sampler prior to sampling to insure no contaminants are introduced from the Sigma sampler or associated tubing. (See 9.)

#### 1. Scope and Application

- 1.1 The Sigma composite sampler is used to collect a representative sample of the water reclamation plant's activity over a period of 24 hrs.
- 1.2 Raw influent and final effluent are collected by this method as required by Wastewater Discharge Requirements (WDR) permits.

#### 2. Summary of Method

- 2.1 Composite samples are collected over a 24 hr period using calculated time intervals.
  - 2.2 Typically 12 collection times for Raw Influent are calculated based on the flow into the particular reclamation plant.
  - 2.3 Typically 12 collection times for the Secondary Final Effluent are set for every two hours from the time the Sigma is programmed.
3. Sample Handling and Preservation
    - 3.1 Water Reclamation Plants (WRP) samples are collected using appropriate containers and preservation methods as directed in Standard Methods for the Examination of Water and Wastewater.
    - 3.2 After collection, and as soon as possible, place samples into an ice chest with ice to keep their temperature at 0-6°C during transport from the sample collection site to Sample Receiving Control (SRC).
    - 3.3 Once removed from the ice chest the samples are placed into a refrigerator or walk-in cooler to maintain the cold temperature for storage.
4. Interferences
    - 4.1 If a reclamation plant is not operating normally, an extreme drop in water level below the strainer may interrupt sampling.
    - 4.2 Interruption in power to the Sigma may cause failure to complete sampling.
    - 4.3 During excessive rainfall, it may not be possible to collect a representative sample.
    - 4.4 During excessive cold weather, sample line to the Sigma may freeze.
5. Apparatus
    - 5.1 Sigma 900 MAX All Weather Refrigerated Sampler (Figure 1)

5.2 10, 12, or 25 ft, 3/8" ID -- Teflon lined suction tubing with stainless steel strainer

5.3 3 ft Silastic medical grade silicon tubing

5.4 1 to 4 10 L glass jars depending on amount to be collected

5.5 Teflon stir bar

5.6 Stainless steel funnel

## 6. Reagents

6.1 ACS Grade Sodium Thiosulfate crystals

## 7. Procedure

### 7.1 Sigma Setup

7.1.1 Open the top cover from the Sigma sampler unit (Figure 1).

7.1.2 Remove cover plates from the pump case and liquid detector.

7.1.3 Thread the silicon tubing through the pump tube port and the center section tube guide.

7.1.4 Thread the other end of the silicon tubing through the pump case and the liquid detector.

7.1.5 Replace pump and liquid detector covers. When complete, the setup should look like Figure 2.

7.1.6 Place the 10 L glass jars into the refrigerated section.

7.1.7 If a dechlorinated sample is required, add 0.5 g of Sodium Thiosulfate crystals per 1 L of sample to the 10 L jar (approximately 4.5 g for a full sampling event).

7.1.8 Close the sampler.

## 7.2 Programming the Sigma

7.2.1 Basic set up is performed at initial equipment installation (see catalog #8854 Sigma 900 MAX All Weather Refrigerator user manual for instructions) operator must use the “Modify” option when programming the Sigma for sampling.

7.2.2 Figure 3 shows the programming tree of the programming options.

7.2.3 The first display should be MAIN MENU as seen in Figure 4. From the Main Menu select SETUP>MODIFY ALL ITEMS. Press ACCEPT.

7.2.4 Enter the number of sample bottles and the bottle volume. Select gallons or milliliters using the CHANGE UNIT key. Press ACCEPT and continue to Intake Tubing.

7.2.5 Enter the intake tube length of the intake tubing attached to the sampler. Length values from 100 to 3000cm (3 to 99ft) are valid. Change measurement unit using the CHANGE UNITS key. Press ACCEPT to move to the Intake Tubing Type

7.2.6 Select the type of intake tube (3/8 in. Teflon). Press ACCEPT pass PROGRAM LOCK and PROGRAM DELAY to continue with Sample Collection.

7.2.7 Select the type of sample collection; Time Proportional or Flow-Proportional Constant Volume, Variable Time (CVVT)

7.2.7.1 For **Time Proportional sampling** (time-weighted) go to Sample Collection menu, press CHANGE CHOICE until Timed Proportional is displayed, press ACCEPT and enter the interval between samples (normally two hours) and press ACCEPT. Select TAKE FIRST SAMPLE IMMEDIATELY or AFTER FIRST INTERVAL, press ACCEPT to start sampling program.

7.2.7.2 For **Flow Proportional Constant Volume, Variable Time (CVVT)**

(flow-weighted) go to Sample Collection menu and press CHANGE CHOICE until Flow Proportional is displayed, press ACCEPT. In the Flow Proportional menu press CHANGE until CVVT is displayed. Press ACCEPT. Select either Internal or External flow meter and press ACCEPT. Enter the flow volume between samples and select a unit of measure using the CHANGE UNITS key. Enable or Disable the Timed Over-Ride using the CHANGE CHOICE key. Press ACCEPT, then enter a time period using numeric key. Select Take First Sample Immediately or After First Interval, press ACCEPT to start sampling program.

### 7.3 Setting up Sampler at the Reclamation Plant

- 7.3.1 Prior to departing for the sample location, contact the operations group of the reclamation plant to ensure the plant is operating normally.
- 7.3.2 Upon arrival to the sample location observe the surrounding area for normal sampling conditions. Note any unusual events if any are observed.
- 7.3.3 Open the cover of the top section.
- 7.3.4 Insert the Teflon lined suction tube into the loose end of the silicon pump tubing about 1 to 1.5 cm.
- 7.3.5 Lower the stainless steel strainer into the sample source. The strainer should be about 2 ft below the surface of the sample source. This depth can vary depending on the conditions of the source; however, 2 ft should be sufficient for most conditions.
- 7.3.6 Proceed with Programming the Sigma.
- 7.3.7 Replace the top cover.

### 7.4 Sigma Sampler Collection

- 7.4.1 Remove top cover.
- 7.4.2 Check display, it will indicate if any problem occurred while sampling

- 7.4.3 Remove suction tubing from pump tubing. If sample remains in the tubing, press REVERSE PUMP to purge the line.
- 7.4.4 Open refrigerated section of the sampler and remove sample jars.
- 7.4.5 Gently stir sample with Teflon bar.
- 7.4.6 Carefully pour sample into appropriate sample containers. If necessary, use a stainless steel funnel to aid in pouring.
- 7.4.7 Dump any remaining sample back into the sample source.
- 7.4.8 Collect all materials (tubing, cones, etc.) and store them securely in the vehicle.
- 7.4.9 Preserve samples as necessary and place all samples in an ice chest for transport. Take the necessary precautions in loading the cooler to prevent breakage during transport.

## 7.5 Cleaning the Sampler

- 7.5.1 Wash all equipment with Liquinox and water.
- 7.5.2 Run Liquinox through suction tubing using an Isco portable sampler pump.
- 7.5.3 Flush suction tubing thoroughly with tap water to remove all soap.
- 7.5.4 Rinse the inner surface of the 10L glass jar with a 1:1 nitric acid solution. Carefully move the acid solution around inside the jar to sufficiently coat the inner surface of the jar.
- 7.5.5 Dump excess acid into a sink under a fume hood and rinse the jar with copious volumes of DI water.
- 7.5.6 Rinse all equipment with methanol. Add a small amount into the tubing and jars. Move the methanol around in the equipment to sufficiently rinse the inner surface.

7.5.7 Rinse all equipment several times with DI water.

7.5.8 Set equipment out to air dry.

## 8. Calculations

8.1 Table 1 shows an example of the average daily flow measurements over a period of 3 days. The 2 hr averages are used in Table 1 to calculate sample collection times.

8.2 The calculations take into account the total average daily flow, the ratio of the 2 hr average flow, and the cumulative ratio of total flow to derive sample times which would be the most representative for the given 2 hr time interval.

## 9. Quality Assurance Guidelines

### 9.1 Equipment Blank

9.1.1 Fill a 10 L glass jar with reagent-grade water.

9.1.2 Place the stainless steel strainer into the 10L glass jar filled with reagent-grade water.

9.1.3 Press MANUAL SAMPLE or PUMP FORWARD to run the reagent-grade water through the sampling equipment and into the sample collection jar.

9.1.4 Pour off the collected water into appropriate containers for analysis.

### 9.2 NDMA Equipment Blank

9.2.1 Sampling the equipment blank and bottle blank for NDMA follows the same procedure as listed in 9.1 with a few additions.

9.2.3 The sample containers must be rinsed three times with laboratory's reagent-grade water before filling for the equipment blank or bottle blank.

## 10. Method Performance

10.1 Not Applicable.

## 11. References

11.1 User Manual Sigma 900 MAX All Weather Refrigerated Sampler, Copyright 2006.

11.2 Laboratory Section Procedures for the Characterization of Water and Wastewater, Fourth Edition, 1989, p. II-1 to II-14 – Sampling.

11.3 Sampling Receiving Control – Field Sampling Protocol, Section 1.

Figure 1.



Figure 2.

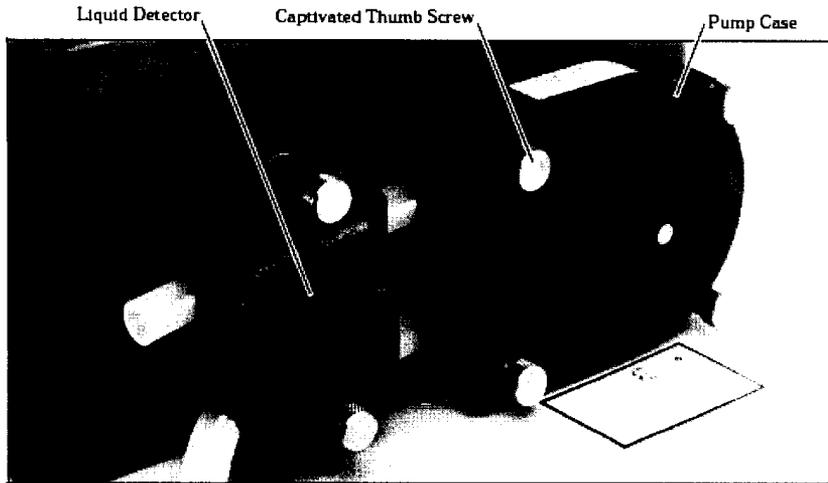




Table 1.

FLOW WEIGHTED COMPOSITE CALCULATIONS:

TIME	AVERAGE FLOW (MGD)	RATIO OF TOTAL FLOW	CUMULATIVE FLOW	SAMPLING TIMES
2.00	5.55	0.0667	0.066693	2.4632 2.28
4.00	5.97	0.0717	0.138394	4.7325 4.44
6.00	6.50	0.0781	0.216503	6.7637 6.46
8.00	7.30	0.0877	0.304226	8.6486 8.39
10.00	7.38	0.0887	0.39295	10.515 10.31
12.00	7.77	0.0933	0.486281	12.288 12.17
14.00	7.92	0.0951	0.581414	14.034 14.02
16.00	7.85	0.0943	0.675746	15.815 15.49
18.00	7.68	0.0923	0.768075	16.246 16.15
20.00	7.75	0.0931	0.861206	19.394 19.24
22.00	6.03	0.0725	0.933707	21.539 21.32
24.00	5.52	0.0663	1	24 24.00
TOTAL FLOW =	83.22 MGD			

Example Flow Calculation (first 2hr time interval):

$$\frac{(2/24) * 2}{0.563} + 4 - \frac{2}{0.0563} * 0.135428 = 2.14 \text{ (sample collection time in decimal form)}$$

$$(2.14 - 2) * 0.6 + 2 = 2.09 \text{ (sample collection time)}$$

**Sanitation Districts of Los Angeles County  
Laboratories Section**

**METHOD APPROVAL FORM**

*Method Number*      Not Applicable

*Method Name*        ISCO Composite Sampling Procedure

*Version*              10.1.0

*Method Date*        February 09, 2010

*Reasons for  
Method Revision*      Annual review; no modifications were made

*Written by:*

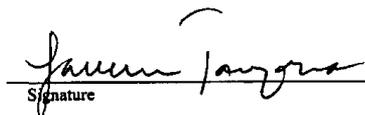
Jessica Pacheco  
Laboratory Technician II  
QA/Sample Receiving

  
Signature

  
Date

*Approved by:*

Lavern Tamoria  
Supervising Chemist  
QA/Sample Receiving

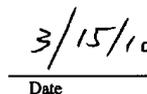
  
Signature

  
Date

*Final Approval:*

Maria Pang  
Assistant Manager of  
the Laboratories

  
Signature

  
Date

## ISCO COMPOSITE SAMPLING

### INTRODUCTION

The Sample Receiving group collects influent and effluent samples for priority pollutants and other regulated constituents. The portable samplers used by this group are manufactured by the ISCO Company and we, therefore, refer to our samplers as ISCOs. Because it is impractical to study the entire body of water treated by a water reclamation plant, a sample is taken that represents the entire body. The ISCO sampler achieves this by collecting a flow-weighted composite over a 24 hr period. Sample Receiving field crews set up ISCOs to collect fixed volumes at designated times based on the average daily flow of the reclamation plant being sampled. The aliquots are combined into a single container during sampling. Once sampling has been completed, the single large volume is divided into smaller containers for transport back to the lab for analysis.

The flow-weighted sample times are created using a flow calculation spreadsheet specific to each plant. The calculations are based on the average daily flow per hour of the reclamation plant's final effluent discharge over a period of 3 days. The days used are typically weekdays which do not immediately follow weekends or holidays. These days are selected to record data that will be most representative of a typical day of discharge from the plant. The hourly flows are then averaged into 2 hr increments and entered into a spreadsheet to generate 12 sample times for collection over a 24 hr period. Calculations are updated on a semi-annual basis following the time change for Daylight Savings Time.

Some samples require low-level analysis (e.g., Hg and NDMA). In these cases it is necessary to take further steps in preparing the ISCO sampler prior to sampling to insure no contaminants are introduced to the sample from the sampler (see 9.).

#### 1. Scope and Application

- 1.1 The ISCO composite sampler is used to collect a representative sample of the water reclamation plant's activity over a period of 24 hrs.
- 1.2 Raw influent and final effluent are collected by this method as required by National Pollution Discharge Elimination System (NPDES) permits.

#### 2. Summary

- 2.1 Composite samples are collected over a 24 hr period using calculated time intervals.
- 2.2 Typically 12 collection times are calculated based on the flow discharged from the particular reclamation plant.

### 3. Sample Handling and Preservation

- 3.1 Water Reclamation Plants (WRP) samples are collected using appropriate containers and preservation methods as directed in Standard Methods for the Examination of Water and Wastewater.
- 3.2 After collection, and as soon as possible, place samples into an ice chest with ice to keep their temperature at 0-6°C during transport from the sample collection site to Sample Receiving Control (SRC).
- 3.3 Once removed from the ice chest the samples are placed into a refrigerator or walk-in cooler to maintain the cold temperature for storage.

### 4. Interferences

- 4.1 If a reclamation plant is not operating normally, an extreme drop in water level below the stainless steel strainer may interrupt sampling.
- 4.2 Insufficiently charged batteries may cause failure to complete sampling.
- 4.3 During excessive rainfall, it may not be possible to collect a representative sample.

### 5. Apparatus

- 5.1 ISCO 3710 Compact portable sampler (Figure 1)
- 5.2 10, 12, or 25 ft, 3/8" ID – Teflon lined suction tubing with stainless steel strainer
- 5.3 3 ft Silastic medical grade silicon tubing
- 5.4 10 L glass jar
- 5.5 Charged rechargeable Ni/Cd or lead/acid battery
- 5.6 Teflon stir bar
- 5.7 Stainless steel funnel
- 5.8 Orange safety cones

### 6. Reagents

## 6.1 Sodium Thiosulfate crystals

## 7. Procedure

### 7.1 ISCO Setup

- 7.1.1 Remove the top cover from the ISCO sampler unit (Figure 1).
- 7.1.2 Remove cover plates from the pump case and liquid detector (Figure 1).
- 7.1.3 Thread the silicon tubing through the pump tube port and the center section tube guide (Figure 2).
- 7.1.4 Thread the other end of the silicon tubing through the pump case and the liquid detector as shown in Figure 3.
- 7.1.5 Replace pump and liquid detector covers.
- 7.1.6 Place the 10 L glass jar into the base section.
- 7.1.7 Fill the remaining space of the base section around the 10 L jar with ice.
- 7.1.8 If a dechlorinated sample is required, add 0.5 g of Sodium Thiosulfate crystals per 1 L of sample to the 10 L jar (approximately 4.5 g for a full sampling event).
- 7.1.9 Reassemble the sampler.

### 7.2 Programming the ISCO

- 7.2.1 Press the ON/OFF button to turn the sampler ON.
- 7.2.2 Figure 4 shows the programming tree of the programming options.
- 7.2.3 The first display should be STANDBY as seen in Figure 4. Anything other than STANDBY indicates the sampler encountered a problem during its last use. If this has happened the screen may read PROGRAM HALTED and should be treated the same as if it read STANDBY for initial programming. Press the ENTER/PROGRAM button to begin programming.
- 7.2.4 Figure 4 - Display #1, will appear as the next screen. Use the Left or Right Arrow keys to highlight PROGRAM, the selected item should flash when highlighted, and press ENTER.

- 7.2.5 Table 1 shows the series of steps to follow and the appropriate selection for each.
  - 7.2.6 Next enter the appropriate collection times. Use Flow Calculations for the specific reclamation plant being sampled (Table 3).
  - 7.2.7 Enter hours HH, minutes MM, day DD, and month MM pressing ENTER after each to proceed to the next. By default the day and month displayed will be the current day and month, where as the times will be the times previously programmed.
  - 7.2.8 At 2400 hours enter 00:00 for the time value and advance the day to the next day.
  - 7.2.9 Enter 750 mL for the sample volume; press ENTER.
  - 7.2.10 This should complete programming and PROGRAMMING SEQUENCE COMPLETED should appear briefly before returning to the initial STANDBY screen.
  - 7.2.11 Occasionally after entering the volume other options may appear on the display screen depending on the configuration of the sampler. Typically these two options will appear: SUCTION HEAD OF: 12 FEET (1 – 12) and CALIBRATE SAMPLE VOLUME [YES, NO]. If this does occur, enter the length of suction line being used for the first option and select NO for the second.
- 7.3 Setting up Sampler at the Reclamation Plant
- 7.3.1 Prior to departing for the sample location, contact the operations group of the reclamation plant to ensure the plant is operating normally.
  - 7.3.2 Upon arrival to the sample location observe the surrounding area for normal sampling conditions. Note any unusual events if any are observed.
  - 7.3.3 Place sampler at the appropriate sample location.
  - 7.3.4 Remove the cover of the top section.
  - 7.3.5 Insert the Teflon lined suction tube into the loose end of the silicon pump tubing about 1.5 to 2 cm.
  - 7.3.6 Lower the stainless steel strainer into the sample source. The strainer should be about 2 ft below the surface of the sample source. This depth can vary depending on the conditions of the source; however, 2 ft should be sufficient for most conditions.

- 7.3.7 Wrap excess suction tubing around the base of the sampler. Be sure not to allow the tubing to become kinked or crushed under the weight of the sampler.
  - 7.3.8 Press START SAMPLING, the display should read: SAMPLE 1 of 12, at HH:MM
  - 7.3.9 Replace the top cover.
  - 7.3.10 Place a safety cone near the sampler so that the equipment is clearly visible.
- 7.4 ISCO Sampler Pick-Up
- 7.4.1 Remove top cover.
  - 7.4.2 Check display, it should read: DONE 12 SAMPLES
  - 7.4.3 Remove suction tubing from pump tubing. If sample remains in the tubing, press REVERSE PUMP to purge the line.
  - 7.4.4 Remove the center section from the base section.
  - 7.4.5 Gently stir sample with a clean Teflon bar.
  - 7.4.6 Carefully remove jar from base section. Avoid putting fingers inside the sample jar to remove it from the base.
  - 7.4.7 Carefully pour sample into appropriate sample containers. If necessary, use a clean stainless steel funnel to aid in pouring.
  - 7.4.8 Return any remaining sample back into the sample source.
  - 7.4.9 Replace the jar into the base section and reassemble the sampler for transport back to SRC.
  - 7.4.10 Collect all materials (tubing, cones, etc.) and store them securely in the vehicle.
  - 7.4.11 Preserve samples as necessary and place all samples in an ice chest for transport. Take the necessary precautions in loading the cooler to prevent breakage during transport.
- 7.5 Cleaning the Sampler
- 7.5.1 Wash all equipment with Liquinox and water.

- 7.5.2 Run Liquinox through pump and suction tubing.
- 7.5.3 Flush pump and suction tubing thoroughly with tap water to remove all soap.
- 7.5.4 Rinse the inner surface of the 10 L ISCO jar with a 1:1 nitric acid solution. Carefully swirl the acid solution around the inside the jar to sufficiently coat the inner surface of the jar.
- 7.5.5 Dispose excess acid into a sink under a fume hood and rinse the jar with copious volumes of DI water.
- 7.5.6 Rinse all equipment with methanol. Add a small amount into the tubing and jars. Swirl the methanol around in the equipment to sufficiently rinse the inner surface.
- 7.5.7 Rinse all equipment several times with DI water.
- 7.5.8 For the final rinse use reagent-grade water from the SJC MRQA laboratory. Put the water into a carboy to be used at the cleaning station in SRC. Water should be renewed per each cleaning event.
- 7.5.9 Set equipment out to air dry.

## 8. Calculations

- 8.1 Table 2 shows an example of the average daily flow measurements over a period of 3 days. The 2 hr averages are used in Table 2 to calculate sample collection times.
- 8.2 The calculations take into account the total average daily flow, the ratio of the 2 hr average flow, and the cumulative ratio of total flow to derive sample times which would be the most representative for the given 2 hr time interval.

## 9. Quality Assurance Guidelines

### 9.1 Equipment Blank

- 9.1.1 Fill a 10 L glass jar with reagent-grade water.
- 9.1.2 Setup an ISCO sampler for normal sampling.
- 9.1.3 Place the stainless steel strainer into the 10 L ISCO jar filled with reagent-grade water.

9.1.4 Press MANUAL SAMPLE or PUMP FORWARD to run the reagent-grade water through the sampling equipment and into the sample collection jar.

9.1.5 Pour off the collected water into appropriate containers for analysis.

## 9.2 NDMA Equipment Blank

9.2.1 Sampling the equipment blank and bottle blank for NDMA follows the same procedure as listed in 9.1 with a few additions.

9.2.2 The source for the reagent-grade water is the SJC MRQA Laboratory; the laboratory where the sample will be analyzed.

9.2.3 Sample containers (4 L amber jugs) must be thoroughly rinsed with the laboratory's reagent-grade water. Rinse the containers several times before filling for the equipment blank or bottle blank.

## 10. Method Performance

10.1 Not Applicable

## 11. References

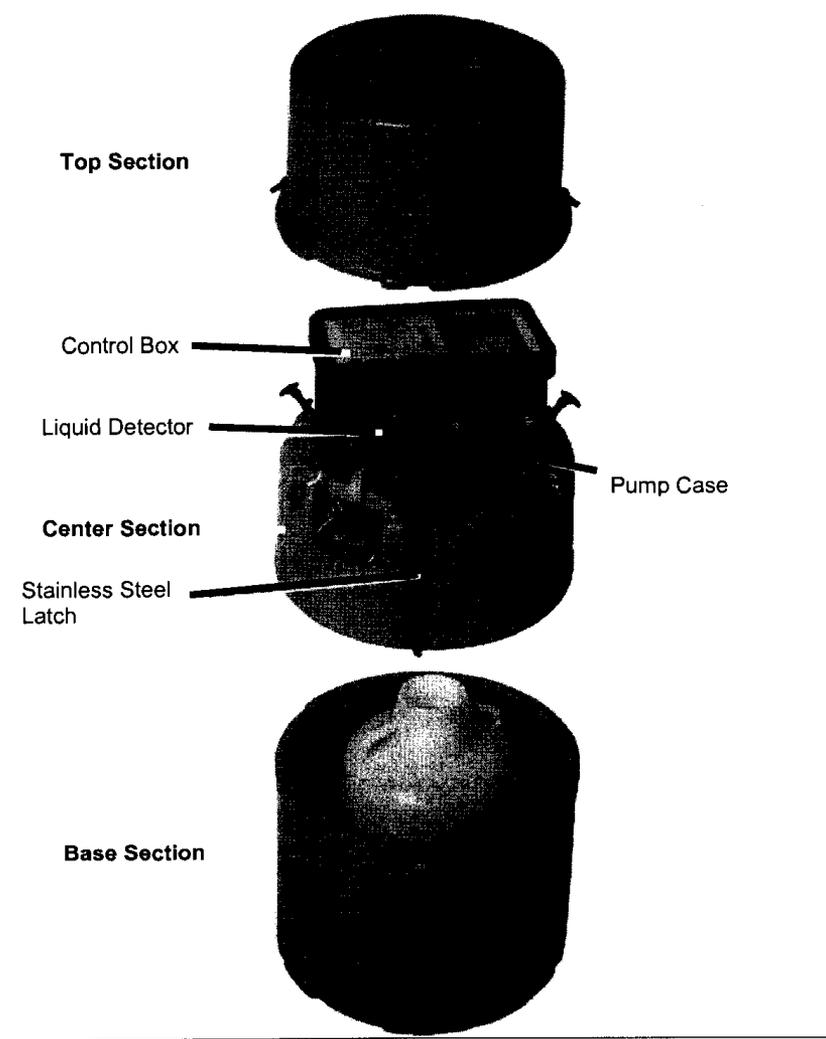
11.1 Instruction Manual 3710 Standard and Compact Sampler, Copyright 1996, Issued: July 12, 1996, Revision: D, January 1998.

11.2 Laboratory Section Procedures for the Characterization of Water and Wastewater, Fourth Edition, 1989, p. II-1 to II-14 – Sampling.

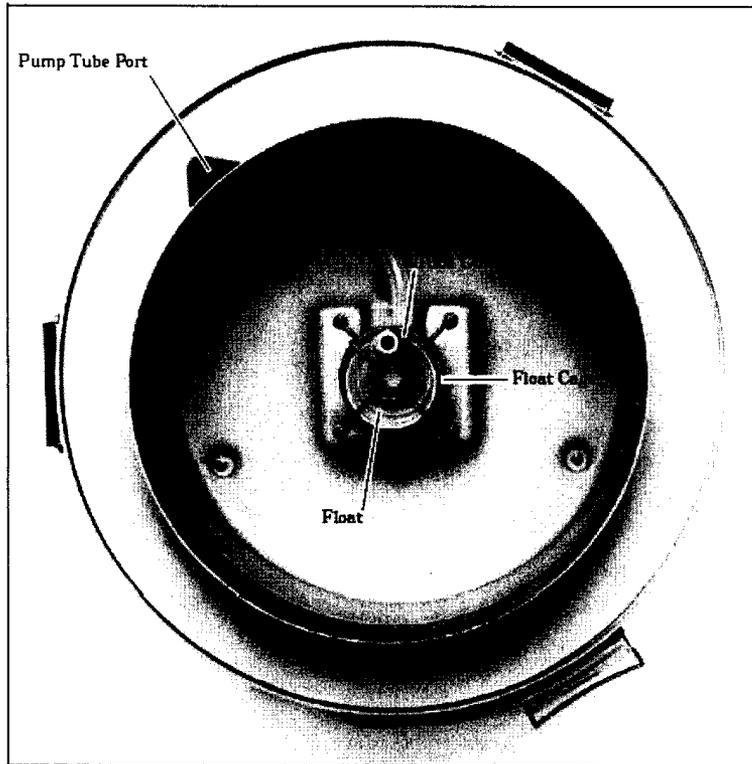
11.3 Sample Receiving Control – Field Sampling Protocol, Section 1.

**FIGURE 1**

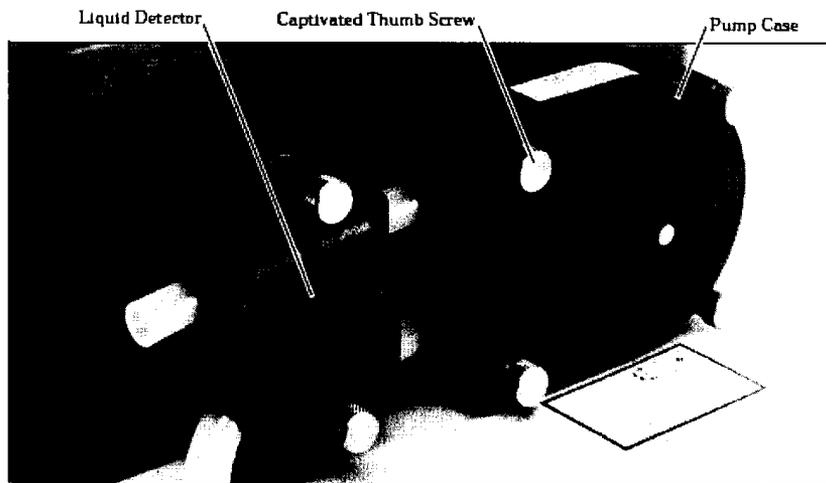
**3710 Standard and Compact Sampler**



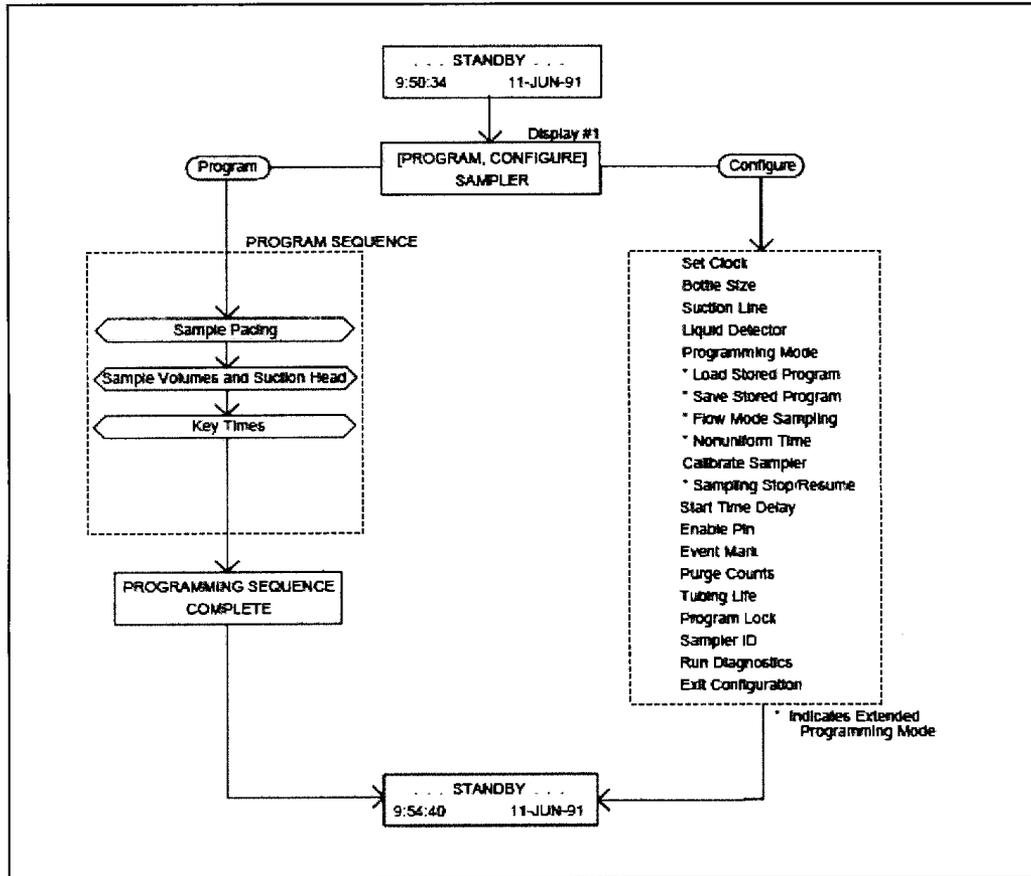
**FIGURE 2**



**FIGURE 3**



**FIGURE 4**



**TABLE 1**

<b>SECTION</b>	<b>CHOICES</b>	<b>SELECTION</b>
SAMPLER	PROGRAM, CONFIGURE	PROGRAM
PACED SAMPLING	TIME, FLOW	TIME
TIME INTERVALS	UNIFORM, NONUNIFORM	NONUNIFORM
MODIFY SEQUENCE	YES, NO	YES

**TABLE 2**

	FLOW	FLOW	FLOW	AVERAGE	2-HOUR AVE
TIME	11/13/07	11/14/07	11/15/07	FLOW	FLOW
1:00	5.30	5.40	5.80	5.50	
2:00	5.20	5.50	6.10	5.60	5.55
3:00	5.50	6.10	6.00	5.87	
4:00	6.00	6.10	6.10	6.07	5.97
5:00	5.80	6.40	6.70	6.30	
6:00	6.50	6.90	6.70	6.70	6.50
7:00	7.00	7.20	7.50	7.23	
8:00	6.90	7.50	7.70	7.37	7.30
9:00	6.90	7.50	7.70	7.37	
10:00	6.90	8.20	7.10	7.40	7.38
11:00	7.60	8.70	7.70	8.00	
12:00	7.60	7.00	8.00	7.53	7.77
13:00	7.80	7.90	8.10	7.93	
14:00	7.50	8.20	8.00	7.90	7.92
15:00	7.50	8.30	7.80	7.87	
16:00	7.20	8.30	8.00	7.83	7.85
17:00	7.30	7.90	8.00	7.73	
18:00	7.30	7.80	7.80	7.63	7.68
19:00	7.40	8.10	8.10	7.87	
20:00	7.50	7.80	7.60	7.63	7.75
21:00	7.30	5.70	6.60	6.53	
22:00	5.50	5.90	5.20	5.53	6.03
23:00	5.60	5.90	5.00	5.50	
0:00	5.50	6.50	4.60	5.53	5.52

**TABLE 3**  
**FLOW WEIGHTED COMPOSITE CALCULATIONS**

TIME	AVERAGE FLOW (MGD)	RATIO OF TOTAL FLOW	CUMULATIVE FLOW	SAMPLING TIMES	
2.00	5.55	0.0667	0.066693	2.4632	2.28
4.00	5.97	0.0717	0.138394	4.7325	4.44
6.00	6.50	0.0781	0.216503	6.7637	6.46
8.00	7.30	0.0877	0.304226	8.6486	8.39
10.00	7.38	0.0887	0.392950	10.515	10.31
12.00	7.77	0.0933	0.486281	12.288	12.17
14.00	7.92	0.0951	0.581414	14.034	14.02
16.00	7.85	0.0943	0.675746	15.815	15.49
18.00	7.68	0.0923	0.768075	16.246	16.15
20.00	7.75	0.0931	0.861206	19.394	19.24
22.00	6.03	0.0725	0.933707	21.539	21.32
24.00	5.52	0.0663	1	24	24.00
TOTAL FLOW =	83.22 MGD				

Example Flow Calculation (first 2hr time interval):

$$\frac{(2/24) * 2}{0.563} + 4 - \frac{2}{0.0563} * 0.135428 = 2.14 \text{ (sample collection time in decimal form)}$$

$$(2.14 - 2) * 0.6 + 2 = 2.09 \text{ (sample collection time)}$$

**Sanitation Districts of Los Angeles County  
Laboratories Section**

**METHOD APPROVAL FORM**

*Method Number*      Not Applicable

*Method Name*        Volatile Organic Compound Sampling

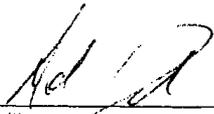
*Version*              09.1.0

*Method Date*        November 19, 2009

*Reasons for  
Method Revision*      First formal written procedure

*Written or revised by:*

Andre Dubois  
Laboratory Technician  
QA/Sample Receiving

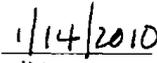
  
\_\_\_\_\_  
Signature

  
\_\_\_\_\_  
Date

*Approved by:*

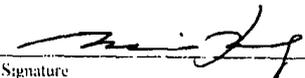
Lavern Tamoria  
Supervising Chemist  
QA/Sample Receiving

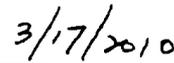
  
\_\_\_\_\_  
Signature

  
\_\_\_\_\_  
Date

*Final Approval:*

Maria Pang  
Assistant Manager of  
the Laboratories Section

  
\_\_\_\_\_  
Signature

  
\_\_\_\_\_  
Date

## VOLATILE ORGANIC COMPOUND SAMPLING

### INTRODUCTION

Volatile Organic Compounds (VOCs) are organic chemical compounds that have high enough vapor pressures under normal conditions to significantly vaporize and enter the atmosphere. The Sample Receiving Group frequently samples for these compounds at several well locations, and at all of the Los Angeles County Sanitation Districts water reclamation plants, for both raw influent and final effluent. This standard operating procedure (SOP) states the responsibilities and describes the process of sampling volatile organic compounds, including the selection of equipment and materials used in the sampling process.

1. Scope and Application
  - 1.1 Raw influent and final effluent are collected by this method as required by National Pollution Discharge Elimination System (NPDES) permits.
  - 1.2 A grab sample is collected to provide a snapshot of the current state of the reclamation plant's activity.
  - 1.3 A grab sample is collected to minimize loss of constituents through volatilization.
2. Summary
  - 2.1 Obtain a grab sample in a 1 L wide-mouth amber glass jar.
  - 2.2 If the sample is chlorinated, de-chlorinate the sample with sodium thiosulfate (see §7.2).
  - 2.3 Fill 3-6 septum vials (40 mL) with no headspace.
3. Sample Handling and Preservation
  - 3.1 Water Reclamation Plants (WRP) samples are collected using appropriate containers and preservation methods as directed in Standard Methods for the Examination of Water and Wastewater.
  - 3.2 After collection, and as soon as possible, place samples into an ice chest with ice to keep their temperature at 0-6°C during transport from the sample collection site to Sample Receiving Control (SRC). This will minimize volatilization of target analytes.

- 3.3 Once removed from the ice chest, the samples are placed into a refrigerator or walk-in cooler to maintain the cold temperature for storage.
4. Interferences
    - 4.1 Several common office products can easily contaminate septum vials with VOCs including; cleaning solvents, paints, adhesives, markers, solvents and some strong odors. Storage of the septum vials nearby these products should be avoided.
    - 4.2 Septum vials should not be stored near products that can potentially off-gas VOCs into the air (i.e. photocopy machines).
    - 4.3 Burning biomass (including cigarette smoke) can emit VOCs into the air, contaminating samples, or sample containers.
    - 4.4 The kit used by Sample Receiving personnel for field chlorine residual analysis has been linked to possible VOC contamination. This kit should not be used for storage of VOC vials at any time.
5. Apparatus
    - 5.1 1 L wide-mouth amber glass jar
    - 5.2 100 mL graduated cylinder
    - 5.3 250 mL Nalgene cup
    - 5.4 VOC vials. There are two types of vials typically used for VOC sampling including: 40 mL amber glass vials with a septum cap (Scientific Specialties Service, Inc. product number: 376840-VAC), and 40 mL clear glass vials with a septum cap, pre-preserved with Hydrochloric Acid(Scientific Specialties Service, Inc. product number: 376740-1/2HCL-V).
6. Reagents
    - 6.1 Acetate Buffer Solution, pH 4
    - 6.2 Potassium Iodide (KI)
    - 6.3 Soluble Starch Solution
    - 6.4 Deionized Water

- 6.5 1% Sodium Thiosulfate Solution. Dissolve 1 g of sodium thiosulfate in 1 L of deionized water, and pour an aliquot into a dropper bottle. This solution should be made on the day of sampling, and discarded at the end of the day.

## 7. Procedure

### 7.1 Collect the Grab Sample

- 7.1.1 Using white masking tape, securely attach the 1 L wide-mouth amber glass jar to the end of a grab pole, and collect the grab water sample by submerging the bottle 1 foot below the surface.
- 7.1.2 If the sample is chlorinated, de-chlorinate using §7.2 of this SOP.
- 7.1.3 Fill each septum vial with the sample. If the vial is pre-acidified, avoid any overflow of sample. To prevent volatilization of the compounds in the sample, minimize turbulence of the sample.
- 7.1.4 Pour a small amount of sample into the cap, and use the cap to top off the vial. The vial should be filled enough so that the surface tension holds the water in a “convex meniscus”, and then apply the cap. Some overflow is lost using this method, but air space in the vial is eliminated.
- 7.1.5 After capping, turn the vial over and gently tap it to check for gas bubbles. If gas bubbles can be seen in any vials, those vials should be re-opened in order to repeat the procedure, until all samples are free of gas bubbles.

### 7.2 De-chlorinate the Sample

- 7.2.1 Rinse both the 100 mL graduated cylinder and the 250 mL Nalgene cup three times with deionized water, and then three times with a small portion (about 20 mL) of sample from the 1 L wide-mouth amber glass jar .
- 7.2.2 Fill the graduated cylinder with 100mL of sample from the 1 L wide-mouth amber glass jar. Transfer the 100mL of sample into the 250 mL Nalgene cup.
- 7.2.3 Add approximately 0.5 – 1 g KI crystals to the sample. Avoid a gross excess of KI. Add approximately 4 mL of acetate buffer solution.
- 7.2.4 Swirl to mix.
- 7.2.5 Add 1 mL starch solution. If a blue color is apparent, the sample must be de-chlorinated using the following steps. If the solution is clear, continue to §7.1.3

- 7.2.6 Drop-wise, add the 1% Sodium Thiosulfate Solution to the sample. Swirl to mix after each drop. When the sample is completely clear again, record the number of drops used.
- 7.2.7 Use Section 8 (Calculations) to determine how many drops of 1% Sodium Thiosulfate Solution to use to de-chlorinate the sample left in the 1 L wide-mouth amber glass jar.
- 7.2.8 Replace the lid to the 1 L wide-mouth amber glass jar, and gently swirl to mix. Do not shake the sample, as it can cause the volatilization of target compounds.

## 8. Calculations

- 8.1 Determine the approximate volume remaining in the 1 L wide-mouth amber glass jar. This volume would typically be between 800 and 900 mL.
- 8.2 Divide this volume by 100 mL (the volume of sample that was de-chlorinated in §7.2.2).
- 8.3 Multiply the result by the number of drops recorded in §7.2.6. The result is the number of drops of Sodium Thiosulfate Solution to add to the remaining sample in the 1 L wide-mouth amber glass jar.

## 9. Quality Assurance Guidelines

- 9.1 Trip Blanks must be made for each VOC constituent being analyzed. If VOCs are to be collected using both the clear and amber septum vials, then trip blanks must be made using both clear and amber vials.
  - 9.1.1 Use water from the “double” deionized water system, located on the south wall of the Instrumentation Lab. Allow the water system to run for one full minute before filling the trip blank vials. Assure there is no headspace left in the vials, as in §7.1.5. If this water system cannot be accessed, or it is non-functional, use Arrowhead water from the tap in the Laboratories section break room.
- 9.2 The Trip Blanks must be kept alongside the sample vials until the sampling is complete, and samples have been delivered to SRC.

## 10. Method Performance

- 10.1 To verify the chlorine residual analysis method, sample collectors participate in quarterly quantitative chlorine residual analyses as part of the QA Check Sample program.

11. References

- 11.1 Standard Methods For The Examination Of Water And Wastewater, 21st Edition, 2005, pp. 6-1 to 6-3.
- 11.2 U.S. Environmental Protection Agency, 2004, 5.B. Sampling Procedures And Techniques, Office of Enforcement and Compliance Assurance, Washington, D.C.
- 11.3 U.S. Environmental Protection Agency, Methods For Organic Chemical Analysis Of Municipal And Industrial Wastewater, Method 624: Purgeables, 1996, Office of Science and Technology, Washington, D.C.

**Sanitation Districts of Los Angeles County  
Laboratories Section**

**METHOD APPROVAL FORM**

*Method Number*      1S3  
*Method Name*        Dissolved Oxygen Field Measurements  
*Version*                10.1.0  
*Method Date*         February 24, 2010  
*Reasons for  
Method Revision*      Annual review; no revisions were made

*Written by:*

Julie Randol  
Laboratory Technician I  
Lancaster Sample Receiving

  
Signature

02-24-10  
Date

*Approved by:*

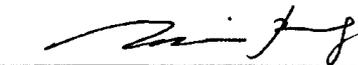
Lavern Tamoria  
Supervising Chemist  
QA/Sample Receiving

  
Signature

3/10/2010  
Date

*Final Approval:*

Maria Pang  
Assistant Manager of  
Laboratories

  
Signature

3/15/2010  
Date

## 1S3. OXYGEN, DISSOLVED - FIELD MEASUREMENT

### INTRODUCTION

The concentration of dissolved oxygen (DO) in a water source depends on the prevailing physical, chemical and biological activities. An electrometric method, using a dissolved oxygen meter, is based on the rate of diffusion of molecular oxygen across a membrane. As part of the "Receiving Water Limitations" in NPDES permits, the dissolved oxygen in receiving waters shall not be depressed below 5 mg/L as a result of the wastes discharged.

#### 1. Scope and Application

- 1.1 The membrane electrode provides an excellent method for DO analysis in polluted waters, highly colored waters, and strong waste effluents as well as drinking, surface, and saline waters.
- 1.2 This method is recommended for use under conditions that are unfavorable for use of the Winkler method, or when that test and its modifications are subject to serious errors caused by interferences.
- 1.3 The meter for the dissolved oxygen probe is calibrated in a convenient range (e.g., 0 to 5, 0 to 10, or 0 to 20 mg/L).

#### 2. Summary of Method

- 2.1 The dissolved oxygen probe functions on a polarographic principle, measuring the partial pressure of oxygen in a gas or dissolved in a liquid. The sensor consists of two electrodes, a silver anode and a gold cathode, in an electrolyte gel or solution. This system is separated from the sample by a gas permeable membrane. A polarizing voltage, supplied by the instrument, causes oxygen to diffuse across the membrane and be reduced at the gold cathode. This reduction causes a current to flow. This current is linearly proportional to the partial pressure of oxygen present. The current is amplified and monitored by the instrument. The instrument must be standardized regularly against known conditions.

#### 3. Sample Handling and Preservation

- 3.1 The probe may be used in the field in tanks, ponds, streams, etc. Where there is not rapid natural movement of the water, artificial agitation must be provided.

#### 4. Interferences

- 4.1 Plastic films used with the membrane electrode systems are permeable to a variety of gases other than oxygen, none of which is easily depolarized at the indicator electrode.
  - 4.2 Prolonged use of membrane electrode in water solutions containing gases such as H<sub>2</sub>S tends to lower the cell sensitivity. This is eliminated by frequent changing of the membrane and calibration of the membrane electrode.
  - 4.3 Dissolved oxygen probes are temperature-sensitive, and the manufacturer typically provides automatic temperature compensation.
  - 4.4 Organic materials may coat the membrane, reducing sensitivity. Clean with detergent or HCl as directed by the manufacturer.
5. Apparatus
    - 5.1 YSI 550 Handheld Dissolved Oxygen meter, or equivalent
    - 5.2 300 mL glass BOD bottle with air-tight glass stopper
6. Reagents
    - 6.1 Filling solutions, electrolytes, spare membranes; handle as directed in the manufacturer's manual.
    - 6.2 Deionized water
7. Procedure
    - 7.1 Use and Care of the Probe
      - 7.1.1 The probe is kept in the transport chamber attached to the back of the instrument between measurements. A small sponge is kept moistened inside the chamber to provide a water saturated air environment, which is ideal for air calibration.
      - 7.1.2 The probe is also stored in the transport chamber; the moist environment will prolong effective membrane performance and probe life.
      - 7.1.3 Maintain sponge moistness with tap water only.
    - 7.2 Dissolved Oxygen Meter Air Calibration

- 7.2.1 The DO meter must be calibrated before making DO measurements.
- 7.2.2 Turn the instrument on by pressing the **ON/OFF** key. Allow 15 minutes for warm-up.
- 7.2.3 Fill a BOD bottle to about half with fresh DI water. Remove the probe from the storage chamber and unscrew the probe guard.
- 7.2.4 Press the **MODE** key until mg/L appears on the right side of the screen prior to calibration.
- 7.2.5 Place the probe in the bottle. Let the temperature acclimate for a couple of minutes. Record current temperature value as it will disappear once in calibration mode.
- 7.2.6 Enter the calibration menu by pressing and releasing both the **UP ARROW** and **DOWN ARROW** keys at the same time.
- 7.2.7 The meter should now display CAL on the lower left of the screen as well as the current DO reading.
- 7.2.8 Obtain the solubility of oxygen in mg/L by using a corresponding temperature displayed by the meter. Review the temperature you recorded and use it with the solubility chart (see Figure 1). Use this value as your adjusted calibration value. Record both the value you started with and the calibrated value you adjusted to in the calibration log.
- 7.2.9 Using the **UP ARROW** and **DOWN ARROW** keys, adjust the DO reading to the value found in the chart and press **ENTER**. The meter will now prompt you for a salinity value of the water that will be analyzed. Enter "0" and press the **ENTER** key.
- 7.2.10 The meter should now return to normal operation and is ready for use in the field. Screw the probe guard back on and place the probe back into the storage chamber for transport to the field.

### 7.3 DO Measurement of Aqueous Samples

- 7.3.1 Immerse the probe into a flowing water source assuring that it is kept below the surface. Keep all sediment and algae away from the tip of the probe.
- 7.3.2 Measure the DO of the sample. Record the value after the DO stabilizes.

7.3.3 If the value is out of acceptable range (exceedence is  $< 5$  mg/L), check the DO of upstream receiving water station or outfall of the upstream water reclamation plant, whichever is closer. Record the upstream values to report with the exceedence. DO exceedences are reported by email to the appropriate laboratory and monitoring staff within a day or two of their discovery.

7.3.4 Rinse probe with deionized water after measurement and return to the transport chamber.

## 8. Calculations

8.1 Not Applicable

## 9. Quality Assurance Guidelines

9.1 Duplicate every tenth sample.

9.2 It is imperative that the DO meter be calibrated prior to use.

9.3 Rinse the probe with deionized water between measurements in the field.

9.4 Note correction value for temperature. Adjust value if applicable.

9.5 Check calibrated DO meter at least every 4th calibration by comparison with BOD dilution water obtained from the Treatment Plant laboratory. The Treatment Plant Laboratory determines the DO of the BOD dilution water by the Winkler method. Note the difference in the calibration log.

## 10. Method Performance

10.1 The thermometer of the meter is calibrated once a year by the QA group at SJCWQL by comparison to an NIST certified thermometer in a water bath.

## 11. References

11.1 Sanitation Districts of Los Angeles County, Laboratory Section: Procedures for the Characterization of Water and Wastes, 4th Edition, 1989, James D. Lehner, "Method 115B, Dissolved Oxygen".

11.2 YSI Incorporated Dissolved Oxygen Meter Model 550 Manual, September 2000.

**Figure 1. Solubility of Oxygen in mg/L in Water Exposed to Water-Saturated Air at 760 mm Hg Pressure**

Temp°C	Chlorinity: 0 Salinity: 0	5.0 ppt 9.0 ppt	10.0 ppt 18.1 ppt	15.0 ppt 27.1 ppt	20.0 ppt 36.1 ppt	25.0 ppt 45.2 ppt
0.0	14.62	13.73	12.89	12.10	11.36	10.66
1.0	14.22	13.36	12.550	11.78	11.07	10.39
2.0	13.83	13.00	12.22	11.48	10.79	10.14
3.0	13.46	12.66	11.91	11.20	10.53	9.90
4.0	13.11	12.34	11.61	10.92	10.27	9.66
5.0	12.77	12.02	11.32	10.66	10.03	9.44
6.0	12.45	11.73	11.05	10.40	9.80	9.23
7.0	12.14	11.44	10.78	10.16	9.58	9.02
8.0	11.84	11.17	10.53	9.93	9.36	8.83
9.0	11.56	10.91	10.29	9.71	9.16	8.64
10.0	11.29	10.66	10.06	9.49	8.96	8.45
11.0	11.03	10.42	9.84	9.29	8.77	8.28
12.0	10.78	10.18	9.62	9.09	8.59	8.11
13.0	10.54	9.96	9.42	8.90	8.41	7.95
14.0	10.31	9.75	9.22	8.72	8.24	7.79
15.0	10.08	9.54	9.03	8.54	8.08	7.64
16.0	9.87	9.34	8.84	8.37	7.92	7.50
17.0	9.67	9.15	8.67	8.21	7.77	7.36
18.0	9.47	8.97	8.50	8.05	7.62	7.22
19.0	9.28	8.79	8.33	7.90	7.48	7.09

Temp °C	Chlorinity: 0 Salinity: 0	5.0 ppt 9.0 ppt	10.0 ppt 18.1 ppt	15.0 ppt 27.1 ppt	20.0 ppt 36.1 ppt	25.0 ppt 45.2 ppt
20.0	9.09	8.62	8.17	7.75	7.35	6.96
21.0	8.92	8.46	8.02	7.61	7.21	6.84
22.0	8.74	8.30	7.87	7.47	7.09	6.72
23.0	8.58	8.14	7.73	7.34	6.96	6.61
24.0	8.42	7.99	7.59	7.21	6.84	6.50
25.0	8.26	7.85	7.46	7.08	6.72	6.39
26.0	8.11	7.71	7.33	6.96	6.62	6.28
27.0	7.97	7.58	7.20	6.85	6.51	6.18
28.0	7.83	7.44	7.08	6.73	6.40	6.09
29.0	7.69	7.32	6.96	6.62	6.30	5.99
30.0	7.56	7.19	6.85	6.51	6.20	5.90
31.0	7.43	7.07	6.73	6.41	6.10	5.81
32.0	7.31	6.96	6.62	6.31	6.01	5.72
33.0	7.18	6.84	6.52	6.21	5.91	5.63
34.0	7.07	6.73	6.42	6.11	5.82	5.550
35.0	6.95	6.62	6.31	6.02	5.73	5.46
36.0	6.84	3.52	6.22	5.93	5.65	5.38
37.0	6.73	6.42	6.12	5.84	5.56	5.31
38.0	6.62	6.32	6.03	5.75	5.48	5.23
39.0	6.52	6.22	5.98	5.66	5.40	5.15
40.0	6.41	6.12	5.84	5.58	5.32	5.08
41.0	6.31	6.03	5.75	5.49	5.24	5.01
42.0	6.21	5.93	5.67	5.41	5.17	4.93
43.0	6.12	5.84	5.58	5.33	5.09	4.86
44.0	6.02	5.75	5.50	5.25	5.02	4.79
45.0	5.93	5.67	5.41	5.17	4.94	4.72

**Sanitation Districts of Los Angeles County  
Laboratories Section**

**METHOD APPROVAL FORM**

*Method Number*        1S1  
*Method Name*         Field pH Measurements  
*Version*                10.1.0  
*Method Date*         February 24, 2010  
*Reasons for  
Method Revision*        Amended to include Extech ExStik EC500 meter

*Written by:*

Julie Randol  
Laboratory Technician I  
Lancaster Sample Receiving

  
Signature

02-24-10  
Date

*Approved by:*

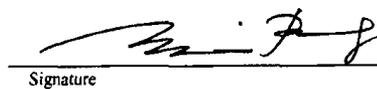
Lavern Tamoria  
Supervising Chemist  
QA/Sample Receiving

  
Signature

3/10/2010  
Date

*Final Approval:*

Maria Pang  
Assistant Manager of  
Laboratories

  
Signature

3/15/2010  
Date

## 1S1. pH (HYDROGEN ION CONCENTRATION) - FIELD

### INTRODUCTION

Measurement of pH is one of the most important and frequently used tests in water chemistry. At a given temperature the intensity of the acidic or basic character of a solution is indicated by pH or hydrogen ion activity. pH as defined by Sorenson as  $-\log (H^+)$ ; it is the intensity factor of acidity.

The pH value of a highly dilute solution is approximately the same as the negative common logarithm of the hydrogen ion concentration. Natural waters usually have pH values in the range of 4 to 9, and most are slightly basic because of the bicarbonates and carbonates of the alkali and alkaline earth metals. As part of the "Receiving Water Limitations" in the Joint Outfall System NPDES permits, the pH of inland surface waters shall not be depressed below 6.5 or raised above 8.5 as a result of the wastes discharged. For the Antelope Valley, the WDR limitations are 6.0 and 9.0 pH units as set forth by the Lahontan RWQCB.

#### 1. Scope and Application

- 1.1 This procedure is applicable to all waters and wastewaters.

#### 2. Summary of Procedure

- 2.1 The pH meter is standardized with the appropriate buffer solutions taking into account the solution temperature.
- 2.2 For receiving water stations, the pH is measured by immersing the electrode directly in the stream with flow continuously running over the probe.
- 2.3 For groundwater locations, the pH is measured using electrodes enclosed in a flow-through cell. The probe has a stirring apparatus attached to provide continuous mixing of the water sample.

#### 3. Sample Handling and Preservation

- 3.1 No sample is collected; this procedure is specific to field measurements.

#### 4. Interferences

- 4.1 High sodium concentrations at a high pH will cause an error. This sodium error can be reduced by either using “low sodium error electrodes” or by making approximate corrections in accordance with information supplied by the manufacturer.
  - 4.2 Temperature affects pH in two ways. First, the pH potential, i.e., the change in potential per pH unit, varies with temperature. Second, the ionization in the sample varies with temperature.
5. Apparatus
    - 5.1 YSI 60 handheld pH meter, VWR Model SP20 portable pH meter, QED MicroPurge Basics Flow Cell MP20, Extech ExStik EC500, or equivalent
    - 5.2 3-100 mL plastic graduated cylinders
    - 5.3 Rinse container (for waste water used in calibration)
6. Reagents
    - 6.1 Buffer solutions. Buffer solutions of various concentrations are prepared as indicated from commercially obtained reagents.
    - 6.2 Deionized water
7. Procedure
    - 7.1 Use and Care of the Electrode
      - 7.1.1 For short term storage between measurements in the field (up to one week)
        - 7.1.1.1 YSI. Place the probe in the transport chamber in the side of the instrument case. Make sure that the sponge inside the chamber is wet (tap water).
        - 7.1.1.2 VWR. This probe does not require any special storage procedures. After being cleaned and dried, place the storage cap over the end of the probe to prevent any possible damage during storage or transport.
        - 7.1.1.3 QED. Place approximately 1 cm of tap (**not distilled or deionized**) water in the transport storage container and insert probe.

- 7.1.1.4 ExTech: Place the probe in the wetting cap, ensuring that the sponge is moistened with pH 4 buffer solution.
- 7.1.2 For long term storage (over one week)
  - 7.1.2.1 YSI: Place the probe in the storage bottle containing a mixture of 50 % pH 4 buffer and 50 % 1.5 M KCl. This will assure the fastest possible pH response. If this mixture is not available, storage in tap water is the next best choice. **Do NOT store the probe dry or in distilled or deionized water.**
  - 7.1.2.2 VWR, QED, and Extech: Use the same procedures as for short-term storage.
- 7.1.3 The electrode should never be used in organic solvents.
- 7.1.4 The electrode should be rinsed and blotted dry with a Kimwipe. Do not wipe the surface, as it will damage the membrane (in the case of the YSI model). Do not use paper towels.
- 7.1.5 Cleaning and Maintenance
  - 7.1.5.1 All meters and connectors should be wiped down after use to prevent any possible contamination and as part of maintaining a clean work environment.
  - 7.1.5.2 The pH probes should be cleaned both prior to and after sampling, and may occasionally require other maintenance.
  - 7.1.5.3 The glass bulbs may become coated with oil or other substances as a result of the samples being analyzed. If this occurs, remove the bulb cover (if present) and use a cotton swab and rubbing alcohol to carefully clean the probe of all residues. Should the above procedure prove insufficient to clean the sensor, use a cotton swab and 1 M HCl to gently clean the glass bulb.
  - 7.1.5.4 The probe can also be soaked in a 1:1 dilution of chlorine bleach for up to an hour to remove any possible contaminants. **(NOTE: the probe should in turn be rinsed and soaked in deionized water for an additional hour to remove any remaining bleach.)**
  - 7.1.5.5 Rinse and swab the probe with deionized water and replace the cover (if applicable).

7.1.5.6 Make sure that all probes are properly rinsed with deionized water and recalibrated prior to use.

## 7.2 Calibration of the pH Meter

### 7.2.1 YSI 60 Handheld pH meter

- 7.2.1.1 The pH meter must be calibrated before making pH measurements.
- 7.2.1.2 Turn the instrument on by pressing the **ON/OFF** key.
- 7.2.1.3 Remove the probe from the transport chamber and rinse with deionized water.
- 7.2.1.4 Place 25 to 30 mL of pH 7 buffer into a clean 100 mL graduated cylinder. **CAUTION:** Skin irritant; use safety goggles, gloves and lab coat for protection.
- 7.2.1.5 Immerse the probe into the cylinder being sure to immerse both the pH and temperature sensors.
- 7.2.1.6 Allow the probe to acclimate the pH 7 buffer before calibrating; this should take about 5 to 10 minutes.
- 7.2.1.7 Set the meter to calibrate by pressing and releasing the **UP ARROW** and **DOWN ARROW** keys at the same time. You should see **CAL** and **STAND** appear at the bottom of your screen if you are in calibration mode. **STAND** will be flashing, and the display should show a pH value of 7.
- 7.2.1.8 Press the **ENTER** key. **STAND** will stop flashing and the pH calibration value will be shown with middle decimal point flashing. When the reading is stable, the decimal point will stop flashing. Press and hold the **ENTER** key to save the calibration point. **SAVE** and **OFS** will flash on the display screen to indicate the value has been saved.
- 7.2.1.9 **SLOPE** will appear flashing. This indicates the meter is ready to be calibrated with a second point.
- 7.2.1.10 Rinse the probe with DI water and place into a clean 100 mL graduated cylinder with either pH 4 or pH 10 buffer solutions. If the pH is 4, a decimal point will flash to the left of the middle point and if it is pH 10, the decimal will flash to the right of the middle point.

- 7.2.1.11 Press the **ENTER** key. When the reading is stable the decimal point will stop flashing. Press and hold the **ENTER** key to save the first SLOPE. SAVE and SLP will flash on the screen to indicate the SLOPE has been saved. SLOPE will again flash on the screen to indicate the meter is ready for the third pH buffer.
  - 7.2.1.12 Rinse and place the probe into the third clean 100 mL graduated cylinder with the pH buffer not yet chosen, either the pH 4 or pH 10. Press **ENTER**. Once again, depending on the value of the third pH buffer the decimal point will flash to the right or the left of the middle point. When the decimal stops flashing, press and hold the **ENTER** key to save the second slope value. Again the meter will flash SAVE and SLP to indicate the second slope has been saved.
  - 7.2.1.13 The meter is now calibrated at three points and will now return to normal operation.
  - 7.2.1.14 Rinse the probe and take a reading of pH 7 buffer solution from a 2nd lot and let acclimate for a few minutes. The reading should be within  $\pm 0.2$  pH units from 7.0.
  - 7.2.1.15 Document the calibration, recording the calibrated values at each point in the calibration log.
- 7.2.2 VWR Model SP20 portable pH meter
- 7.2.2.1 The pH meter must be calibrated before making pH measurements.
  - 7.2.2.2 Attach the electrode and ATC probes to meter
  - 7.2.2.3 Press the power button to turn on the meter.
  - 7.2.2.4 Rinse the probe with deionized (DI) water and then with pH 7.00 buffer solution.
  - 7.2.2.5 Place 25 to 30 mL of pH 7 buffer into a clean 100 mL graduated cylinder. **CAUTION:** Skin irritant; use safety goggles, gloves and lab coat for protection.
  - 7.2.2.6 Immerse the probe into the cylinder being sure to immerse both the pH and temperature sensors.

- 7.2.2.7 Allow the probe to acclimate the pH 7 buffer before calibrating; this should take about 5 to 10 minutes.
  - 7.2.2.8 Set the meter to calibrate by pressing and releasing the **CAL** key. It will indicate that the probe is calibrating by displaying a slope graphic in the lower field of the screen.
  - 7.2.2.9 P1 will be displayed in the temperature area as the first calibration measurement is being made.
  - 7.2.2.10 When the **READY** light appears, press **OK**; this will accept the initial pH value.
  - 7.2.2.11 When **P2** is displayed and flashing, the probe is ready to be calibrated with the second buffer.
  - 7.2.2.12 Rinse the probe with DI water and place into a clean 100 mL graduated cylinder with either pH 4 or pH 10 buffer solutions.
  - 7.2.2.13 The second calibration will begin as soon as the probe is immersed in the new solution. When the reading is stable the **READY** light will appear. Press the **OK** key to save the second calibration buffer data. The meter is ready for the third pH buffer.
  - 7.2.2.14 Rinse and place the probe into the third clean 100 mL graduated cylinder with the pH buffer not yet chosen, either the pH 4 or pH 10. The third calibration will begin, and the **READY** light will appear when the reading is stable. Save the third calibration data by pressing the **OK** button to accept. The main field will display the slope obtained by the three-point calibration.
  - 7.2.2.15 The meter is now calibrated at three points and will now return to normal operation.
  - 7.2.2.16 Rinse the probe and take a reading of pH 7 buffer solution from a 2<sup>nd</sup> lot and let acclimate for a few minutes. The reading should be within  $\pm 0.2$  pH units from 7.0.
  - 7.2.2.17 Document the calibration, recording the calibrated values at each point in the calibration log.
- 7.2.3 QED MicroPurge Basics Flow Cell MP20
- 7.2.3.1 The pH meter must be calibrated before making pH measurements.

- 7.2.3.2 Turn on the meter and allow to boot up. When the meter is prepared to receive data, all applicable measuring criteria will be displayed.
- 7.2.3.3 Set the circulator to **OFF** if necessary by pressing the **ESC/Circulator** key. This will prevent any calibration standards used from being splashed.
- 7.2.3.4 Set the screen page to **CALIB**, and then scroll down using the arrow keys to **pH**, which is the value to be calibrated. The **7.00 Indicator Light** will flash in the corner of the display screen to show that this is the parameter being calibrated.
- 7.2.3.5 Attach the calibration cup; rinse the probe with deionized (DI) water and then with pH 7.00 buffer solution.
- 7.2.3.6 Fill the calibration cup to within 1cm of the top with pH 7.00 buffer solution. The pH probe should be fully immersed.  
**CAUTION:** Skin irritant; use safety goggles, gloves and lab coat for protection.
- 7.2.3.7 Press and release the **ARROW** (Enter) key to calibrate for the initial buffer solution.
- 7.2.3.8 The main display will show the value of the first buffer solution. Use the **UP** and/or **DOWN** arrows to change the display until the true value of the calibration solution is shown.
- 7.2.3.9 Press and release the **ARROW** key; this will accept the initial pH value. If the value is accepted for calibration, the display will return to the **CALIB** screen. Should the value not fall within the sensors parameters, the screen will read **FAIL** before returning to the **CALIB** screen.
- 7.2.3.10 Should such failure occur, replace the buffer solution and recalibrate. The probe may also require cleaning. If this is the case proceed with the proper procedures as listed in section 7.1.3.
- 7.2.3.11 When the initial calibration value has been accepted, the probe is ready to be calibrated with the second buffer. Press **ESC** to move to the second value for calibration.
- 7.2.3.12 Rinse the probe with DI water and fill the calibration cup with either pH 4 or pH 10 buffer solutions.

- 7.2.3.13 Press and release the **ARROW** key to begin calibrating for the second buffer. Use the **UP** and/or **DOWN** arrows until the display shows the true numeric value of the buffer solution. Press the **ARROW** key to accept the second calibration buffer data. The meter is ready for the third pH buffer.
- 7.2.3.14 Rinse the probe again, and fill the calibration cup with the pH buffer not yet chosen, either the pH 4 or pH 10. Use the **ARROW** key and **UP** and/or **DOWN** arrows to set the numeric value of the buffer solution. Save the third calibration data by pressing the **ARROW** button to accept. Use the **ESC** key to return to the main display page.
- 7.2.3.15 The meter is now calibrated at three points and ready to return to normal operation.
- 7.2.3.16 Rinse the probe and take a reading of pH 7 buffer solution from a 2<sup>nd</sup> lot and let acclimate for a few minutes. The reading should be within  $\pm 0.2$  pH units from 7.0.
- 7.2.3.17 Document the calibration, recording the calibrated values at each point in the calibration log.

#### 7.2.4 Extech

- 7.2.4.1 The pH meter must be calibrated before making pH measurements.
- 7.2.4.2 Turn the instrument on by pressing the **ON/OFF** key.
- 7.2.4.3 Remove the probe from the transport chamber and rinse with deionized water.
- 7.2.4.4 Place approximately 4 mL of pH 7 buffer into the corresponding calibration tube. Insert the probe into the tube, ensuring that enough buffer is present to contact the tip of the electrode.  
**CAUTION:** Skin irritant; use safety goggles, gloves and lab coat for protection.
- 7.2.4.5 Allow the probe to acclimate the pH 7 buffer before calibrating; this should take about 5 to 10 minutes.
- 7.2.4.6 Set the meter to calibrate by pressing and holding the **CAL/RECALL** key. It will indicate that the probe is calibrating by displaying “CAL” in the lower field of the screen.

- 7.2.4.7 The pH reading will flash as the first calibration measurement is being made.
  - 7.2.4.8 The meter automatically recognizes the solution, and calibrates to the corresponding value, as indicated by the circled letter on the LCD screen. These are indicated as **L** (4), **M** (7), and **H** (10).
  - 7.2.4.9 The meter will display **SA**, then **END** when calibration is complete. It will then return to normal operation mode.
  - 7.2.4.10 The unit is ready for the second calibration. Remove the probe from the solution, rinse with DI water, and fill the calibration cup with the second buffer solution, either pH 4 or 10.
  - 7.2.4.11 Press and hold **CAL/RECALL** until “CAL” is displayed. The unit will now calibrate to the second buffer, again displaying the value (L, M, H) circled on the screen.
  - 7.2.4.12 Calibration has been achieved when the unit displays **SA**, then **END**, and returns to normal operation mode.
  - 7.2.4.13 Prepare the probe for the third calibration. Remove the probe from the solution, rinse with DI water, and fill the calibration cup with the third buffer solution, either pH 4 or 10 (whichever was not yet used).
  - 7.2.4.14 Press and hold **CAL/RECALL** until “CAL” is displayed. The unit will now calibrate to the third buffer, again displaying the value (L, M, H) circled on the screen.
  - 7.2.4.15 When the unit displays **SA**, then **END**, the third calibration has been completed, and the probe is ready for analysis. Remove from solution and rinse with DI water.
  - 7.2.4.16 Rinse the probe and take a reading of pH 7 buffer solution from a 2<sup>nd</sup> lot and let acclimate for a few minutes. The reading should be within  $\pm 0.2$  pH units from 7.0.
  - 7.2.4.17 Document the calibration, recording the calibrated values at each point in the calibration log.
- 7.2.5 Troubleshooting Procedures
- 7.2.5.1 pH Out of Range

- 7.2.5.1.1 Ensure that the probe is properly submerged in the solution to be measured, and that the electrodes are firmly connected to the meter.
- 7.2.5.1.2 Recalibrate using fresh buffer solutions. Make sure to check that the correct buffers are being used, and that they are not past their expiration dates.
- 7.2.5.1.3 Sample may indeed be out of range.
- 7.2.5.2 pH Auto-Calibration Errors. This can occur when the user is attempting to accept values that are outside the range or when calibrating buffers out of sequence.
- 7.2.5.3 Verify buffers being used, and recalibrate using fresh buffer samples.
- 7.2.5.4 Clean electrodes if necessary.
- 7.2.6 Calibration Standard Errors. Same pH values are recorded for two different buffers.
  - 7.2.6.1 Check that different buffers are in fact being used, and that the correct buffer is being measured.
  - 7.2.6.2 Recalibrate using fresh buffer solutions.
- 7.2.7 Bad Slope. pH slope is not inside the accepted value of 80-120%.
  - 7.2.7.1 Recalibrate using fresh buffers.
  - 7.2.7.2 Clean electrodes if necessary.
- 7.2.8 No Display
  - 7.2.8.1 Press the power button to ensure that the meter did not utilize its auto shut-off function.
  - 7.2.8.2 Check that batteries are properly aligned, and replace if necessary.

### 7.3 pH Measurement

#### 7.3.1 Receiving Water Stations

- 7.3.1.1 Immerse the probe upstream of your position into the flow making sure to keep both temperature and pH sensors under the surface. Keep all sediment and algae away from the tip of the probe.
- 7.3.1.2 Let sit for a few minutes until pH stabilizes. Record value.
- 7.3.1.3 If value is out of acceptable range (6.5 – 8.5), check pH of upstream receiving water station or outfall of upstream water reclamation plant, whichever is closer. Record the upstream values to report with the exceedence to monitoring. pH exceedences are reported by e-mail to appropriate laboratory and monitoring staff within a day or two of their discovery.
- 7.3.1.4 Rinse probe with deionized water after measurement and return to transport chamber.

7.3.2 Groundwater Monitoring

- 7.3.2.1 Replace the storage cap with the flow-through cell, and attach the unit to the groundwater well using the enclosed tubing and corresponding connectors.
- 7.3.2.2 Press and release the **ESC** key while on the main screen to turn on the circulator (if necessary).
- 7.3.2.3 Use the **LEFT/RIGHT ARROW** keys to toggle the unit to **STORE** mode and select **ENTER** using the main arrow key.
- 7.3.2.4 The flow cell will now record field measurements at three0minute intervals until all corresponding parameters have stabilized. Field pH will show as stable when it maintains a range of  $\pm 0.2$  units.
- 7.3.2.5 The meter will beep and flash a slope icon when the sample is stable and ready for collection. Note the pH and other applicable data on the appropriate field sheet.

8. Calculations

- 8.1 Not applicable

9. Quality Assurance Guidelines

- 9.1 Duplicate every tenth sample or fraction thereof.
- 9.2 It is imperative that the pH meter be calibrated prior to use.
- 9.3 Rinse the probe with deionized water between changes of calibration buffer solutions and measurements in the field.
- 9.4 To test for drift during the day, rinse the probe and place in pH 7 buffer solution. Record the reading and repeat this step after returning back to SRC from the field using a different pH 7 standard. The reading should be  $\pm 0.2$  pH units.
- 9.5 Note correction factor for temperature. Adjust value if applicable.

#### 10. Method Performance

- 10.1 The thermometer of the meter is calibrated once a year by the QA group at SJCWQL by comparison to a NIST certified thermometer in a water bath.

#### 11. References

- 11.1 Laboratory Section: Procedures for the Characterization of Water and Wastes, 4th Edition, 1989, James D. Lehner, pp. 101-1 through 101-3.
- 11.2 YSI Incorporated Model 60 Manual, July 2001, pp. 6-16.
- 11.3 VWR Portable pH/ISE Meters Instruction Manual, April 2001, pp. 12, 24-25.
- 11.4 QED Flow Cell User's Guide, March 2004, pp. 9-11, 19-20.
- 11.5 Extech ExStik EC500 User's Guide, March 2008, pp. 8-9.

**Sanitation Districts of Los Angeles County  
Laboratories Section**

**METHOD APPROVAL FORM**

*Method Number*      302 (field measurement)  
*Method Name*        Chlorine Residual Field Measurement  
*Version*              10.1.0  
*Method Date*        February 09, 2010  
*Reasons for  
Method Revision*      Annual review; no modifications were made

*Reviewed by:*

Jessica Pacheco  
Laboratory Technician II  
QA/Sample Receiving

  
Signature

2/10/10  
Date

*Approved by:*

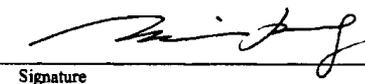
Lavern Tamoria  
Supervising Chemist  
QA/Sample Receiving

  
Signature

3/10/2010  
Date

*Final Approval:*

Maria Pang  
Assistant Manager of  
the Laboratories

  
Signature

3/15/2010  
Date

## 302. FIELD CHLORINE RESIDUAL QUALITATIVE ANALYSIS

### INTRODUCTION

Chlorination is one way to disinfect or kill microorganisms during the final stages of wastewater treatment. The amount of the chlorine that can be discharged out of a treatment plant after the dechlorination stage must be less than 0.05 mg/L. High levels of chlorine are toxic to fish and other organisms. The field chlorine residual qualitative analysis is used to determine the presence or absence of chlorine in a sample. When chlorine levels exceed 0.05 mg/L a blue coloration will form and further quantitative measurements are necessary. The sample will be taken to one of the local treatment plant laboratories for quantitative analysis. Field chlorine residual is an NPDES permit requirement for the Saugus and Valencia Water Reclamation Plants operated by the Sanitation Districts of Los Angeles County, applicable to receiving water stations RA, RB, RC, RD, and RE.

1. Scope and Application
  - 1.1 The field chlorine Residual qualitative analysis detects the presence or absence of chlorine.
  - 1.2 The field chlorine residual qualitative analysis is conducted along receiving water sites covered in the NPDES permits for Saugus and Valencia Water Reclamation Plants.
2. Summary of Method
  - 2.1 Obtain sample and add KI, acetate buffer solution, and soluble starch solution. Swirl to mix.
  - 2.2 If the mixture appears clear, the level of chlorine present in the sample is less than 0.05 mg/L. If the mixture forms a blue color, the level of chlorine is greater than 0.05 mg/L.
3. Sample Handling and Preservation
  - 3.1 This procedure is performed in the field.
  - 3.2 The sample is observed for blue color immediately and discarded as prolonged exposure to sunlight may generate a false positive.
  - 3.3 When a sample exceeds 0.05mg/L, a sample is collected in a 1 liter Nalgene bottle with no headspace, and taken to a local treatment plant laboratory for a

quantitative chlorine residual analysis. The sample should be analyzed immediately after collection and should not be stored or exposed to excessive light or agitation during transit.

4. Interferences

- 4.1 Manganese, iron, and nitrite interfere, but buffering to pH 4 before the addition of KI may minimize their effect.
- 4.2 An unusually high concentration of organic matter may cause some uncertainty in the endpoint. This uncertainty can be reduced by lowering the pH to 1.0 in the absence of manganese, iron, and nitrate.

5. Apparatus

- 5.1 250 mL Nalgene Cup

6. Reagents

- 6.1 Acetate Buffer Solution, pH 4
- 6.2 Potassium Iodide (KI)
- 6.3 Soluble Starch Solution
- 6.4 Deionized Water

7. Procedure

- 7.1 Rinse the 250 mL Nalgene cup three times with deionized water and then rinse three times with sample.
- 7.2 Collect 200 mL of sample in a 250 mL Nalgene cup.
- 7.3 Add approximately 0.5 – 1 g KI crystals to the sample. Avoid a gross excess of KI. Add approximately 4 mL of acetate buffer solution.
- 7.4 Swirl to mix.
- 7.5 Add 1 mL starch solution. If a blue color is apparent, a quantitative chlorine residual determination must be determined. If the solution is clear, record the chlorine residual as < 0.05 mg/L and disregard the rest of this procedure.

- 7.6 Upon completion of the qualitative measurement, collect waste in a 1 liter plastic Nalgene bottle for proper disposal in the laboratory. Rinse the 250 mL plastic cup three times with deionized water.
  - 7.7 If chlorine is detected in the qualitative test, a sample is collected in a 1 liter Nalgene bottle with no headspace, and taken to a local treatment plant laboratory for a quantitative chlorine residual analysis. The sample must be analyzed as soon as possible after collection.
  - 7.8 Notify Operations if chlorine is detected from the quantitative analysis, so treatment plant personnel are aware. Also, notify a supervisor or a chemist in the Sample Receiving Section to allow the result to be reported immediately to the Water Quality Control Board. An email notification of exceedence is sent to the applicable operations, monitoring and laboratory staff as soon as possible.
8. Calculations
    - 8.1 Not applicable.
9. Quality Assurance Guidelines
    - 9.1 All reagents must be replaced when the expiration date is exceeded.
    - 9.2 Keep all reagents out of sunlight and tightly sealed when not in use.
    - 9.3 Potassium iodide has a white color; a purple color indicates that it must be discarded and fresh used.
    - 9.4 The soluble starch solution is prepared by the San Jose Creek West APL.
10. Method Performance
    - 10.1 To verify the chlorine residual analysis method, quarterly quantitative chlorine residual analyses are performed as part of the QA Check Sample program.
11. References
    - 11.1 Laboratory Section: Procedures for the Characterization of Water and Wastes, 4th Edition, 1989, James Lehner, Method.302A.
    - 11.2 Sample Receiving Control - Field Sampling Protocol, Section 1.2.4, pp. 20-22.

# **REPRESENTATIVE SAMPLING OF GROUNDWATER FOR HAZARDOUS SUBSTANCES**

Guidance Manual for Groundwater Investigations

July 1995  
Revised February 2008

California Environmental Protection Agency  
Department of Toxic Substances Control

## FOREWORD

The California Environmental Protection Agency (Cal/EPA) was created in 1991 by Governor's Executive Order. Six Boards, Departments, and Office were placed within the Cal/EPA "umbrella" to create a cabinet level voice for the protection of human health and the environment. Cal/EPA's mission is to restore, protect, and enhance the environment, to ensure public health, environmental quality, and economic vitality. Within Cal/EPA, groundwater investigations are mainly conducted under the oversight of the Department of Toxic Substances Control (DTSC), the State Water Resources Control Board (SWRCB) and its nine Regional Water Quality Control Boards (RWQCBs). DTSC's mission is to restore, protect, and enhance the environment, to ensure public health, environmental quality, and economic vitality, by regulating hazardous waste, conducting and overseeing cleanups, and developing and promoting pollution prevention. The SWRCB's mission is to preserve and enhance the quality of California's water resources, and ensure their proper allocation and efficient use for the benefit of present and future generations. The mission of the RWQCBs is to develop and enforce water quality objectives and implementation plans which will best protect the beneficial uses of the State's waters, recognizing local differences in climate, topography, geology and hydrology.

Within DTSC's Emergency Response and Statewide Operations Division (ERSO), the Engineering and Geological Services Branch (EGSB), supports the other programs within DTSC by providing expert technical assistance. As part of the EGSB, the Geological Support Unit (GSU) provides geologic assistance, training, and guidance. This document was prepared by GSU staff and it provides guidelines for the characterization and investigation of groundwater at hazardous substance release and hazardous waste sites. It should be used in conjunction with the two-volume companion reference for hydrogeologic characterization activities:

*Guidelines for Hydrogeologic Characterization of Hazardous Substances Release Sites (Cal/EPA 1995a)*

*Volume 1: Field Investigation Manual*

*Volume 2: Project Management Manual*

Within this document, the terms *hazardous substance release site*, *hazardous waste site* and *toxic waste site*, are used synonymously. However, it should be noted that any unauthorized release of a substance, hazardous or not, that degrades or threatens to degrade water quality may require corrective action to protect its beneficial use.

This document is an updated version of and supersedes the document, *Representative Sampling of Groundwater for Hazardous Substances, Guidance Manual for Groundwater Investigations (Cal/EPA 1995c)*. Additional copies of this document may be obtained from DTSC's web site at [www.dtsc.ca.gov](http://www.dtsc.ca.gov).

## COMMENT SHEET

As a user of this document, your comments are important. Please use this sheet to inform us of any errors, deficiencies or suggested improvements to this document. If you identify an error or deficiency, please suggest how it can be corrected. Attach additional sheets if necessary. Send your comments to:

California Department of Toxic Substances Control  
5796 Corporate Avenue  
Cypress, California 90630

Attention: Theodore Johnson, C.E.G., C.Hg., Geological Services Unit

<b>REPRESENTATIVE SAMPLING OF GROUNDWATER FOR HAZARDOUS SUBSTANCES GUIDANCE MANUAL FOR GROUNDWATER INVESTIGATIONS JUNE 2005</b>					
<b>Contact Information</b> - Providing contact information is optional; however, including this information will help us follow-up and address your comments.					
<b>Name</b>					
<b>Agency/Company</b>					
<b>Street Address</b>					
<b>City</b>		<b>State</b>		<b>Zip Code</b>	
<b>Phone Number</b>		<b>Email</b>			

<b>Section Number</b>		<b>Section Title</b>	
<b>Comment</b>			
<b>Suggested Revision</b>			

## **ACKNOWLEDGEMENTS**

The preparation of this guidance document was achieved through the efforts of many individuals at DTSC. The following people were responsible for editing and writing:

Steve Belluomini	Senior Engineering Geologist
Kathleen Considine	Engineering Geologist
Marie McCrink	Engineering Geologist
Bill Owen	Engineering Geologist
John Woodling	Senior Engineering Geologist

Members of a technical guidance work group participated in the development of this document by providing comments and direction. Additional review and comments were provided by staff of the Regional Water Quality Control Boards and Dennis Parfitt of the State Water Resources Control Board. Their cooperation and helpful suggestions are appreciated.

Theodore Johnson, DTSC Senior Engineering Geologist, was the primary individual responsible for editing this 2008 revision of this guidance. Finally, thank you to the many people who provided editorial review and comments, especially DTSC GSU management and staff, other DTSC program staff, and the many anonymous reviewers outside Cal/EPA, whose comments were indispensable for completing the revision of this document.

## TABLE OF CONTENTS

FOREWORD .....	i	
COMMENT SHEET .....	ii	
ACKNOWLEDGEMENTS .....	iii	
1.0 INTRODUCTION .....	1	
1.1 Purpose .....	1	
1.2 Applicability .....	1	
1.3 Limitations .....	1	
2.0 Work Plan .....	1	
2.1 Sampling and Analysis Plan .....	1	
2.1.1 Sampling Objectives .....	2	
2.1.2 Sampling Frequency .....	2	
2.1.3 Pre-Sampling Activities .....	3	
2.1.3.1 Well-Head Inspection .....	3	
2.1.3.2 Static Water Level Elevation Measurement .....	3	
2.1.3.3 Detection Of Immiscible Layers .....	4	
2.1.4 Sampling Method Selection .....	6	
2.1.4.1 Changing Sampling Methods .....	7	
2.1.4.2 Well Purging Method Selection .....	7	
2.1.4.3 Purge Methods .....	8	
2.1.4.4 Pump Intake Position .....	11	
2.1.4.5 Passive Methods .....	11	
2.1.4.6 Groundwater Sampling Equipment Selection And Use .....	11	
2.1.4.7 Decontaminating Sampling Equipment .....	12	
2.1.4.7 Collecting Groundwater Samples .....	13	
2.1.5 In-Situ or Field Analyses .....	14	
2.2 Sample Preservation and Handling .....	14	
2.2.1 Sample Containers .....	15	
2.2.2 Sample Preservation .....	15	
2.2.3 Special Handling Considerations .....	15	
2.2.3.1 Sample Filtration .....	16	
2.3 Chain-Of-Custody and Records Management .....	17	
2.3.1 Sample Labels .....	18	
2.3.2 Sample Custody Seal .....	18	
2.3.3 Field Logbook or Log Sheets .....	18	
2.3.4 Chain-of-Custody Record .....	19	
2.3.5 Sample Analysis Request Sheet .....	19	
2.3.6 Laboratory Logbook .....	20	
2.4 Analytical Procedures .....	20	
2.5 Field And Laboratory Quality Assurance/Quality Control .....	20	
2.5.1 Field QA/QC Program .....	21	
2.5.2 Laboratory QA/QC Program .....	22	
2.5.3 Groundwater Data Quality Evaluation .....	22	
3.0 References .....	23	
<b>APPENDICES</b>		
A	Sampling Devices	
<b>TABLES</b>		
1	Stabilization Criteria with References for Water-Quality-Indicator Parameters .....	10
2	Quality Control Samples .....	21

## 1.0 INTRODUCTION

The goal of groundwater sampling is to generate effective, meaningful, and representative groundwater chemistry data. Samples representative of in-situ groundwater conditions are those collected by methods that minimize artifacts caused by sampling equipment or procedures. Groundwater sample collection and handling procedures can cause variability in reported water quality concentrations due to differences in personnel, sampling procedures, and equipment (U.S. EPA 1995). The goal of this document is to promote consistent sampling methods in order to minimize variability in groundwater sampling data caused by equipment or procedures.

No single sampling method is applicable for all sampling objectives. As new methods and/or equipment are developed, additional groundwater sampling protocols should be developed and incorporated into this document. This document was revised to include guidelines on low-flow (minimal drawdown) sampling procedures and the use of passive samplers. Key references are cited within this guidance. A more detailed discussion of sampling procedures, devices, techniques, etc. is provided in various publications by the United States Environmental Protection Agency (U.S. EPA) (Barcelona et al. 1985 and U.S. EPA 1993, 2002 (Yeskis and Zavala)) and the U.S. Geological Survey (Wilde et. al. 1998).

### 1.1 PURPOSE

This document is intended to provide guidelines for the sampling and analysis of groundwater used for the characterization of hazardous substance release and hazardous waste sites. The purpose of this document is to aid in the selection of sampling devices and analytical methods, provide recommended quality assurance and quality control (QA/QC) procedures, and to provide a standardized approach for the presentation of the resulting data. The recommendations contained herein represent minimum criteria judged necessary to obtain quality data and assure reasonable and independently verifiable interpretations.

The recommendations presented here are a subset of the larger site characterization process. Refer to the *Guidelines for Hydrogeologic Characterization for Hazardous Substance Release Sites* (Cal/EPA 1995a) for additional information on investigative tools for site characterization.

### 1.2 APPLICABILITY

This guidance is applicable to the characterization and investigation of groundwater associated with hazardous substance release sites, hazardous waste sites, and proposed new or expanding school sites under the oversight of DTSC pursuant to the following statutes:

- Hazardous waste sites - Health and Safety Code, division 20, chapter 6.5 – Hazardous Waste Control
- Hazardous substance release sites - Health and Safety Code, division 20, chapter 6.8 – Hazardous Substance Account
- Proposed new or expanding school sites - Education Code, sections 17210, 172101, 17213.1, and 17213.2

### 1.3 LIMITATIONS

The recommendations presented here represent criteria that can aid in obtaining quality data and assuring reasonable and independently verifiable interpretations. Some sites may require investigative efforts above and beyond the scope of this document, while at other sites a less rigorous application of this guidance may be appropriate. It is the obligation of the responsible parties and qualified professionals performing site investigations to consult with pertinent regulatory agencies, identify all requirements, and meet them appropriately.

This document discusses broad categories of methods and devices used in sampling groundwater. It does not define specific operating procedures for sampling nor propose guidelines for every available

sampling device. This guidance is not intended to exclude alternate sampling approaches; however, any alternative method should only be used with the concurrence of Department of Toxic Substances Control (DTSC). The qualified professional in charge of the field investigation should specify the sampling methods, equipment, and operating procedures in an appropriate work plan and document any significant departures from the work plan.

This document does not supersede existing statutes and regulations. Applicable or relevant and appropriate federal, state and local regulations, statutes, and ordinances should be identified, and site characterization activities should be performed in accordance with the most stringent of these requirements.

## 2.0 WORK PLAN

A work plan should be prepared for the investigation to be conducted. The work plan provides the purpose of the investigation, summary of site background information, and a description of the tasks to be performed and should include a sampling and analysis plan (SAP) and health and safety plan (HSP). For groundwater investigations, the SAP should specify all procedures and techniques used for groundwater sample collection, sample preservation and shipment, analytical procedures, and chain-of-custody documentation. Field personnel should follow the SAP while performing, collecting, and analyzing groundwater samples. Project tasks and time lines, dates anticipated for initiating and completing monitoring activities may be included in the SAP.

### 2.1 SAMPLING AND ANALYSIS PLAN

The SAP consists of a field sampling plan (FSP) and a quality assurance project plan (QAPP). The FSP describes, in detail, the sampling and data-gathering methods to be used in the field on a project. The QAPP describes the policy, organization, activities, and protocols necessary to achieve the data quality objectives dictated by the intended use of the data. The SAP should include the following information:

- Field Sampling Plan (FSP)
  - Site background
  - Sampling objectives;
  - Sample location and frequency
  - Sample designation
  - Sampling equipment and procedures
  - Sample handling and analysis
- Quality Assurance Project Plan (QAPP)
  - Project description
  - Project organization and responsibilities
  - QA objectives for measurement
  - Sampling procedures
  - Calibration procedures
  - Analytical procedures
  - Data reduction, validation, and reporting
  - Internal Quality Control
  - Performance and systems audits
  - Preventative maintenance
  - Data assessment procedures
  - Corrective actions
  - Quality assurance reports

Additional guidance on the preparation of SAPs can be found in the *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (U.S. EPA 1988).

During preparation, the following information specific to groundwater sampling should be considered and incorporated into the SAP:

- Sampling objectives
- Pre-sampling activities;
- Sampling method selection
- In-situ or field analyses
- Sample preservation and handling
- Chain-of-custody documentation and records management
- Analytical procedures and quantitation limits for both laboratory and field methods
- Field and laboratory quality assurance/quality control
- Evaluation of data quality

### 2.1.1 Sampling Objectives

The specific objectives of a sampling effort should describe the intended use of data and should include the collection of samples “representative” of the current groundwater conditions over a specific volume of aquifer (U.S. EPA 2002). In meeting this objective, sampling equipment, sampling method, monitoring well construction, monitoring well operation and maintenance, and sample handling procedures should not alter the chemistry of the sample. A sample obtained from a poorly constructed well, using improper sampling equipment, using poor sampling techniques, or improperly preserving samples, can bias the analytical results. Biased or unrepresentative samples can lead to misinterpretations of groundwater quality data (Nielsen 1991 and Nielsen, 2006)

The sampling program data quality objectives (DQOs) should be thoroughly developed, presented and understood by all parties involved in the sampling. The purpose of the sampling effort and data use(s) should be clearly defined when developing the DQOs. For example, DQOs for site assessment sampling to determine if a contaminant is present may differ from those for determining the nature and extent of a contaminant. Differences in the sampling objectives may dictate the type of sampling equipment used, type of information collected, sampling protocol, and analytical scheme.

A dynamic site conceptual model should be constructed to develop appropriate DQOs. The conceptual model, as it applies to the DQOs, should focus on the contaminant fate and transport processes, such as contaminant migration pathways, influence of geologic materials on contaminant migration (e.g. depositional environments, geologic structure, lithology, etc.), contaminant types (e.g., hydrophobic versus hydrophilic, dissolved versus suspended, and processes that influence concentrations of the contaminants present (e.g. dilution, biodegradation, and dispersion) (U.S. EPA 2002). The detail of the conceptual model is dependent on the information available when the plan is developed. The conceptual site model should be modified as new data becomes available. Initial investigations will have a simpler conceptual site model than previously investigated sites. Specific parameters that should be described or shown in a conceptual model that may impact the design of a groundwater-sampling program include:

- Geologic materials controlling contaminant transport to and from the site.
  - Horizontal (lateral) and vertical (thickness) , extent
  - Horizontal and vertical flow direction
  - Horizontal and vertical hydraulic conductivity and contrasts between different geologic materials
- Types of contaminants to be sampled and factors that could bias sampling results.
- Horizontal and vertical distribution of contaminants.

Prior to the completion of a groundwater monitoring well installation program, vertical aquifer characterization is strongly recommended. A detailed vertical aquifer characterization program should include field characterization of hydraulic conductivities, determination of vertical and horizontal flow directions, assessment of lithologic and geologic variations, and determination of vertical and horizontal contaminant distributions (U.S. EPA 2002).

### 2.1.2 Sampling Frequency

In most situations, sampling frequency should be based on the hydrogeology of the site. There is no minimum or maximum sampling frequency set by DTSC for all sites. Groundwater analytical results should be reviewed periodically, and sampling frequency modified according to data needs, historical water quality trends, and regulatory goals. To track potential seasonal changes in concentration, at least two sampling rounds should roughly coincide with maximum and minimum water table or potentiometric surface elevations. DTSC recommends sampling at least quarterly for a minimum of one year to track seasonal changes and establish water quality trends. The document *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Addendum to Interim Final Guidance* (U.S. EPA 1992a) suggests a method for choosing a sampling interval that will reflect site-specific hydrogeologic conditions. The method uses the Darcy equation to determine the horizontal component of the average linear velocity of

groundwater flow for confined, semi-confined, and unconfined aquifers. This value is used to determine a sampling interval that will yield an independent sample of groundwater. Research performed in the area of groundwater sampling frequency (Barcelona et. al. 1989) indicates that groundwater monitoring data should be carefully collected over long periods of time (i.e. greater than two years) to determine optimal sampling frequency and to delineate seasonal trends in groundwater monitoring results. In this research, groundwater samples were collected biweekly for 18 months and analyzed for 26 water quality and geochemical constituents. The researchers determined that for the study site, groundwater sampling performed four to six times per year would result in an estimated data/information loss below 20 percent and would minimize redundancy. The researchers concluded that by using careful sampling and analytical procedures, sampling and analytical errors can be controlled to approximately  $\pm 20$  percent of the annual mean inorganic chemical constituent concentration in groundwater.

### **2.1.3 Pre-Sampling Activities**

The following activities should be conducted before each sampling event.

#### **2.1.3.1 WELL-HEAD INSPECTION**

Well-head conditions (e.g., condition of well casing, well lock, marking, standing water at surface, condition of surface pad, and annular seal) and any suggested maintenance should be assessed and documented in the field notes. The SAP should describe procedures and schedules for performing routine well maintenance. Incidental maintenance should be documented and conducted in a timely manner. A well-head maintenance checklist should be included in the SAP. The well-head inspection should include gas monitoring in and around well-heads and well vaults.

#### **2.1.3.2 STATIC WATER LEVEL ELEVATION MEASUREMENT**

The SAP should include provisions for measuring the static water elevation in each well prior to each sampling event. Measurement of water level elevations on a continuing basis is important to determine whether horizontal and vertical components of the hydraulic gradient change over time. A change in groundwater flow may necessitate modification to the design of the groundwater monitoring system. The following methods for determining water level elevations are suggested:

- Electric water level sounders
- Pressure transducers

These devices and other methods are described in more detail in U.S. EPA (1987), Aller et al. (1989), Nielsen (1991), and ASTM D4750 (2001). The SAP should specify the device to be used for water level measurements, procedure for measuring water levels, and accuracy of the measuring device.

The following criteria should be met when determining water level elevations in monitoring wells or piezometers:

- The top of the well casing should be surveyed and tied into a known vertical datum.
- Each well should have a permanent, easily identified reference point from which all depth measurements are taken. The reference point (the top of the inner casing, outer casing, or security/protective casing) should remain constant through all measurements, should be clearly marked on the casing and its description recorded. The inner casing should be used as a reference point, since the outer casing and surrounding area may be affected by other phenomena (e.g., general instability of outer casings due to frost heaving, and vehicular damage) which could cause movement of casings. The elevation of this reference point should be known and clearly marked at the well site (Nielsen, 1991 and Nielsen, 2006). This reference point should also have a known latitude and longitude consistent with the Regional and National Minimum Data Elements requirements. The elevation of the reference point should be surveyed relative to Mean Sea Level (MSL) using the NAVD 88 datum (U.S. EPA 2002).

- After well construction and development, water levels should be allowed to stabilize for a minimum of 24 hours prior to measurement. Low yield aquifers may take longer, and several water level measurements should be made over a period of several days to ensure that adequate recovery has occurred.
- Water levels (the depth to standing water) should be accurately measured with a precision of  $\pm 0.01$  foot from the survey datum on the top of the well casing. The method or device used to measure water levels should be sufficiently sensitive so that a measurement to 0.01 foot can be reliably obtained.
- Water level measurements used to establish a water table (the surface of the zone of saturation) or any single potentiometric surface should be collected as soon as practicable (e.g., within less than one day). This practice is adequate if the magnitude of change is insignificant over a specific time period. In certain situations, small water level changes could be significant or site-specific variables may warrant collecting water level measurements within a short time interval. These situations may include:
  - tidally influenced aquifers
  - aquifers affected by river stage, bank storage, impoundments, and/or unlined ditches
  - aquifers stressed by intermittent pumping of production, irrigation or supply or remediation wells
  - aquifers being actively recharged because of recent precipitation
  - aquifers that demonstrate significant water level fluctuations in response to barometric pressure changes
- Water level and well depth measurement equipment should be constructed of chemically inert materials not prone to sorption or desorption.
- Water level and well depth measurement equipment should be decontaminated prior to use at each well to ensure sample integrity and prevent cross-contamination of groundwater.
- Devices used to measure water levels and well depths should be periodically calibrated.
- Total well depth measurements should be made periodically using a weighted tape measure or marked cable. The purpose of these depth-to-bottom measurements is two-fold. The first is to determine the length of the water column for purposes of well volume purging calculations. The second is to determine if the well is filling with sediment over time indicating the need for periodic removal of bottom sediments and/or well redevelopment. The weight should be heavy enough to keep the tape measure straight and it should be blunt so that it will not penetrate soft materials on the bottom of the well. The deeper the well, the heavier the weight has to be to "feel" the bottom of the well. Standing water level measuring devices may not be appropriate for making well depth measurements. For wells with dedicated equipment, the total depth should be measured anytime the pump is removed for repair or maintenance or when indicated by elevated turbidity measurements.

Note: When using a well volume purge procedure, depth-to-bottom measurements should be made *before* purging and calculating the purge volume. For other sampling methods, where the well volume calculation is not critical (e.g., low-flow sampling), the depth-to-bottom measurement should be conducted *after* sampling to avoid generating artifact turbidity and to minimize the possibility of introducing contaminants before sampling.

### 2.1.3.3 DETECTION OF IMMISCIBLE LAYERS

The SAP should include provisions for detecting and measuring the thicknesses of immiscible liquid contaminants, such as light non-aqueous phase liquids (LNAPLs) and dense non-aqueous phase liquids (DNAPLs), if present or likely to be present each time the water level is measured. LNAPLs, also known

as "floaters", are organic liquids, less dense than water, that tend to spread across the water table (in unconfined aquifers). DNAPLs, also known as "sinkers", are relatively insoluble organic liquids that are denser than water. DNAPLs tend to migrate downward and accumulate on underlying lower impermeable intervals. The detection of immiscible layers requires specialized equipment that should be used before a well is evacuated for conventional sampling. The SAP should specify the device(s) to be used to locate and determine the thickness of LNAPLs and DNAPLs, as well as the procedures to be used for detecting and sampling these contaminants.

Extra health and safety precautions should be taken when asphyxiates, LNAPLs or DNAPLs are expected in a well, and the lead regulatory agency should be notified when they are detected.

#### 2.1.3.3.1 LNAPL Detection/Collection

The SAP should specify the following procedures for detecting the presence of LNAPLs. These procedures should be followed before the well is purged for conventional sampling.

1. Open the well vault and sample the air in the vault for target vapors using an appropriate testing device capable of detecting the contaminant; typically, a photoionization detector or an organic vapor analyzer is used for common organic contaminants. Record the measurement results. The air above the well head should be monitored to determine the potential for fire, explosion, or health and safety hazards. Air monitoring also serves as a first indication of the presence of LNAPLs. The presence of LNAPLs precludes the exclusive use of water level sounders to make a determination of static water level.
2. Inspect the well vault and the well head to observe evidence of infiltration or danger.
3. If it is safe to do so, and the lid can be opened without introducing non-native materials into the well, remove the locking and protective caps.
4. Sample the air in the well head for target vapors using an appropriate testing device and record the measurements.
5. Two possible methods to determine the presence of LNAPL are:
  - a. Gently lower a clear disposable bailer into the well to just below the fluid level and retrieve a sample. Use of a clear bailer is best for visually determining the presence of very thin or sheen-type layers.
  - b. Alternatively, lower an interface gauging probe or a weighted tape coated with commercially available reactive indicator into the well to determine the depth to the air/LNAPL and the LNAPL/water interfaces. The interface probe serves two related purposes. First, as it is lowered into the well, the probe registers when it is exposed to an organic liquid and thus identifies the presence of LNAPLs. Secondly, after passing through the LNAPL layer, the probe indicates the depth to water. Careful recording of the depths of the air/LNAPL and LNAPL/water interfaces establishes a measurement of the thickness of the LNAPL in the well casing.
6. The approach to collecting LNAPL samples depends on the depth to the floating layer surface and the thickness of the layer. A sample of the LNAPL should be collected without purging the well. To collect an LNAPL sample, a bottom valve bailer is the equipment of choice. The bailer should be lowered slowly until contact is made with the surface of the LNAPL. The bailer should then be lowered to a depth less than that of the LNAPL/water interface depth, determined beforehand using the interface probe.

#### 2.1.3.3.2 DNAPL Detection/Collection

The SAP should specify the following procedures for detecting the presence of DNAPLs. These procedures should be followed before the well is evacuated for conventional sampling:

1. Open the well vault and sample the air in the vault for target vapors using an appropriate testing device capable of detecting the contaminant; typically a photoionization detector or an organic vapor analyzer is used for common organic contaminants, but specialized equipment should be employed where potentially dangerous volatiles are suspected. Record the measurement results. The air around and below the well head should be monitored to determine the potential for the accumulation of dense gases or low oxygen conditions. Air monitoring also serves as a first indication of the presence of DNAPLs. A water interface probe may be used to locate the depth to water, but the presence of DNAPLs can not be determined through the exclusive use of water level sounder.
2. Inspect the well vault and the well head to observe evidence of infiltration or danger.
3. If it is safe to do so, and the lid can be opened without introducing non-native materials into the well, remove the locking and protective caps.
4. Sample the air in the well head for target vapors using an appropriate testing device and record the measurement results
5. Determine the static groundwater level using a water level sounder or other device listed in Section 2.1.3.2.
6. Two possible methods to determine the presence of DNAPL are:
  - a. lower an interface probe (conductivity or resistivity sensor) to the well bottom to determine if an organic liquid is present; or
  - b. lower a transparent, double check-valve bailer to the bottom of the well and withdraw a sample to visually check for the presence of DNAPL. DNAPLs should be collected by slowly lowering and raising the bailer within the well or leaving the bailer in the bottom of the well for an extended period (i.e., overnight).

#### 2.1.4 Sampling Method Selection

Sampling method selection should be based on site-specific conditions and site-specific DQOs. DQOs for the data collection activity include the overall level of uncertainty that a decision-maker is willing to accept in results derived from environmental data. This uncertainty is used to specify the quality of the measurement data required, usually in terms of objectives for precision, bias, representativeness, comparability, and completeness. As described in Chapter One of SW-846, DQOs should be defined prior to the initiation of the field and laboratory work (U.S. EPA 1992b).

Field and laboratory organizations performing the work of the DQOs should be informed so their personnel may make informed decisions during the course of the project to attain those DQOs. The procedures used to characterize the hydrogeology of a site, to design and construct a monitoring network, to collect and analyze environmental samples, and to evaluate analytical results should ensure that the data are of the type and quality necessary to allow for the detection of contamination when hazardous substances have migrated from the waste management area (U.S. EPA 1992b). Please refer to Section 2.1.1, Sampling Objectives, for additional information.

Method selection refers to the type of sampling method that will be used at the site, such as low-flow, bailer, or passive samplers. Implementation of each method will differ at each site and at specific wells. Some criteria to be considered when selecting a sampling method include location of the sampling intake, purge completion measurements, the general composition of the groundwater, recharge rates, and

degree of screen submersion. Each of these and other site-specific conditions should be considered when selecting a groundwater sampling method for a site. Regardless of the sampling method used at the site, detailed step-by-step procedures and rationale for the proposed sampling method should be included in the SAP.

Sampling method selection should take into consideration that water in a well screen and surrounding filter pack is generally in a state of flux, while water in the blank casing above the screen tends to stagnate (Robin and Gillham 1987, Powell and Puls 1993, U.S. EPA 2002, and ASTM 2002). Groundwater sampling methods that purge relatively large volumes from the well to achieve a representative sample must ensure that the blank casing water is effectively removed before sample collection. Methods that do not remove multiple casing volumes must ensure the sampling location is within the screen interval to assure formation water is sampled. Non-pumping sampling methods, also known as passive sampling, relies on a constant state of flux in the screen zone and that samples are collected from the actively flushed portion of well (i.e. the screen zone).

The following sections include details of several common sampling methods. However, other methods may be applicable to a groundwater monitoring program. Methods not included here can be proposed to the regulatory agency, detailing the proposed method. Alternate methods, meeting site data quality objectives, are encouraged.

#### *2.1.4.1 CHANGING SAMPLING METHODS*

Cal-EPA recognizes sampling technologies or methods will evolve. During the site investigation or remediation, new technologies or sampling methods may be proposed. Maintaining the same sampling method throughout the life of a project, provided the method is carried out the same way every time (e.g., pump inlet depth), removes a variable that may impact sample results. However, a new method may be proposed as being more cost effective and capable of providing a representative sample. In cases where a new sampling method is proposed to replace a previous sampling method, some type of comparison evaluation is necessary. When applicable, comparisons should include conversion between volume-based purging and sampling and low flow purging and sampling.

Comparison between two sampling methods can be in the form of side-by-side evaluations (collection of water samples using the two different sampling methods over a period of time, trend evaluations (change sampling method and provide the trend plots from the previous and new sampling method on the same graph), or a combination of methods. How the method(s) will be compared and evaluated should be established prior to initiation of the new sampling method and presented in an appropriate workplan or SAP. Results of the comparison sampling can be provided in either a separate groundwater sampling report or incorporated into an existing routine groundwater report (e.g., quarterly groundwater monitoring report).

#### *2.1.4.2 WELL PURGING METHOD SELECTION*

Water standing in a monitoring well casing may not be representative of in-situ formation groundwater quality. Water in the blank (unscreened) portion of the well is generally considered "stagnant" and non-representative. Studies have shown that water within the screened section of a well can be representative of adjacent groundwater (Robin and Gillham 1987, Powell and Puls, 1993, U.S. EPA 2002, ASTM 2002). In cases where water from the "stagnant" casing cannot be separated from the screen zone water (e.g. during bail sampling, or due to drawdown during pumping), purging of well water is conducted to assure screen zone formation water is collected.

Well purging and the requirements for completion criteria were updated and revised in the groundwater literature over the last 20 years. This guidance incorporates findings of available research and field practice, as well as allowing for new findings and new technologies, and includes discussion and rationale for several well sampling procedures. No judgment is made about what purging methodology is most appropriate in every scenario because different sampling approaches may be applicable for different sampling needs. The overarching purpose of the guidance is to outline the requirements of several sampling protocols and to help the user choose a protocol appropriate for site-specific DQOs. For

methods not specifically discussed, it is recommended that the user incorporate elements of a similar method/protocol in the SAP and discuss variances with the site's lead regulator for concurrence on the sampling methodology prior to sampling.

The SAP should include detailed, step-by-step procedures for the selected purge method including the purge method rationale. Depending on the type of purge method chosen, the SAP should contain descriptions of the equipment to be used for pumping, the instrumentation used to quantitatively measure water quality indicator parameters (including calibration methods), intervals between parameter readings, well drawdown, the location of the pump in relation to the well screen and water table, and the purge pump rate.

#### 2.1.4.3 PURGE METHODS

Well purging methods are as follows:

1. Purge a Minimum of Three to Five Well Casing Volumes. This approach is based on the removal of a sufficient volume of water from the well prior to sample collection to assure "stagnant" or non-representative water is removed and formation water is being sampled. The minimal volume is cited as three to five casing volumes (U.S. EPA 1987, Wilde et. al. 1998) reportedly based on engineering calculations used to determine effective flushing. For enforcement purposes, U.S. EPA recommends the collection of water quality stabilization parameters (U.S. EPA 1998) during purging. As technology and experience with the practice of well sampling advanced, the collection of indicator parameters to document parameter stabilization with this method became routine. In such cases, many SAPs stipulate well purging will cease when one of the two criteria first occurs, either removal of the minimal purge volume (usually three casing volumes) or the attainment of the parameter stabilization criteria.
2. Purge to Stabilization. This approach is referred to as "Purging to Stabilization" or "Well Volume Approach" (U.S. EPA 2002). This method evolved from the traditional three to five well volume/parameter stabilization approach, but without purging a fixed minimum number of well volumes. The method is based on continuously monitoring groundwater indicator parameters during purging until they have stabilized within an acceptable range, at which point stagnant water is presumed to be removed and steady-state conditions achieved. When parameter stabilization occurs, the sample is presumed to be representative. This approach became possible with the development of flow-through cell water quality indicator parameter measurement instruments with continuous data recording capability, which greatly enhanced the ability to determine parameter stabilization characteristics and assurance of steady state conditions. The critical issue with this purge method is to define the criteria for indicator parameter stabilization (e.g., the time interval between measurements, minimal purge time, purge rate, and parameter selection.) Refer to U.S EPA 2002b for an example protocol for this purge method.
3. Low-Flow Purging ("Low-Stress Approach", "Micro-Purge Method" or "Minimal Drawdown Method"). Low-flow purging practices (Puls and Barcelona 1996) were the culmination of numerous observations and studies, in the late 1980s and early 1990s, that groundwater generally flows through the monitoring well screen with sufficient velocity to maintain an exchange with formation water surrounding the screen. If water is removed from a well at rate minimizing stress to the groundwater system, as measured by drawdown in the well, then the pumped water should be representative of formation water after water level and parameter stabilization. In low-flow purging, the pump intake must be situated within the screened portion of the well, and well drawdown must be minimized (Puls and Barcelona 1996). This approach effectively isolates the screened interval from the overlying (stagnant) casing water which the more traditional methods remove by purging. Groundwater indicator parameters are measured during low-flow purging and purging is considered complete, regardless of the amount of water removed from the well, when the indicators parameters have stabilized. During purging, careful measurement and documentation of water levels and pump rate are required to assure that this

method is being effectively performed. Puls and Barcelona recommend this method not be used with well screen intakes greater than ten feet. Refer to U.S EPA 2002a for an example protocol for this purge method.

DTSC recommends the type of sampling method chosen be determined on a well-by-well basis, depending on the hydraulic properties of the monitored zone, the physical nature of the contaminants, and the hydraulic performance of the well (Barcelona et al. 1990, Barcelona, 1985). DTSC will consider the following recommendations and requirements when evaluating monitoring well purge methods:

- Some purge method strategies may be better suited to specific site conditions than others. For example, purging three to five well volumes may detect contamination, while a low-flow method, at the same well, may not. This may be due to the differing hydraulic influence (i.e. radius of influence) of each method. At sites where characterization is limited or uncertain, where well characteristics are not fully known, or where specific constituents are sensitive to certain purge methods, side-by-side comparisons between purging protocols should be considered to determine which method should be used to yield the most representative data or to meet the site-specific DQOs.
- The use of purging equipment which can excessively disrupt the well and potentially affect sample quality, such as bailers or vacuum systems, are discouraged. The use of a dedicated pump is recommended to minimize turbulence during sampling and eliminates the need for equipment decontamination.
- Pump placement within the well may be critical to effective purging. The depth of pump placement should be determined based on the selected purge method, pump design, aquifer characterization, well characteristics, and the nature of contaminants. Comparative sampling at various depths within the screen interval may be required to avoid missing zones of contamination or preferential contaminant pathways.
- Wells should be purged at rates below those used to develop the well. This is to prevent excessive stress on the well (i.e. inducing high turbidity), to prevent damage to the well, and to avoid disturbing accumulated corrosion or reaction products in the well (Puls et al. 1990; Puls and Barcelona 1989a, Puls and Barcelona 1989b, Barcelona et al. 1985). A low purge rate will also reduce the possibility of stripping volatile organic compounds (VOCs) from groundwater, and will reduce the likelihood of mobilizing solids in the subsurface that are immobile under natural flow conditions. However, purge rates should not be purposefully kept low to mask deficiencies in well design or development, as shown by excessively high turbidity. Water quality parameters should be resampled at the lower sampling rate to ensure water quality parameters are stable.
- Water levels should be monitored during purging and sampling to ensure the proper pump flow rate is used to provide minimum drawdown and/or water level stabilization.
- Water quality indicator parameters should be measured in all cases to document stabilization and steady-state conditions. Parameters should include temperature, specific conductance, pH, oxidation-reduction potential (ORP), and dissolved oxygen (Puls and Eychaner 1990, Puls et al. 1990; Puls and Barcelona 1989a, Puls and Barcelona 1989b). In general, the order of parameter stabilization is pH, temperature, specific conductance, ORP, dissolved oxygen, and turbidity. In-line flow-through cells instruments are preferred, and are considered essential for the purge to stabilization method. Turbidity measurements should be collected during purging, and should be used to evaluate the need to redevelop monitoring wells.
- Parameter stabilization should be based on the criteria shown in Table 1, at the end of this section. The intervals between parameter readings should be based on either a set time interval or a specified volume of water purged. These intervals (time or water volume) should be of

sufficient spacing and quantity to assure true stabilization trends are achieved before sampling. At a minimum, four parameter stabilization measurements should be recorded while purging.

- At a minimum, wells with screens below the water table should be purged of a volume of water equivalent to the volume of water standing in the blank casing of the well above the screened interval.
- For wells screened in media with low hydraulic conductivities, special considerations apply. If development data or pump tests show a well will either pump to dryness or that pumping will expose a significant portion of the saturated screen interval, the well recharge rate should be quantitatively determined to evaluate if water is entering the well with excessive turbulence. Turbulent flow can cause a significant loss of volatile contaminants and may affect water chemistry. Once identified and characterized, such wells should be purged at sufficiently low pump rates to avoid turbulent flow (low-flow).
- The purging/sampling method should ensure formation water does not cascade (i.e. flow vertically down the screen) down the sides of the well screen (this may occur when the water level in the well is lowered into or below the screened interval). Laboratory experiments have shown that unless cascading is prevented, up to 70 percent of the volatiles present could be lost before sampling. At no time should a well be purged to dryness if recharge causes formation water to cascade down the sides of the screen, as this may cause an accelerated loss of volatile constituents, resulting in a sample not representative of actual groundwater quality. This problem should be anticipated; water should be purged from the well at a rate that does not cause recharge water to be excessively agitated.
- Wells recharging at a slow rates should be sampled as soon as a sufficient volume of groundwater has entered the well to enable the collection of the necessary groundwater samples. Re-purging should be performed if a well is inactive for more than 24 hours after full recharge.
- Purged water should be stored in appropriate containers until analytical results are available, at which time proper arrangements for disposal or treatment should be made.

**TABLE 1. Stabilization Criteria with References for Water-Quality-Indicator Parameters**

Parameter	Stabilization Criteria	Reference
Temperature	± 3% of reading (minimum of ± 0.2° C)	SAM 2002
pH	+/- 0.1	Puls and Barcelona, 1996; Wilde et al., 1998
specific electrical conductance (SEC)	+/- 3%	Puls and Barcelona, 1996
oxidation-reduction potential (ORP)	+/- 10 millivolts	Puls and Barcelona, 1996
dissolved oxygen (DO)	+/- 0.3 milligrams per liter	Wilde et al., 1998

#### 2.1.4.4 PUMP INTAKE POSITION

There are two positions for pump intake placement, within the screened interval or the blank casing above the screen. Each of these positions has advantages and disadvantages based on the portion of the screen sampled, data reproducibility, and potential purge volumes (U.S. EPA 2002).

The vertical location within the well where the pump is placed during an assessment is of primary concern. Unless adequate precautions are taken to lower the pump into the exact position used in previous sampling rounds, or a dedicated system is used, the position of the sampling pump intake may vary between sampling rounds potentially resulting in sampling different zones within the aquifer. When the pump intake location varies along the well screen, reproducibility of the sampling results can be reduced. The variability of sample collection points along the well screen length can be reduced by using dedicated sampling pumps or a premeasured sampling pump hose.

To minimize the contact time between groundwater and the well construction materials during sampling, and ensure the evacuation of the stagnant water above the screen, Keely and Boateng (1987) suggested that the sample pump be gradually lowered through the submerged blank casing while purging. This would minimize contact time between the groundwater and the well construction materials while sampling, as well as ensure the evacuation of the stagnant water above the screen. (U.S. EPA 2002).

DTSC recommends placing the pump intake location during sampling within the well screen, instead of above it, to minimize potential mixing of stagnant water, to minimize the required purge time, and to keep the intake off the bottom of the well where accumulated sediment may be disturbed and drawn into the sample. Locating the pump intake centrally within the well screen provides the best opportunity to collect samples representative of water across the entire well screen (Varljen 2006). Shorter well screens are preferred to reduce concentration averaging across large profiles of the aquifer and to reduce time required for water to reach the pump intake from portions of the screen distant from the pump intake.

#### 2.1.4.5 PASSIVE METHODS

Passive Sampling. Passive sampling approaches do not incorporate purging or pumping as part of the groundwater sampling method. These include diffusion samplers such as polyethylene diffusion bags (PDB), or rigid porous pipe samplers (RPP); *equilibrated* grab samplers such as the Snap Sampler or Hydrasleeve; and sorptive samplers such as the Gore sampler. These devices are placed in the screened section of wells for a device-specific equilibration period. Most devices can be left downhole between sampling events. Passive methods rely on ambient aquifer flow-through to deliver groundwater to the sampling device. The operation of these devices includes exposure and diffusion of contaminants of concern into the sampling device, or collection of a whole water sample at a user-identified collection event.

#### 2.1.4.6 GROUNDWATER SAMPLING EQUIPMENT SELECTION AND USE

The following is a list of the most common categories and types of groundwater sampling devices (Nielsen 2006, Pohlmann and Hess 1988, ITRC 2007):

- Active
  - Grab samplers (e.g. bailers and syringe devices)
  - Positive displacement pumps (e.g. gear drive, bladder, helical rotor, piston, and centrifugal)
  - Suction lift pumps (e.g. peristaltic)
  - Gas contact pumps
- Passive
  - Polyethylene Diffusion Bags
  - Rigid Porous Pipe Samplers
  - Dialysis Membrane Sampler
  - Snap Samplers
  - Hydrasleeve

- Gore Sampler

DTSC prefers all sampling equipment be dedicated to a particular well. To encourage innovation, DTSC may allow the use of other devices that are not specifically mentioned above if it can be demonstrated that the device will yield "representative" groundwater samples.

The following criteria should be considered when selecting sampling equipment:

- Sampling equipment should be chosen based on the analytes of interest and the characteristics and depth of the saturated zone from which the sample is withdrawn. For example, the choice of sampling equipment should reflect consideration of the potential for LNAPLs and DNAPLs.
- Sample collection equipment should not alter analyte concentrations, such as by sorption or desorption, degradation, or corrosion.
- Sampling equipment should cause minimal sample agitation and should be selected to reduce/eliminate sample contact with the atmosphere during sample transfer. Sampling equipment should not allow volatilization or aeration of samples that may alter analyte concentrations.

Appendix A briefly discusses each category and various types of sampling devices, including their appropriateness for use and relative advantages and disadvantages.

#### 2.1.4.7 DECONTAMINATING SAMPLING EQUIPMENT

When dedicated equipment is not used for sampling (or purging), or when dedicated equipment is stored outside of the well, the SAP should include procedures for disassembly and cleaning of equipment before each use at each well.

Disposable items such as rope and low-grade tubing should be properly disposed between wells. Thoroughly cleaning equipment parts that come into contact with well water is especially important. In addition, a clean plastic sheet should be placed adjacent to or around the well to prevent surface debris from coming in contact with the purging and sampling equipment. Clean sampling equipment should not be placed on the ground or on other contaminated surfaces prior to insertion in the well. The effects of cross-contamination can be minimized by sampling the least contaminated well first and progressing to more contaminated ones. Equipment blanks to document the effectiveness of the decontamination procedures should be collected on a regular basis from non-dedicated equipment. The frequency depends on the SAP and regional protocols.

The following cleaning procedure is recommended for organic constituents:

1. Wash the equipment with a non-phosphate detergent
2. Rinse with tap water
3. Rinse with organic-free reagent water or deionized water

If separate phase or hydrophobic contaminants are present (such as LNAPL, DNAPL, high levels of contaminants, etc.), additional decontamination steps may be added. For example, an organic solvent, such as reagent-grade isopropanol or acetone may be added as a first spraying/bucket prior to the soapy water/tap, water/deionized rinse procedure/buckets.

The following cleaning procedure is recommended for inorganic constituents:

1. Wash the equipment with a non-phosphate detergent/soap mixture
2. Rinse with dilute (0.1Mole) hydrochloric or nitric acid
3. Rinse with tap water

4. Rinse with reagent water. Dilute hydrochloric acid with a reagent water rinse is preferred when cleaning stainless steel because nitric acid may oxidize the steel.

The waste decontamination fluids should be containerized and characterized to determine whether they should be treated or disposed of as hazardous waste.

#### 2.1.4.8 COLLECTING GROUNDWATER SAMPLES

Monitoring well sampling should always progress from the well expected to be least contaminated to the most contaminated, to minimize the potential for cross-contamination of samples that may result from inadequate decontamination of sampling equipment. Samples should be collected and containerized according to the volatility of the target analytes. The preferred collection order for some of the more common groundwater analytes is as follows:

- Volatile organic compounds (VOCs)
- Semivolatile organic compounds (SVOCs)
- Major water quality cations and anions
- Stable isotopes (e.g. oxygen, hydrogen, nitrogen, lead)
- Metals
- Cyanide
- Turbidity
- Radionuclides

The following guidelines should be adhered to while using and operating groundwater sampling equipment:

- Check valves should be designed and inspected to ensure that fouling problems do not reduce delivery capabilities or result in aeration of samples.
- Sampling equipment (especially bailers) should never be dropped into the well, as this will cause degassing of the water upon impact.
- Sampler contents should be transferred to sample containers in a way that will minimize sample agitation and aeration.
- Clean sampling equipment should not be allowed to come into contact with the ground or other contaminated surfaces prior to insertion into the well.
- The rate at which a well is sampled should not exceed the rate at which the well was purged. Sampling rates of less than one liter per minute are suggested for wells that have historically yielded turbid samples (Puls et al., 1990). Wells are routinely sampled at rates as low as 100 to 500 milliliter per minute (Puls, et al., 1990; Puls and Barcelona, 1989a).
- Water levels should be monitored during purging and sampling to ensure the proper pump flow rate is used to provide minimum drawdown and/or water level stabilization.
- If the rates of purging and sampling are different, the sample water should be verified as stable by collecting additional field parameters and utilizing the stabilization criteria herein.
- If a flow through cell is used, groundwater samples should be collected before the flow-through cell, between the flow-through cell and the well head. Installation of a Y-fitting approximately 1 foot from the inlet to the flow-through cell will facilitate sampling without interrupting flow.

### 2.1.5 In-Situ or Field Analyses

Physically or chemically unstable analytes should be measured in the field, rather than in the laboratory. Examples of unstable parameters include pH, redox potential, chlorine, dissolved oxygen, ferrous iron, alkalinity, and temperature. It is suggested that dissolved oxygen, turbidity, and specific conductance be determined in the field as soon as practicable. Although the specific conductance (i.e. electrical conductance) of a sample should be relatively stable, DTSC recommends that this analyte also be measured in the field. Most conductivity instruments require temperature compensation; therefore, the temperature of the samples should be measured at the time conductivity is determined unless the instrument automatically makes this compensation.

Three methods can be employed for measuring unstable field parameters:

- Specially designed meters with probes that may be lowered down into the well.
- In-line flow-through monitoring chamber with ports for probe attachment, allowing continuous readings during purging
- Collect a sample in a clean bottle or beaker in the same manner that a sample for laboratory analysis would be collected, and then to analyze the sample using field test kits or meters.

Unstable parameters should be measured in samples collected from the well after the well has been purged and before samples are collected for laboratory analysis. If down-hole probes (pH electrode, specific ion electrode, and thermistor) are used to measure unstable parameters, the probes should be decontaminated in a manner that prevents the probe(s) from contaminating the water in the well. In no case should field analyses be performed directly on samples that will be submitted for laboratory analysis. Monitoring probes should not be placed in shipping containers containing groundwater samples for laboratory analysis. Dissolved oxygen should only be measured with a flow-through cell or downhole instrument.

The SAP should list the specific parameters that will be measured in the field, types of instruments (e.g. downhole probes, meters) that will be used to make these measurements, and describe the procedures for operating the instruments and recording the measurements. The SAP should describe all instrument calibration procedures, including the frequency of calibration. The description of calibration procedures should include: discussion of initial calibration, multi-level calibration for determination of usable range, periodic calibration checks, conditions that warrant re-calibration of instruments, acceptable control limits, and the maintenance of calibration records in the field log book. All instruments should be calibrated with standards that have not exceeded their expiration dates. At a minimum, all field instruments should be calibrated at the beginning of each use and in accordance with the frequency suggested by the manufacturer. Field instruments should be calibrated using at least two calibration standards spanning the range of results anticipated during the sampling event. For example, the pH meter should be calibrated at 4 and 7 pH, or at 7 and 10 pH, dependent if the anticipated pH of the groundwater is either acidic or basic, respectively.

### 2.2 SAMPLE PRESERVATION AND HANDLING

The procedures employed for sample preservation and handling are nearly as important for ensuring the integrity of the samples as the collection device itself. Detailed procedures for containerization, preservation, packaging, and handling (e.g. shipped daily by overnight courier) should be provided in the SAP. Samples collected from a well should never be composited in a large container for subsequent transfer to the appropriate smaller bottles. Regardless of the analytes of concern, exposure of the samples to the ambient air should be minimized.

Splitting of samples is sometimes required for quality assurance/quality control purposes. When sampling for VOCs, the procedure is changed slightly. For non-VOC samples, one half of the sample is emptied from the sampling device into one container, and one half is emptied into the other, with the procedure being repeated until the containers are full. For VOCs, however, the first volatile organic analysis (VOA) container should be completely filled and sealed, and then the VOA container into which the other split sample will be placed should be completely filled and sealed.

### 2.2.1 Sample Containers

The SAP should identify the type of sample containers to be used to collect samples, as well as the procedures used to ensure that sample containers are free of contaminants prior to use. The SAP should refer to the specific analytical method that designates an acceptable container and sufficient sample quantity.

The most important factors to consider when choosing sample containers are compatibility with the contaminant or waste, cost, resistance to breakage, and volume. Containers must not distort, rupture, or leak as a result of chemical reactions with constituents of concern. The containers must have adequate wall thickness to withstand handling during sample collection and transport to the laboratory. Containers with wide mouths are often desirable to facilitate transfer of samples from samplers to containers.

New containers should be prepared based on the analyte of interest; used containers are to be discarded. The cleanliness of a batch of precleaned bottles should be verified in the laboratory. The residue analysis should be available prior to sampling in the field.

### 2.2.2 Sample Preservation

The SAP should identify the sample preservation methods that will be used. Methods of sample preservation are relatively limited, and are generally intended to 1) retard biological action, 2) retard chemical reactions such as hydrolysis or oxidation, and 3) reduce sorption effects. Preservation methods are generally limited to pH control, chemical addition, refrigeration, and protection from light.

Most sample containers provided by a laboratory have pre-added preservative if the analyte of interest requires preservation. If these are not available, then preservatives should be added in the field. Samples should not be brought back to the laboratory for preservation. For pH control, test strips should be used to verify that samples have attained the appropriate pH range for sample preservation.

Most commercial shipping containers ("coolers") leak when the interior water level reaches the lid-body interface and may result in the carrier refusing to ship the container. For this reason, DTSC recommends using two water-tight sealable polyethylene bags for shipping. The first will contain the sample bottles, the second the ice needed to keep the samples at 4±2 °C. Glass containers should be protected from breakage using holders bubble wrap and/or vermiculite. The vermiculite will also absorb any spills or melted ice. The number of samples in the cooler should not prevent effective sample preservation (i.e. cooling). Blue ice should only be used if the samples are pre-cooled before shipping, since blue ice may not chill the samples sufficiently for the duration of the trip to the laboratory. Care should also be taken with the VOC samples to prevent freezing in transit.

As specified by U.S. EPA (1998), a temperature history of the samples should be maintained as a quality control measure. This is done by recording the temperature on the chain-of-custody record (Section 2.3.4) before the sample containers are sealed for shipment. Upon receipt of the shipment, the laboratory is required to record the temperature at receipt on the chain-of-custody record. A temperature blank should be included in the cooler (i.e. a vial or container filled with clean water and marked as such, which is measured by the laboratory upon receipt).

Holding time refers to the period that begins when the sample is collected from the well and ends with its extraction or analysis. Holding time is not measured from the time the laboratory receives the samples. Any laboratory submission to DTSC should contain the date/time sampled, the date/time received, the date/time extracted, and the date/time analyzed.

### 2.2.3 Special Handling Considerations

During groundwater sampling, every attempt should be made to minimize changes in the chemistry of the samples so that data representative of subsurface hydrogeochemistry are collected. DTSC agrees with the following U.S. EPA protocols that will assist in preserving the natural chemistry of groundwater samples:

- Do not routinely filter groundwater samples in the field.
- Do not transfer samples from one sample container to another.
- Do not allow headspace in the containers of samples that will be analyzed for volatile organic compounds, alkalinity, and dissolved gases.

### 2.2.3.1 SAMPLE FILTRATION

Decisions to filter samples should be dictated by sampling objectives rather than as a fix for poor sampling practices. Field-filtering of certain compounds should not be the default. Evaluation of what the application of field-filtration is trying to accomplish should be considered (Puls and Barcelona 1996) and included in the SAP.

Groundwater samples used to determine if there is statistically significant evidence of groundwater contamination by organic compounds should not be field-filtered. Data generated from filtered samples provide information on only the dissolved constituents that are present, as suspended materials are removed by the filtration process. The analytical results of both filtered and un-filtered groundwater samples are used to determine if hazardous constituents were released to groundwater. As discussed in greater detail below, current research in groundwater sampling protocol indicates that hazardous constituents are mobile in the subsurface in both the aqueous (dissolved) phase and the solid phase. The research of Puls and Barcelona (1989a), Puls and Barcelona (1989b), Penrose et al. (1990), Backhus et al. (1993) and West (1990) are the primary sources of the discussion of field filtration that follows.

During groundwater sampling, every attempt should be made to minimize changes in the chemistry of the sample so the data is representative of site conditions. A sample that is exposed to the atmosphere or changes in ambient conditions as a result of field filtering is very likely to undergo chemical changes (e.g. volatilization, precipitation, chemical flocculation) that alter constituent concentrations. These reactions can change the concentrations of organic compounds and metals if they are present in the sample. VOCs may partition to the atmosphere if exposed, thereby resulting in groundwater monitoring data that are not representative of in-situ concentrations. Further, precipitated and emulsion trapped constituents migrating in the aquifer are lost through field filtering, because they are unable to pass through a standard 0.45 micron field filter.

For metals analysis of groundwater samples, however, the situation is not as clear. The argument against filtering is that it will not provide accurate information concerning the mobility of metal contaminants. Metals may move through the aquifer matrices not only as dissolved species, but also as precipitated phases, and/or polymeric species; some metals may be adsorbed to, or encapsulated in, organic or inorganic particles (e.g. colloid-size particles), that are likely to be removed by filtration. In addition, field filtration may introduce oxygen into the sample, which can oxidize dissolved ferrous iron to form a ferric hydroxide precipitate ( $\text{Fe}(\text{OH})_3$ ); this may entrap other metals in the sample, removing them from solution. Precipitated and entrapped constituents would be removed by field filtration.

The argument for filtering samples prior to analysis for inorganic constituents is that small differences in sample turbidity can mean very large differences in analytical results. Sample turbidity is an indirect measurement of the amount of particulate matter suspended in a sample, and is highly dependent on the nature of the aquifer material. In aquifers containing significant silt or clay, turbidity can be reduced through proper well design, construction and development, and by use of appropriate sample collection methods. However, turbidity is rarely eliminated. Since sample turbidity is not directly related to sources of contamination, resulting values from unfiltered samples do not necessarily provide direct evidence of metals contamination, and are generally not a useful indication of contaminant load in an aquifer.

Based on these arguments, the following recommendations are provided as a guide to sampling groundwater for the analysis of trace metals:

- For risk assessment, unfiltered samples should be analyzed if the potential for colloidal transport is suspected.
- Field filtered samples may be collected at the same time for comparison purposes, but field filtering is not a substitute for properly constructed, developed and sampled wells.
- Samples should never be filtered when a water supply well is sampled.

Since significant differences in water quality may be attributed to contamination, it is critical to control other variables that may affect groundwater quality. In addition to factors already discussed in this document, these recommendations, where applicable, should also be followed:

- Monitoring wells should be designed, constructed and developed to minimize turbidity; well construction is discussed in *Monitoring Well Design and Construction for Hydrogeologic Characterization* (Cal/EPA 1995b), and in the Department of Water Resources Bulletin 74-90 (DWR 1990).
- Whenever possible, well purging and sampling should be performed with dedicated pumps at low discharge rates.
- As previously stated throughout this document, wells should be purged until measured values for the stabilization criteria in Table 1 are achieved.
- In-line, positive-pressure filters should be used at all times; vacuum filtration is not acceptable.
- Manufacturer's recommendations for the volume of water to be flushed through the filter prior to sampling should be followed; if guidelines are not available, a volume of groundwater equal to twice the capacity of the filter should be flushed through the filter and discarded before collecting samples.
- There are certain circumstances where it is necessary to filter or centrifuge the sample under controlled laboratory conditions prior to analysis to prevent instrument damage. Sample filtration in the laboratory is permissible if insoluble materials that could damage laboratory equipment (e.g., silicates) remain after acid digestion of the sample. If this step is necessary, the filter and the filtering apparatus should be thoroughly cleaned and pre-rinsed with dilute nitric acid before use. Laboratory personnel should refer to SW-846 (U.S. EPA 1998) for information concerning these procedures. The analytical reports submitted to DTSC should clearly state that groundwater samples were laboratory filtered.
- Samples should not be transferred from one sample container to another. Transferring samples between containers may result in losses of organic material onto the walls of the container or sample aeration.
- To minimize the possibility of volatilization of organics, no headspace should exist in the containers of samples containing volatile organics. Field logs and laboratory analysis reports should note the headspace, if present, in the sample container(s) at the time of receipt by the laboratory, as well as at the time the sample was first transferred to the sample container at the wellhead.

### **2.3 CHAIN-OF-CUSTODY AND RECORDS MANAGEMENT**

A chain-of-custody procedure should be designed to allow for the reconstruction of how and under what circumstances a sample was collected, including any problems encountered. U.S. EPA (1998) provides a complete description of chain-of-custody and records management. The chain-of-custody procedure is intended to prevent misidentification of the samples, to prevent tampering with the samples during

shipping and storage, to allow easy identification of any tampering, and to allow for the easy tracking of possession. Groundwater samples should always be stored in a secure area.

To avoid water damage of the chain-of-custody form during transport in the sample cooler, the form should be placed into a water-tight sealable bag and placed on top of the cooler contents.

### **2.3.1 Sample Labels**

To prevent sample misidentification, labels should be affixed to each sample container at the time of sampling. The labels should be sufficiently durable to remain legible even when wet and should contain, at a minimum, the following information:

- Site designation
- Sample identification number
- Name and signature of collector
- Date and time of collection
- Place of collection
- Parameters requested (if space permits)

Samples can be labeled by recording the above information directly on the sample containers. Alternatively, multiple-part labels consisting of a unique identification number that is placed on the container and at least two copies of the descriptive information for the samples (referenced to the identification number) may be used. One copy should be kept in a separate file or logbook, and a second copy is shipped inside the cooler with the samples to the laboratory.

### **2.3.2 Sample Custody Seal**

In cases where samples leave the samplers immediate control (e.g. shipment to laboratory), a custody seal should be placed on the shipping container or on the individual sample bottles. Custody seals provide prevention or easy detection of sample tampering. The custody seal should bear the signature of the collector and the collection date. It can be placed on the front and back of a cooler, around the opening of sealable polyethylene bags or on the lid of each sample container before it is taped shut for shipping. Caution should be exercised in doing any of the above. Experience has shown that the seal may not always adhere to some plastic coolers, and the cooler may arrive at the destination without the appropriate seal. Sometimes the sample containers become wet from melting ice or condensation; thus, while their labels will stick, their custody seals may not. Taping over the seal with a transparent tape generally solves this problem and can be similarly applied to cooler lids (Note: Some tapes contain chemicals which may be chemicals of concern).

### **2.3.3 Field Logbook or Log Sheets**

If a sample analysis produces an unexpected or unexplainable result, it will be necessary to determine if the circumstances of sample collection, rather than a change in the groundwater quality, are responsible. Examination of the field logbook or log sheets is critical in this process. The field logbook or log sheets should document the following:

- Well identification
- Condition of well and surface completion
- Top of casing surveyed elevation
- Well depth from top of casing
- Static water level depth and measurement technique
- Presence and thickness of immiscible layers and detection method
- Well purging procedure and equipment
- Purge volume and pumping rate
- Time well purged
- Well yield (high or low)

- Well recovery after purging (slow, fast)
- Collection method for immiscible layers
- Sample withdrawal procedure and equipment
- Date and time of collection
- Measurement of groundwater stabilization parameters
- Well sampling sequence
- Types of sample bottles used and sample identification numbers
- Preservatives used and pH verification
- Parameters requested for analysis
- Field observations of sampling event
- Name of collector
- Climatic conditions, including air temperature
- Internal temperature of field and shipping containers

The field logbook or log sheets for well purging and sampling should be included within reports submitted to DTSC.

#### **2.3.4 Chain-of-Custody Record**

Sample possession should be clear from the chain-of-custody record sheet. A chain-of-custody sheet should be filled out and should accompany all samples. It should also contain enough copies so that each person possessing the shipment receives his/her own copy. At a minimum, the record should contain the following information:

- Site designation
- Site address
- Sample number
- Sample description and location
- Signature of collector
- Date and time of collection
- Sample matrix (e.g. groundwater)
- Identification of sampling point (well)
- Number and types of containers
- Parameters requested for analysis
- Preservatives used
- Signature of persons involved in the chain of possession
- Inclusive dates and times of possession
- Internal temperature of shipping container when samples were sealed into the container for shipping
- Internal temperature of container when opened at the laboratory
- Remarks section to identify potential hazards or to relay other information to the laboratory

#### **2.3.5 Sample Analysis Request Sheet**

This document should accompany the sample(s) on delivery to the laboratory and clearly identify which sample containers have been designated for each requested parameter. It may be included in the chain-of-custody record. Addition of preservatives should also be noted. This document should include the following types of information:

- Name of person receiving the sample
- Name and addresses of analytical laboratory
- Laboratory sample number (if different from field number)
- Date of sample receipt
- Analyses to be performed
- Internal temperature of shipping container upon opening in the laboratory

- Preservatives added in the field

### **2.3.6 Laboratory Logbook**

Once the sample has been received in the laboratory, the sample custodian and/or laboratory personnel should clearly document the processing steps that are applied to the sample. All sample preparation techniques and instrumental methods used should be identified in the logbook. Experimental conditions, such as the use of specific reagents, temperatures, reaction times, and instrument settings, should be noted. The results of the analyses of all laboratory quality control samples should be identified, specific to each batch of groundwater samples analyzed. The laboratory logbook should include the time, date, and name of the person who performed each processing step.

## **2.4 ANALYTICAL PROCEDURES**

The SAP should describe in detail the analytical procedures that will be used to determine the concentrations of constituents or parameters of interest. These procedures should include suitable analytical methods, the associated analytical detection limits, as well as proper quality assurance and quality control protocols.

The SAP should identify a method that will be used for each specific parameter or target analyte that can achieve the required detection limits. The following should be addressed:

1. For SW-846 analytical methods, reference SW-846 and the analysis methods (by method number), including all sample preparation methods (U.S. EPA 1998).
2. For analysis by modified- or non-SW-846 methods, the analytical procedure and method detection limits to be used should be documented in the format of a Standard Operating Procedure (SOP).

## **2.5 FIELD AND LABORATORY QUALITY ASSURANCE/QUALITY CONTROL**

It is important to establish programs to ensure the reliability and validity of field and analytical laboratory data, as part of the overall groundwater monitoring program. Refer to SW-846 (U.S. EPA 1998) for requirements and guidance on establishing and maintaining field and laboratory quality control programs. In general, laboratory quality assurance and quality control (QA/QC) programs should address the following areas:

- Control samples
- Acceptance criteria
- Deviations
- Corrective action for sampling and analysis procedures
- Data handling
- Laboratory control samples
- Method blanks
- Matrix-specific effects

The SAP should explicitly describe the QA/QC program that will be used in the field and laboratory in the Quality Assurance Project Plan (QAPP). The QAPP describes the quality assurance and quality control (QA/QC) protocols necessary to achieve the objectives dictated by the intended use of the data. Control protocols include the procedures for sample collection, preservation, chain-of-custody, and transport, calibration and maintenance of instruments, processing verification, storage, and reporting of data, and other relevant QA/QC procedures required to maintain precision and accuracy of the data. The DQOs of the project should be described in terms of precision, accuracy, completeness, representativeness and comparability for both field activities (sampling, measurements and screening) and laboratory analyses, including the project required acceptance limits and means to achieve these QA objectives. Refer to U.S. EPA 1992b, for a discussion of DQOs. In addition, the preventative maintenance procedures to be used for the field and laboratory instruments and the groundwater monitoring system should be described. A

table showing the type of maintenance to be performed and the frequency is appropriate. Many groundwater samples are analyzed at commercial laboratories. In these cases, the SAP should be used by the laboratory analyzing samples.

Both field and laboratory QC samples should be prepared during the sampling event. The following samples in Table 2 should be analyzed with each batch of samples (generally every 20 samples):

**TABLE 2. Quality Control Samples**

Type	Typical Frequency	Purpose
Field duplicate	1 per 10 samples	Evaluate precision of sampling and analysis procedures.
Matrix spike	1 per 20 samples or 1 per analytical batch	Evaluate accuracy of analytical procedures.
Matrix spike duplicate	1 per 20 samples or 1 per analytical batch	Evaluate accuracy of analytical procedures.
Equipment blank	1 per set of equipment cleaned. Collect one sample at the beginning of sampling and one each day after decontamination.	Evaluate cross-contamination caused by non-dedicated equipment.
Field blank	1 per day	Evaluate whether contaminants introduced by ambient air during sample collection.
Trip blank	1 per sample cooler containing VOCs	Evaluate whether VOC contamination introduced during sampling, storage, or shipment.
Temperature blank	1 per sample cooler	Evaluate whether sample preservation requirements are achieved.

The matrix-specific detection limit should be determined. This determination does not need to be made on a sample batch basis, but should be made whenever the matrix is suspected to have altered, or as frequently as necessary to document that the matrix has not altered. For an aquifer with relatively static hydrogeological characteristics, this may mean making a matrix-specific detection limit determination twice annually.

### 2.5.1 Field QA/QC Program

The SAP should provide for the routine collection and analysis of QC samples. Various types of QC samples and blanks should be used to verify that the sample collection and handling process has not affected the quality of the samples. Blanks are to be subjected to the same analysis as the groundwater. Contaminants found in the blanks may be the result of: (1) inter-action between the sample and the container, (2) contaminated rinse water, (3) contaminated preservatives, or (4) a handling procedure that alters the sample analysis results. The concentrations of any contaminants found in the blanks should not be used to correct the groundwater data. The contaminant concentrations should be noted, and if the concentrations are more than an order of magnitude greater than the field sample results, groundwater should be re-sampled. All field QC samples should be prepared exactly as regular investigation samples

with regard to sample volume, containers, and preservation. The QC samples should be prepared and analyzed for all of the required monitoring parameters.

Other QA/QC practices such as sampling equipment calibration and decontamination procedures and chain-of-custody procedures should be described in the SAP. Refer to the previous sections in this document for a discussion of these practices.

### **2.5.2 Laboratory QA/QC Program**

The SAP should provide for the use of control samples, as defined in SW-846 (U.S. EPA 1998). Appropriate statistical procedures (U.S. EPA 1992a) should be used to monitor and document performance and to implement an effective program to resolve testing problems (e.g. instrument maintenance, operator training). Data from control samples (e.g. spiked samples, duplicates and blanks) should be used as a measure of performance or as an indicator of potential sources of cross-contamination. When contaminants are detected in QA/QC samples (field, trip, or lab blanks), the accompanying sample results should be appropriately flagged. All sample results shall be reported unadjusted for blank results or spike recoveries. All QA/QC data should be submitted to DTSC with the groundwater monitoring sample results.

### **2.5.3 Groundwater Data Quality Evaluation**

A groundwater sampling and analysis program produces a variety of hydrogeological, geophysical, and groundwater constituent concentration (GWCC) data. This section pertains primarily to the evaluation of GWCC data. The GWCC data may be presented to the owner or operator via electronic transmittal or on reporting sheets. These data then should be compiled and statistically analyzed prior to submittal to the lead regulatory agency. If data are to be transmitted electronically, the procedures should be discussed with the lead regulatory agency staff to ensure that all software and hardware being used are compatible with the electronic data formats for integration in the agencies database.

The following guidelines should help to ensure that units of measure associated with data values are reported consistently and unambiguously:

- The units of measure should accompany each target analyte. Laboratory data sheets that include the statement "values are reported in ppm unless otherwise noted" should generally be discouraged, and at least should be examined in detail by the technical reviewer.
- The units of measure for a given target analyte should be consistent throughout the report.
- Data should be reported correctly for the results to be valid. Chemical analysis, laboratory reporting, computer automation, and report preparation data should be generated and processed to avoid mistakes and ensure completeness and full documentation.

### 3.0 REFERENCES

- Aller, L., T.W. Bennett, G. Hackett, R.J. Petty, J.H. Lehr, H. Sedoris, D.M. Nielsen, and J.E. Denne. 1989. Handbook of Suggested Practices for the Design and Installation of Groundwater Monitoring Wells. EPA/EMSL-Las Vegas, U.S. EPA Cooperative Agreement CR-812350-01, EPA/600/4-89/034, NTIS #PB90-159807.
- American Petroleum Institute (API) 2000. *No-Purge Groundwater Sampling: An Approach for Long-Term Monitoring, A Summary Of Research Results From API's Soil & Groundwater Technical Task Force*, Bulliton No. 12.
- ASTM. 2001. *Standard Test Method for Determining Subsurface Liquid Levels in a Borehole or Monitoring Well (Observation Well)*, D4750-87(2001)
- American Society of Testing Materials (ASTM). 2002. Standard Practice for Low-Flow Purging and Sampling for Wells and Devices Used for Ground-Water Quality Investigations. *ASTM Subcommittee D18.21: Designation D 6771-02*.
- Backhus, D.A., J.N. Ryan, D.M. Groher, J.K. McFarlane, and P.M. Gschwend. 1993. *Sampling Colloids and Colloid-Associated Contaminants in Groundwater*. *Groundwater*, 31(3):466-479.
- Barcelona, M.J., J.P. Gibb, J.A. Helfrich, and E.E. Garske. 1985. *Practical Guide for Groundwater Sampling*, U.S. EPA, Cooperative Agreement #CR-809966-01, EPA/600/2-85/104, 169 pp.
- Barcelona, M.J., H.A. Wehrmann, J.F. Keely, and W.A. Pettyjohn. 1990. *Contamination of Groundwater: Prevention, Assessment, Restoration*. Pollution Technology Review No. 184, Noyes Data Corporation, Park Ridge, NJ, 213 pp.
- Barcelona, M.J., H.A. Wehrmann, M.R. Schock, M.E. Sievers, and J.R. Karny. 1989. *Sampling Frequency for Groundwater Quality Monitoring*. EPA Project Summary. EPA/600/S4-89/032, NTIS: PB-89-233-522/AS.
- California Environmental Protection Agency (Cal/EPA). 1995a. *Guidelines for Hydrogeologic Characterization for Hazardous Substance Release Sites, Volume 1: Field Investigation Manual and Volume 2: Project Management Manual*. State of California Environmental Protection Agency. July 1995.
- Cal/EPA. 1995b. *Monitoring Well Design and Construction for Hydrogeologic Characterization, Guidance Manual for Ground Water Investigations*. State of California Environmental Protection Agency. July 1995.
- Cal/EPA. 1995c. *Representative Sampling of Ground Water for Hazardous Substances, Guidance Manual for Ground Water Investigations*. State of California Environmental Protection Agency. July 1995.
- Church, P.E., Vroblesky, D.A., Lyford, F.P., and Willey, R.E., 2002, *Guidance on the Use of Passive-Vapor-Diffusion Samplers to Detect Volatile Organic Compounds in Groundwater-Discharge Areas, and Example Applications in New England*: U.S. Geological Survey Water-Resources Investigations Report 02-4186, 79 p.
- Department of Water Resources (DWR). 1990. *Final Draft Bulletin 74-90, California Well Standards' Water Wells, Monitoring Wells, Cathodic Protection Wells; Supplement to Bulletin 74-81*.
- Driscoll, F.G. 1986. *Groundwater and Wells*, 2nd edition. Johnson Division, St. Paul, Minnesota, 1089 pp.

- Gillham, R.W., M.J.L. Robin, J.F. Barker, and J.A. Cherry. 1983. *Groundwater Monitoring and Sample Bias*, American Petroleum Institute, API Publication No. 4367, 200 pp.
- Interstate Technology and Regulatory Council (ITRC), 2007, Protocol for use of Five Passive Samplers to Sample for a Variety of Contaminants in Groundwater, DSP-5, ITRC, Washington, DC, 88 p.
- ITRC. 2006. *Technology Overview of Passive Sampler Technologies*. DSP-4. Washington, D.C.: Interstate Technology & Regulatory Council, Authoring Team. ([www.itrcweb.org/Documents/DSP\\_4.pdf](http://www.itrcweb.org/Documents/DSP_4.pdf)).
- Keely, J.F. and K. Boateng, 1987, *Monitoring well Installation, Purging, and Sampling Techniques - Part 1: Conceptualizations*; Groundwater, Vol. 25, No. 4, pp. 427-439.
- Morrison, R.D. 1984. *Groundwater Monitoring Technology Procedures, Equipment, and Applications*. Timco Mfg., Inc., Prairie du Sac, Wisconsin, 111 pp.
- Nielsen, D.M., ed. 1991. *Practical Handbook of Groundwater Monitoring*. Lewis Publishers, Chelsea, MI, 717 pp.
- Nielsen 2006, ed. 2006 Practical Handbook of Groundwater Monitoring, Second Edition... Taylor & Francis
- Pearsall, K.A. and D.A.V. Eckhardt. 1987. *Effects of Selected Sampling Equipment and Procedures on the Concentrations of Trichloroethylene and Related Compounds in Groundwater Samples*. Groundwater Monitoring Review, Spring, pp. 64-73.
- Penrose, W.R., W.L. Polzer, E.H. Essington, D.M. Nelson, and K.A. Orlandini. 1990. *Mobility of Plutonium and Americium through a Shallow Aquifer in a Semiarid Region*, Environ. Sci. Technol., 24:228-234.
- Pohlmann, K.F. and J.W. Hess. 1988. *Generalized Groundwater Sampling Device Matrix*. Groundwater Monitoring Review, Fall, pp. 82-84.
- Powell, R.M., and R.W. Puls. 1993. Passive Sampling of Groundwater Monitoring Wells Without Purging: Multilevel Well Chemistry and Tracer Disappearance. *Journal of Contaminant Hydrology* 12: 51-77.
- Puls, R.W., and M.J. Barcelona. 1996. *Low-Flow (Minimal Drawdown) Groundwater Sampling Procedures*. U.S. EPA Superfund Groundwater Issue, EPA/504/S-95/504.
- Puls, R.W., and M.J. Barcelona. 1989a. *Filtration of Groundwater Samples for Metals Analysis*. Hazardous Waste and Hazardous Materials, v. 6, No. 4.
- Puls, R.W., and M.J. Barcelona. 1989b. *Groundwater Sampling for Metals Analyses*. U.S. EPA Superfund Groundwater Issue, EPA/504/4-89/001, 6 pp.
- Puls, R.W., and J.H. Eychaner. 1990. *Sampling of Groundwater for Inorganics - Pumping Rate, Filtration, and Oxidation Effects*, in Fourth National Outdoor Action Conference on Aquifer Restoration, Groundwater Monitoring, and Geophysical Methods, NWWA, May 14-17, 1990, pp. 313-327.
- Puls, R.W., J.H. Eychaner, and R.M. Powell. 1990. *Colloidal Facilitated Transport of Inorganic Contaminants in Groundwater: Part I. Sampling Considerations*. Environmental Research Brief, EPA/600/M-90/023, 12pp.
- Robin, M.J.L., and R.W. Gillham, 1987, *Field Evaluation of Well Purging Procedures*, Groundwater Monitoring Review, Vol. 7 No.4, pp. 92

- Tai, D.Y., K.S. Turner and L.A. Garcia. 1991. *The Use of a Standpipe to Evaluate Groundwater Samplers*. Groundwater Monitoring Review, Winter, 125-132.
- United States Environmental Protection Agency (U.S. EPA). 2002. *Groundwater Sampling Guidelines for Superfund and RCRA Project Managers*. Ground Water Forum Issue Paper. Office of Solid Waste and Emergency Response. EPA 542-S-02-001
- U.S. EPA 2002a. Example Standard Operating Procedure: Standard Operating Procedure for Low-Stress (Low Flow)/Minimal Drawdown Ground-Water Sample Collection. ATTACHMENT 3 in *Groundwater Sampling Guidelines for Superfund and RCRA Project Managers*, May 2002, pgs. 27-38.
- U.S. EPA 2002b. Example Standard Operating Procedure: Standard Operating Procedure for the Standard/Well-Volume Method for Collecting a Ground-Water Sample. ATTACHMENT 4 in *Groundwater Sampling Guidelines for Superfund and RCRA Project Managers*, May 2002, pgs. 39-53.
- U.S. EPA. 1998. *Test Methods for Evaluating Solid Waste, SW 846*, Office of Solid Waste and Emergency Response., November 1986, (Update III Revision 5, dated September, 1998).
- U.S. EPA. 1995. *Groundwater Sampling - A Workshop Summary*, Dallas, Texas, November 30-December 2, 1993; EPA/600/R-94/205, 146 pp.
- U.S. EPA. 1994. *Guidance for the Data Quality Objectives Process*, EPA QA/G-4, EPA/600/R-96/055 Washington, D.C.
- U.S. EPA. 1993. *Subsurface Characterization and Monitoring Techniques: A Desk Reference Guide: Volume I: Solids and Groundwater Appendices A and B*; EPA/625/R-93/003a.
- U.S. EPA. 1992a *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities Addendum to Interim Final Guidance*.
- U. S. EPA. 1992b. *RCRA Groundwater Monitoring: Draft Technical Guidance*. Office of Solid Waste, Washington, D.C. EPA/530/R-93/001, NTIS PB 93-139350
- U.S. EPA. 1987. *A Compendium of Superfund Field Operations Methods*. EPA/540/P-87/001.
- U.S. EPA. 1988. *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final*. Office of Emergency and Remedial Response. EPA/540/G-89/004. OSWER Directive 9355.3-01. October 1988.
- U.S. EPA. 1983. *Draft RCRA Permit Writer's Manual*, Groundwater Protection, 40 CFR Part 264, Subpart F, 263 pp.
- Varljen, M. D., Barcelona, M. J., Obereiner, J., and Kaminski, D. 2006. *Numerical Simulations to Assess the Monitoring Zone Achieved during Low-Flow Purging and Sampling*; Ground Water Monitoring & Remediation 26, no. 1/Winter 2006/pages 44–52.
- Vroblecky, D.A., 2001a, *User's Guide for Polyethylene-Based Passive Diffusion Bag Samplers to Obtain Volatile Organic Compound Concentrations in Wells, Part 1: Deployment, Recovery, Data Interpretation, and Quality Control and Assurance*; U.S. Geological Survey Water-Resources Investigations Report 01-4060, 18 pp.
- Vroblecky, D.A. ed., 2001b, *User's Guide for Polyethylene-Based Passive Diffusion Bag Samplers to Obtain Volatile Organic Compound Concentrations in Wells, Part 2: Field Tests*; U.S. Geological Survey Water-Resources Investigations Report 01-4061, variously paginated.

- West, Candida Cook. 1990. *Transport of Macromolecules and Humate Colloids through a Sand and a Clay Amended Sand Laboratory Column*. EPA Project Summary, EPA/600/S2-90/020, 7 pp.
- Wilde et al. 1998. Wilde, F.D., D.B. Radtke, J.Gibs and R.T. Iwatsubo, eds., 1998, National Field Manual for the Collection of Water-Quality Data; U.S. Geological Survey Techniques of Water-Resources Investigations, Book 9, Handbooks for Water-Resources Investigations, variously paginated.
- Yeskis, D., K. Chiu, S. Meyers, J. Weiss, and T. Bloom. 1988. *A Field Study of Various Sampling Devices and Their Effects on Volatile Organic Contaminants*. Second National Outdoor Action Conference on Aquifer Restoration, Groundwater Monitoring and Geophysical Methods, NWWA, May 23-26, 1988, pp. 471-479.

## APPENDIX A Sampling Devices

### GRAB SAMPLERS

The four main varieties of bailers are the single check valve, double check valve, messenger, and syringe bailers. Bailers are among the simplest groundwater sampling devices. A bailer is simply a rigid tube that fills with water when lowered into the well; when raised back out of the well, it is sealed on one or both ends by some mechanism. The groundwater sample is subsequently transferred into sample containers from the bailer. Bailers are relatively inexpensive to purchase or fabricate (especially the single and double check valve bailers), easy to clean, portable, simple to operate, and require no external power source (U.S. EPA, 1983).

Disadvantages are that their use can be time consuming and labor intensive and that the transfer of water to a sample container may significantly alter the chemistry of groundwater samples due to degassing, volatilization or aeration. Use of a bailer may also result in an increase of turbidity that may affect analysis results. Bailers should not be used to sample groundwater that will be analyzed for volatile organic compounds, unless a bailer is the only available method, or the bailer is used for sampling LNAPL or DNAPL or the use of a bailer is approved by the lead regulatory agency.

Bailers used to collect groundwater samples and the cable used to raise and lower the bailer should be constructed of material (e.g., fluorocarbon resin, Teflon®, stainless steel, HDPE, or PVC) which does not cause analyte concentrations alteration or cause loss of analytes via sorption. Ideally the bailer should be easy to disassemble to facilitate cleaning and decontamination.

Bailers should never be dropped into a well and should be removed from the well in a manner that causes as little agitation to the sample as possible. For example, the bailer should not be removed in a jerky fashion or be allowed to continually bang against the well casing as it is drawn up. To ensure consistent samples, DTSC recommends that the bailer be submerged only to a depth necessary for filling, except when the bailer is being used to sample a DNAPL. When transferring the sample from a bailer to a container, a bottom emptying device with a valve to allow the water to slowly drain from the bailer should be used. The sample should be allowed to run down the sides of the collection bottle to avoid excessive agitation of the sample.

### POSITIVE DISPLACEMENT (SUBMERSIBLE) MECHANISMS

Positive displacement mechanisms for groundwater sampling include gear drive electric submersible pumps, bladder pumps, helical rotor electric submersible pumps, gas-drive piston pumps, and centrifugal pumps. The following sections briefly describe each of these types of pumps and their applications and limitations with regard to collecting groundwater samples.

#### Bladder Pumps

Bladder pumps (also referred to as gas squeeze pumps) consist of a flexible membrane often enclosed in a rigid stainless steel housing. A strainer or screen attaches below the bladder to filter any material that could clog either of the check valves located above and below the bladder. Water enters the membrane through the lower check valve; compressed gas is injected into the cavity between the housing and bladder. The sample is transported through the upper check valve and into the discharge line. The upper check valve prevents water from reentering the bladder. The process is repeated to cycle the water to the surface. Bladder volumes (e.g., volume per cycle) and sampler geometry can be modified to increase the sampling abilities of the pump. Automated control systems are available to control gas flow rates and pressurization cycles. Bladder pumps prevent contact between the gas and water sample and can be fabricated entirely of fluorocarbon resin and stainless steel. A nearly continuous flow can be attained with

the proper cycles. Pohlmann and Hess (1988) determined that bladder pumps can be suitable for collecting groundwater samples for almost any given organic or inorganic constituent. Disadvantages of bladder pumps include the large gas volumes required to actuate the pump (especially for sampling deep groundwater), and potential bladder rupture. Hence, gas cylinders or air compressors are needed to power the pumps. If using a gasoline or diesel powered air compressor, the compressor should be placed downwind of the wellhead.

If a bladder pump has been chosen as the sampling device, it should be operated at a discharge rate of 100 ml/min or less when collecting samples for volatiles analysis. Higher flow rates can increase the loss of volatile constituents and can cause fluctuation in pH and pH-sensitive analytes. Bladder pumps should be operated in a continuous, non-pulsating manner so that they do not produce samples that are aerated in the return tube or upon discharge. Once the portions of the sample reserved for the analysis of volatile components have been collected, a higher pumping rate may be used, particularly if a large sample volume will be collected. The pump lines should be cleared at a low rate before collecting samples for volatiles analysis, or else the sample collected will be from when the pump was rapidly operating. Running the pump at a low flow rate will take time and may deter the use of a bladder pump when the wells are deep and the lines are long.

#### **Helical Rotor Electric Submersible Pumps**

The helical rotor electric submersible pump consists of a sealed electric motor that powers a helical rotor. The water sample is forced up a discharge line by an electrically driven rotor-stator assembly by centrifugal action. Submersible pumps provide relatively high discharge rates for water withdrawal at depths beyond suction lift capabilities. Pumping rates vary depending upon the size of the motor and sampling depth. Heat buildup should be monitored when low (less than 1 gpm) pump rates are used. Heat shields or pump shrouds may be used to aid in heat buildup. A submersible pump provides higher extraction rates than the majority of other methods. However, considerable sample agitation in the well results from operating at high rates, and this may cause alteration of the sample chemistry. In addition, high pumping rates can introduce sediments from the formation into the well that are immobile under ambient groundwater flow conditions, resulting in the collection of unrepresentative samples for metals due to potential partitioning upon contact with the sediment. Further, the potential exists for the introduction of trace metals into the sample from the pump materials. Steam cleaning of the unit followed by rinsing with unchlorinated, deionized water in between sampling is recommended. Where the submersible pump is used for sampling, those parts of the pump in contact with water should be constructed of stainless steel.

#### **Gas-drive Piston Pumps**

A piston pump uses compressed air to force a piston to raise the sample to the surface. A typical design consists of a stainless steel chamber between two pistons. The alternating chamber pressurization activates the piston, which allows water entry during the suction stroke of the piston, and forces the sample to the surface during the pressure stroke. Pumping rates of 500 ml/min have been reported from 30.5 meters; sampling depths of 150 meters are possible. The piston pump provides continuous sample withdrawal at depths greater than is possible with most other approaches. Nevertheless, contribution of trace elements from the stainless steel and brass fittings is a potential problem. Pumping rates at depths less than 150 meters are generally slower than with other pumps.

#### **Centrifugal Pumps**

A centrifugal (sometimes called impeller) pump is similar to the direct line pump except that a centrifugal pump is connected to the tubing at the surface rather than a vacuum pump. A foot valve is usually attached to the end of the well tubing to assist in priming the extraction tube. A centrifugal pump is capable of delivering large quantities of water, against high as well as low head conditions, with good efficiency. Under field conditions a centrifugal pump has an average suction lift capability of 20-25 feet (6.1-7.6 meters) (Driscoll, 1986). Although relatively high pumping rates can be attained, centrifugal pumps cause sample agitation.

## **SUCTION LIFT PUMPS**

Suction lift pumps can be categorized as direct line and peristaltic. The direct line pump requires lowering one end of a plastic tube into a well or piezometer. The surface end of the tube is connected to a two-way stoppered bottle, and a manually or auxiliary powered vacuum pump is attached to a second tube that leads from the bottle. A check valve is attached between the second tube and the vacuum pump to maintain a constant vacuum control.

A peristaltic pump (also called rotary peristaltic) is a self-priming, low-volume suction pump consisting of a rotor and three ball bearing rollers. Plastic tubing inserted around the pump rotor is squeezed by the rollers as they revolve in a circle around the rotor. One end of the tubing is placed into the well while the other end is connected directly to a two-way stoppered flask. As the rotor revolves, water is drawn into the sampling tube and discharged into the collection vessel. A drive shaft connected to the rotor head can be extended so that multiple rotor heads can be attached to a single drive shaft. The withdrawal rate of peristaltic pumps can be carefully regulated by adjusting the rotor head revolution. The system can be arranged so that the sample contacts only fluorocarbon resin tubing prior to entering the sample container. A limiting factor is the depth of sampling; the depth of sample collection is limited to situations where the potentiometric level is less than 25 feet below land surface (Nielsen, 1991). The suction lift approach offers a simple retrieval method for shallow monitoring wells. However, the method can result in sample mixing and oxidation. Degassing and loss of volatiles also occur to some extent. A peristaltic pump provides a lower sampling rate and less agitation than direct line or centrifugal pumps. Hence, when sampling for VOCs, the sampling results will be biased low. Accordingly, sampling with suction lift pumps should be done for screening purposes only.

## **GAS CONTACT PUMPS**

Gas contact sampling devices include gas-lift and gas-drive devices.

### **Gas-Lift Pumps**

An air or gas lift pump allows collection of groundwater samples by bubbling air or gas at depth in the well. Sample transport occurs primarily as a result of the reduced specific gravity of the water being lifted to the surface. Water is forced up a discharge pipe, which may be the outer casing or a smaller diameter pipe inserted into the well. Air or gas lift methods can result in considerable sample agitation and mixing in the well, and are not permitted for collecting samples for chemical analysis. The considerable pressures required for deep sampling can result in significant redox and pH changes.

### **Gas-Drive Pumps**

Gas drive (gas displacement) pumps are distinguished from air lift pumps by their method of sample transport. Gas displacement pumps force a column of water under linear flow conditions to the surface without extensive mixing of the pressurized gas and water. A vacuum can also be used to assist the gas. The disadvantages of a gas drive pump are that the drive gas comes into contact with the water and therefore, can be a source of contamination; also, the pump can be difficult to clean.

Gas control pumps should not be used for the collection of groundwater samples at hazardous substances release sites due to the potential for sample alteration.

## **PASSIVE SAMPLERS**

The effectiveness of a single passive sampler in a well is dependent on groundwater flow through the well screen and whether the water quality directly adjacent to the sampler is representative of the entire screened interval. If there is intrabore flow, multiple intervals contributing to flow, or varying concentrations of contaminants vertically within the screened interval, then multiple passive samplers within a well may be more appropriate for sampling the well. (Vroblecky, D.A., 2001a, Vroblecky, D.A., 2001b).

Passive samplers are classified on the basis of sampler mechanism and nature of the collected sample. A more detailed discussion of these samplers can be found at [www.itrcweb.org/Documents/DSP\\_4.pdf](http://www.itrcweb.org/Documents/DSP_4.pdf).

*1. Devices that recover a grab well water sample.*

Samples are an instantaneous representation of conditions at the sampling point at the moment of sample collection.

- HydraSleeve™ Samplers
- Snap Sampler™

*2. Devices that rely on diffusion of the analytes for the sampler to reach and maintain equilibrium with the sampled medium.*

Samples are time-weighted toward conditions at the sampling point during the latter portion of the deployment period. The degree of weighting depends on analyte and device-specific diffusion rates. Typically, conditions during the last few days of sampler deployment are represented.

- Regenerated-Cellulose Dialysis Membrane Samplers
- Nylon-Screen Passive Diffusion Samplers (NSPDS)
- Passive Vapor Diffusion Samplers (PVDs)
- Peeper Samplers
- Polyethylene Diffusion Bag Samplers (PDBs)
- Rigid Porous Polyethylene Samplers (RPPS)

*3. Devices that rely on diffusion and sorption to accumulate analytes in the sampler.*

Samples are a time-integrated representation of conditions at the sampling point over the entire deployment period. The accumulated mass and duration of deployment are used to calculate analyte concentrations in the sampled medium.

- Semi-Permeable Membrane Devices (SPMDs)
- GORE™ Sorber Module
- Polar Organic Chemical Integrative Samplers (POCIS)
- Passive In-Situ Concentration Extraction Sampler (PISCES)

## **HYDRASLEEVE™ SAMPLERS**

HydraSleeve™ samplers are designed to recover groundwater from monitoring wells without purging and can be used to sample a wide spectrum of analytes (e.g., VOCs, semi-volatile organics, and metals) and can also be used to sample low-yielding wells. HydraSleeve™ samplers allow recovery of discrete samples from the screened zone where the sampler is activated, with no drawdown and minimal agitation of the water column. The reed valve design keeps the device closed except during sample collection, thereby assuring that the sample is collected from the desired interval within the screened zone.

## **SNAP SAMPLER™**

The Snap Sampler™ is designed to collect groundwater samples in situ without purging. The Snap Sampler™ utilizes specialty double-ended bottles closed while submerged in the well. A well re-equilibration period is recommended for passive deployments. The Snap Sampler™ VOA vial can be used directly in common laboratory auto sampler equipment, so samples are not exposed to ambient air during retrieval, field preparation, or analysis at the lab unless manual dilutions or re-analyses are required. Utilizing minimum sample volume requirements, this sampler can be used for analyzing many different physical and/or chemical water quality parameters, including VOCs and metals.

## **REGENERATED-CELLULOSE DIALYSIS MEMBRANE SAMPLERS**

Regenerated-cellulose dialysis membrane samplers collect groundwater samples for inorganic ionic constituents as well as organic constituents using a diffusion-type sampler. Dialysis membrane samplers can be used to sample a wide spectrum of water-quality parameters.

### **NYLON-SCREEN PASSIVE DIFFUSION SAMPLERS (NSPDS)**

NSPDS are diffusion based samplers developed to sample for a broader range of analytes than can be collected by the PDB sampler. Larger volumes can be obtained by using a stack of bottles in the same mesh sleeve.

### **PASSIVE VAPOR DIFFUSION (PVD) SAMPLERS**

Passive-vapor-diffusion (PVD) samplers have been used successfully as reconnaissance tools at many hazardous waste sites. The primary use of PVD samplers is to identify locations where VOC contaminated groundwater is discharging into surface water. PVD samplers also have been used as passive-soil-gas samplers in the unsaturated zone. USGS Water-Resources Investigations Report 02-4186 provides detailed guidance for construction and use of PVD samplers.

### **PEEPER SAMPLERS**

Peeper samplers (a.k.a. Hesslein In-situ Pore Water Sampler) are rigid structures, which can hold volumes of water separated from the environment by porous membranes to monitor constituents in saturated environments. Peepers rely on diffusion of the analytes to reach equilibrium between the sampler and the pore water. Peepers (i.e., dialysis cells) have been used for in situ monitoring of dissolved constituents in saturated sediments. The Peepers sampler measures pore water analyte concentrations. Peepers can be stacked in a specially designed corer so that they sample discrete near-surface depths.

### **POLYETHYLENE DIFFUSION BAG (PDB) SAMPLERS**

The Polyethylene Diffusion Bag (PDB) sampler was developed in the late 1990's and has become a widely accepted technique for determining concentrations of VOCs in groundwater monitoring wells. PDBs are installed in groundwater monitoring wells, at one or more intervals below the water surface in the well screen, and left in place under natural flow conditions. PDBs are also used in saturated sediments in and around surface water to approximate VOC discharge to the surface.

### **RIGID POROUS POLYETHYLENE SAMPLERS (RPPS)**

Rigid porous polyethylene samplers (RPPSs) are diffusion based samplers developed to sample for a broader range of analytes than can be collected by the PDB sampler. The RPPS is constructed from thin sheets of foam-like porous polyethylene with pore sizes of 6 to 15 microns. The sampler is filled with water free of the target analytes, capped at both ends, and placed inside a mesh liner, which is subsequently attached to a deployment rope using cable-ties and deployed in a well.

### **SEMI-PERMEABLE MEMBRANE DEVICES (SPMDs)**

Semi-permeable Membrane Devices (SPMDs) are designed to sample chemicals dissolved in surface water, mimicking the bioconcentration of organic contaminants into the fatty tissues of organisms. The SPMD enables concentration of trace organic contaminant mixtures for analysis, toxicity assessments, and toxicity identification evaluation. It is designed to sample lipid or fat-soluble (nonpolar or hydrophobic) semi-volatile organic chemicals from water and air. The SPMD is an integrative sampler which accumulates analyte mass over a deployment period ranging from days to months. SPMDs provide a highly reproducible means for monitoring contaminant levels, and are largely unaffected by many environmental stressors affecting biomonitoring organisms.

### **GORE™ SORBER MODULE**

The GORE™ Sorber Module relying on diffusion and sorption to accumulate analytes in the sampler. These modules yield a total mass of analytes that can be correlated with analyte concentrations in water

or air. This device can be utilized to sample soil gas in the vadose zone and dissolved organic analytes in water saturated soils or in groundwater monitoring wells. This device has been used in both fresh and saltwater environments, including sampling sediments in marshes, streams, river embankments, and coastal settings.

#### **POLAR ORGANIC CHEMICAL INTEGRATIVE SAMPLER (POCIS)**

The Polar Organic Chemical Integrative Sampler (POCIS) is designed to sample water-soluble (polar or hydrophilic) organic chemicals from aqueous environments. This device relies on diffusion and sorption to accumulate a total mass of analytes. The residence period ranges from weeks to months. The POCIS samples chemicals from the dissolved phase, mimicking the respiratory exposure of aquatic organisms. The POCIS also concentrates trace organic contaminants for toxicity assessments and toxicity identification evaluation (TIE) approaches.

#### **PASSIVE IN-SITU CONCENTRATION EXTRACTION SAMPLER (PISCES)**

The Passive In Situ Concentration Extraction Sampler (PISCES) is designed to sample non-polar or hydrophobic organic chemicals in surface water. This device relies on diffusion and sorption to accumulate a total mass of analytes. The residence period ranges from one day to one month. PISCES consist of a membrane, typically low-density polyethylene (LDPE), forming one end of a metal container filled with an organic solvent, typically hexane or isooctane (2,2,4- trimethylpentane). Analyte uptake is driven by the preferential partitioning of nonionic organic chemicals from water to the solvent. The membrane excludes ionic, high molecular-weight natural organic matter, and particulates.

Where site conditions are not fully characterized, side-by-side comparisons between multiple well-volume purge, low flow groundwater sampling, and diffusion bag sampling methods may be necessary to determine which method should be used to yield the most representative data. The sampling method ultimately used should be discussed with the lead agency before implementation.

Additional information on the use of these samplers can be found at [www.itrcweb.org/Documents/DSP\\_4.pdf](http://www.itrcweb.org/Documents/DSP_4.pdf)

#### **PACKER ASSEMBLAGES**

A packer assembly provides a means by which to isolate and sample a discrete interval in the subsurface. Hydraulic- or pneumatic-activated packers are wedged against the casing wall allowing sample collection from an isolated portion of the well. The packers deflate for vertical movement within the well and inflate when the desired depth is attained. Packers are usually constructed from some type of rubber or rubber compound and can be used with submersible, gas lift, and suction pumps.

If pumps are operated at a low rate, a packer assembly allows sampling of low-yielding wells, and wells that would otherwise produce turbid samples. A number of different samplers can be placed within the packers depending upon the analytical specifications for sample testing. One disadvantage is that vertical movement of water outside the well (e.g., if used in the screened interval) is possible with packer assemblages, depending upon the pumping rate and formation properties. Another possible disadvantage is that the packer material may contribute undesirable organic constituents to the water sample.

TABLE A1. Generalized guide for selection of groundwater sampling devices. Modified from U.S. EPA (1991).

Device Type	Device	Groundwater Parameters													
		Inorganic						Organic					Radioactive		
		EC	pH	Redox	Major ions	Trace metals	Nitrate/Fluoride	Dissolved gases	Non-Volatile	Volatile	TOC	TOX	Coliform bacteria	Radium	Gross alpha and beta
Portable Sampling Devices	Grab	Open Bailer	I	G	G	I	I	I	G	I	G	G	I	I	G
		Point Source Bailer	I	I	I	I	I	G	I	G	I	I	I	I	G
		Passive Diffusion Bags	G	G	G	G	G	G	G	Limited constituents	G	G	G	G	G
		Bat Sampler	I	I	I	I	I	I	I	I	I	I	I	I	I
		Hydropunch	I	I	I	I	I	I	I	I	I	I	I	I	I
		Geoprobe	I	I	I	I	I	I	I	I	I	I	I	I	I
		Syringe Sampler	I	I	I	I	I	I	G	I	I	G	I	I	I
		Gear-drive	I	I	I	I	I	I	I	I	I	I	I	I	I
		Bladder Pump	I	I	I	I	I	I	I	I	I	I	I	I	I
		Helical Rotor (electrical)	I	I	I	I	I	I	I	I	I	I	I	I	I
Positive Displacement (Submersible)	Piston Pump (gas drive)	I	G	G	I	I	I	G	I	I	G	G	I	I	
	Centrifugal (low-rate)	I	I	I	I	I	I	I	I	I	I	I	I	I	
	Peristaltic	I	G	G	I	I	I	G	I	G	G	I	I	I	
Suction Lift	Peristaltic	I	I	I	I	I	I	I	I	I	I	I	I	I	
	Pneumatic	I	I	I	I	I	I	G	I	G	G	I	I	I	

**Acronyms and Abbreviations**

EC electroconductivity TOC total organic carbon  
 Redox oxidation/reduction potential TOX total organic halides

**Symbols**

I Device is generally suitable for application (assuming device is properly operated and is constructed of suitable materials).  
 G Device may be unsuitable or untested for application.

**Sanitation Districts of Los Angeles County  
Laboratories Section**

**METHOD APPROVAL FORM**

*Method Number*      Not Applicable

*Method Name*        Low-flow purging for groundwater sampling

*Version*              10.1.0

*Method Date*        February 18, 2010

*Reasons for  
Method Revision*      Annual Review; no revisions were made

*Reviewed by:*

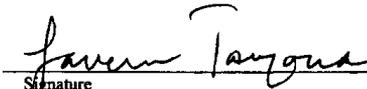
Kelly Lechuga  
Laboratory Technician II  
Lancaster Sampling Receiving

  
Signature

3/24/10  
Date

*Approved by:*

Lavern Tamoria  
Supervising Chemist  
QA/Sample Receiving

  
Signature

3/24/10  
Date

*Final Approval:*

Maria Pang  
Assistant Manager of  
the Laboratories

  
Signature

4/22/10  
Date

## LOW-FLOW PURGING AND SAMPLING FOR GROUNDWATER

### INTRODUCTION

Monitoring wells in the Antelope Valley area have been used over a number of years to assess groundwater quality. The monitoring wells vary in depth from less than 15 feet (MW120 in Lancaster) to 540 feet (MW2 in Palmdale). Several wells are located in the same vicinity while others are more isolated (see Attachments 1 and 2).

#### 1. Scope and Application

- 1.1 This procedure is applicable to groundwater.
- 1.2 This procedure explains the limiting factors involved in sampling low-flow monitoring wells, lists the hazards and appropriate safety precautions needed, and identifies what is required of personnel performing these tasks.
- 1.3 This procedure describes the protocol for LACSD low-flow sampling of monitoring wells in Lancaster and Palmdale. It explains the proper procedures to collect field data including depth-to-water (DTW), purge wells, and to collect samples for later analysis by both Districts' and contract laboratories.

#### 2. Summary of Procedure

- 2.1 Measure the depth-to-water (DTW) of the well by lowering an engineering tape down the well casing until the probe contacts the surface of the water.  
  
If more than one well in the local area will be sampled, take DTW measurements of the wells **before any** purging or sampling is performed. Compare the DTW measurements, and sample the shallow well first, the deeper well next and the deepest well last.
- 2.2 Assemble the well purging equipment. This includes connecting the hose valves to the control box and N<sub>2</sub>/CO<sub>2</sub> canisters, attaching the control box to the well port, and connecting the flow cell to the discharge line on the well assembly.
- 2.3 Adjust the settings on the control box according to the well specifications. Purge the well line, and allow the field parameters to reach stability prior to sampling the well water.

#### 3. Sample Handling and Preservation

- 3.1 Groundwater samples are collected using appropriate containers and preservation methods as directed in Standard Methods for the Examination of Water and Wastewater.
  - 3.2 After collection, and as soon as possible, place samples into an ice chest with ice to keep their temperatures at 0-6°C during transport from the sample location to Sample Receiving (SRC).
  - 3.3 Once removed from the ice chest, the samples are placed into a refrigerator or walk-in cooler to maintain the cold temperature for storage.
4. Interferences
- 4.1 A flattened well bladder, or ruptured bladders/tubing, will result in insufficient sample volumes produced.
  - 4.2 Blowing sand can affect sampling by contaminating the samples being collected. It can also damage the equipment, as sand particles can become lodged in the pressure relief valves, preventing the required pressure from being available for sampling.
  - 4.3 Extreme temperatures are often a deterrent to well sampling. Highs above 100°F can cause the gases in the N<sub>2</sub>/CO<sub>2</sub> tanks to expand, resulting in uncontrolled pressure fluctuations. Below freezing temperatures are common in the Antelope Valley during the winter months. Since the check valve on the well pump prevents backflow of water into the well, extreme low temperatures can freeze water contained within the upper feet of the pump tubing.
  - 4.4 Fluctuating groundwater tables within the Antelope Valley can prevent well sampling. When the water levels are within three feet of the top of the well inlet, the water pressure becomes insufficient to provide the force necessary to raise the water to ground level. Additionally, any significant drawdown will prevent the bladder from fully inflating, resulting in poor sample volumes per purge.
5. Apparatus
- 5.1 Compressed nitrogen gas (cylinder size T is preferable), or compressed carbon dioxide gas (for use with the backpack sampler)
  - 5.2 Depth-to-Water Meter [Micro Purge basics (MP) 30 Drawdown Meter]
  - 5.3 Control Boxes (MP10 Controller)
  - 5.4 Backpack Sampler (MP15 Control & Power Pack)

- 5.5 Hydrolab (MP20 Flow Cell)
- 5.6 Tubing (Bonded 1/4" and 3/8" Teflon-lined; 1/2" Tygon)
- 5.7 Hoses (200' extended reach reel; various hoses with male/female quick connects)

## 6. Reagents

- 6.1 Not Applicable.

## 7. Procedure

### 7.1 Use and Care of the Equipment

- 7.1.1 Check all equipment connections and hoses prior to and after each use to ensure that no damage has occurred.

- 7.1.1.1 Examine depth-to-water meter probe and individual flow cell probes for possible fouling of membranes after each use.

- 7.1.2 All equipment should be stored securely in the vehicle lock boxes to prevent possible theft or damage from the elements.

### 7.2 Calibration

- 7.2.1 The flow cell is calibrated in accordance with the specifications as outlined in the QED Flow Cell User's Guide.

- 7.2.1.1 Calibrations are performed at the start of each sampling day.

### 7.3 Procedural Guidelines

- 7.3.1 **Depth-to-Water.** This instrument measures depth readings from a set point at the top of the well port to a level even with the water's surface. It is composed of a probe at the end of a graduated engineering tape. The probe sends an audible signal when it comes in contact with the water.

- 7.3.1.1 Test the meter prior to use to ensure that the batteries are charged, as this allows the signal to be heard.

- 7.3.1.2 Switch the speaker control to on, and press the I/O button (unit on/off) to test for signal strength.

- 7.3.1.3 Note the tubing length for the well in question as this will approximate how far the probe may need to be fed into the well.
- 7.3.1.4 Remove the cap from the well assembly, and slowly lower the probe into the well casing. As there is no brake provided on the handle of the DTW meter, lower the line at a controllable rate.
- 7.3.1.5 When the probe sounds, indicating that it has come in contact with water, slowly reel in the line until the probe is just even with the water's surface.
- 7.3.1.6 Measurements will be taken at a point even with the top of the well port. This number should be documented as the DTW for the appropriate well.
- 7.3.1.7 Allowable drawdown is equal to 1/4 the distance from DTW to the pump.
  - 7.3.1.7.1 For example, if the DTW is 310', and the tubing length is 330', drawdown equal to 5' is allowed for that well.
- 7.3.1.8 Switch the drawdown control to on, and lower the probe to the depth indicated as the maximum allowable drawdown. With drawdown control on, the probe will sound when it loses contact with water.
- 7.3.1.9 Attach one end of the cable connection to the control port on the meter; the other end should be attached to the control box.
  - 7.3.1.9.1 This connector signals the controller when maximum allowable drawdown is reached, causing the unit to pause pumping until the well has recovered.
- 7.3.1.10 The DTW meter has its own port on the well assembly, so the line should remain in place during the well purge to monitor any possible drawdown.
  - 7.3.1.10.1 **As purging and sampling can impact nearby wells, it is important, prior to purging wells adjacent to one another, to take all applicable DTW measurements.**

- 7.3.1.11 If the probe loses contact with water for more than ten minutes, the unit will automatically shut off; press the I/O button to turn it on again.
- 7.3.2 Assembly of Well Purging Equipment - This includes the gas cylinders, control box, hydrolab, tubing, and hoses. Most of the well equipment is fitted with male/female quick connects, allowing for easy assembly.
  - 7.3.2.1 Nitrogen gas cylinders – These will typically only be used on deep Palmdale wells, although all wells can be purged using nitrogen gas.
    - 7.3.2.1.1 Carefully remove the cover from the top of the cylinder, and screw on the protective sampling cap.
    - 7.3.2.1.2 Screw the regulator to the cylinder, and use a wrench to ensure a secure connection.
    - 7.3.2.1.3 Attach the other end of the hose to the “Air In” valve of the control box.
  - 7.3.2.2 Backpack Sampler - This is a combination of a small aluminum CO<sub>2</sub> canister with attached control box. The backpack sampler is used for more remote Lancaster wells when accessibility is an issue. It consists of one hose, which attaches directly to the well cap.
    - 7.3.2.2.1 Switch the power button to “on” after connecting the hose, and then turn on the cylinder.
    - 7.3.2.2.2 Adjust the pressure by pulling out slightly on the regulator knob and then turning it to the correct psi setting.
    - 7.3.2.2.3 All other adjustments are made as with the other control box.
  - 7.3.2.3 Control Box
    - 7.3.2.3.1 Attach one end of the connector hose to the “Air Out” valve of the control box, and the other end of the hose to the appropriate connection on the well cap.
    - 7.3.2.3.2 Make sure the nitrogen cylinder is securely attached.

- 7.3.2.3.3 Open the valve slightly on the top of the cylinder, allowing the pressure to equilibrate.
- 7.3.2.3.4 Once the pressure is stable, and it is determined that no gas is leaking through the various connections, open the valve all the way, and lock the cylinder cap.

#### 7.3.2.4 Hydrolab

- 7.3.2.4.1 The probes on the hydrolab are stored in a casing containing tap water, which prevents the probes from drying out.
- 7.3.2.4.2 Unscrew this cover, making sure not to spill the water, and set to the side.
- 7.3.2.4.3 With the hydrolab equipment is a flow-thru cell that allows water to pass over the probes and escape through a short piece of tygon tubing.
- 7.3.2.4.4 Attach the flow-thru cell to the probe end of the hydrolab. The flow-thru cell prevents the water from contacting air directly, thereby providing representative groundwater samples.
- 7.3.2.4.5 The hydrolab is equipped with a circulator, which provides a continuously fresh sample to the sensors, allowing for reliable dissolved oxygen measurements.

#### 7.3.3 Well Purging. The wells are tagged with all the necessary information to perform a successful sampling event.

- 7.3.3.1 The control box should be set to the predetermined ID number (the ID numbers are pre-determined based on the number of cycles per minute, as well as discharge and refill rates).
  - 7.3.3.1.1 This is achieved by pressing the “Mode” button once to get the cursor underneath the ID number, and then using the up and down arrows to make any adjustments.
  - 7.3.3.1.2 If needed, the cursor can be moved to the next column over using the (⇔) Value button.

- 7.3.3.2 Once set to the given ID number, adjust the pressure throttle to reflect the maximum pressure indicated on the well tag. This will result in the flow maintaining a slow and steady rate.
- 7.3.3.3 Press the start button to begin sampling.
- 7.3.3.4 It is recommended to have a 5-gallon bucket or similar to collect any water discharged.
- 7.3.3.5 Use a plastic beaker to measure the amount of water released per cycle. The estimated mL/min should be indicated on the well tag, as should the minimum purge volume (a value equal to the amount of water present in the tubing).
- 7.3.3.6 Once this minimum volume has been purged, connect the hydrolab to the dedicated well tubing with the tygon inflow tubing on the flow cell.
  - 7.3.3.6.1 The connector may need to be replaced, depending on the tubing diameter of the well (various connector pieces are provided with the flow cell).
- 7.3.3.7 The hydrolab will gradually fill with water. When the flow cell is full, tilt the hydrolab to remove any air pockets surrounding the probes.
- 7.3.3.8 Use the left/right arrows to move the cursor to the purge scan icon marked "Store", and press Enter. This will execute the selected icon, and begin tracking for stabilization of the selected parameters.
  - 7.3.3.8.1 The hydrolab will automatically store data every three minutes, with back-up data every five minutes.
- 7.3.3.9 When at least three consecutive readings have been taken that satisfy the stabilization range, the hydrolab will sound; note the time and record temperature (T), pH, dissolved oxygen (DO), and specific conductivity (SPC) from hydrolab readout.
- 7.3.3.10 Any water samples to be collected should be taken through the dedicated tubing to prevent possible sample contamination, so disconnect the hydrolab, and collect the requisite samples.
- 7.3.3.11 When the needed samples have been collected, push the hold "[F]" button on the control box. This will halt any further refill/discharge cycles.

- 7.3.3.12 Turn the gas cylinder to off. Turn the control box throttle counter-clockwise to release any remaining pressure in the “Air Out” line, and disconnect the hose from “Air Out” to the well cap.
- 7.3.3.13 Turn the throttle clockwise as far as possible, and push the hold button twice.
  - 7.3.3.13.1 This will allow any air/nitrogen remaining in the “Air In” line to escape.
- 7.3.3.14 When no more gas is escaping, turn the throttle back to zero and disconnect the compressor/cylinder.
- 7.3.3.15 **Be sure to remove the regulator from the gas cylinder prior to transport.**

#### 7.4 Troubleshooting Procedure

- 7.4.1 For wells that fail to produce water or have decreasing purge rates, try the following:
  - 7.4.1.1 Pressure may drop/be insufficient for purging; check control box.
  - 7.4.1.2 Adjust the discharge/refill times to ensure water is still being released at the end of the discharge cycle, and that at least five seconds of refill time remain when venting ceases.
  - 7.4.1.3 Attach control box directly to compressor/cylinder without the extension hose.
  - 7.4.1.4 Check that all attachments are secure.
  - 7.4.1.5 Check tubing length for well. Occasionally there is too little water present to purge and sample. The water should be at least 3 feet over the top of the pump to provide sufficient lift.
  - 7.4.1.6 Look for possible drawdown; the well may not have enough refill time to meet demand.
  - 7.4.1.7 Examine the tubing for kinks or tears. Depending on outside temperatures, the water may also freeze in the lines, which will prevent sampling from occurring.
- 7.4.2 If the hydrolab is not stabilizing:

- 7.4.2.1 Make sure there is no air trapped in the flow cell.
- 7.4.2.2 Check the previous data frames to determine which constituent is preventing stabilization from being reached (typically DO)
- 7.4.2.3 The hydrolab can store up to 200 data frames; make sure it has not reached this maximum. If it has, “Fail” will be displayed in the parameter readings.
- 7.4.2.4 Look for the circulator icon on the unit screen. If the icon is not displayed, press and hold the “Esc” button to toggle it on again.

## 7.5 Hazard Control Measures and Limitations

- 7.5.1 Take proper precautions when approaching well sites to prevent vehicles from becoming trapped in the sand. Examine the ground if necessary, and contact the project engineer if the site is inaccessible.
- 7.5.2 *Sampling cannot be conducted under extreme climatic conditions. Freezing temperatures prevent sampling, as the water remains in the tubing at or above ground level. In addition, sampling also cannot occur on excessively hot days (temperatures in excess of 100 °F), due to pressure gradients in the hoses and control box.*
- 7.5.3 When opening well covers, do so carefully and open away from you to avoid possible contact with any animals, spiders, etc, which may be present.
- 7.5.4 Always carry a first-aid kit, and know the protocol to follow (contact persons, location of emergency care facilities, etc) in case of emergency. Familiarizing oneself with these procedures **in advance** may aid in avoiding confusion should incidents occur.
- 7.5.5 Snakes, coyotes, and other animals may be encountered, and spiders (black widows in particular) are an almost certainty. Vagrants are known to occasionally frequent areas near some of the well sites, so it is advisable to be alert to one’s surroundings.
- 7.5.6 Improper connections could result in leakage of N<sub>2</sub>/CO<sub>2</sub> gas, or hoses thrashing about if they become disconnected. Ensure that all connections are secure and tightened prior to turning on gas cylinders.

## 8. Calculations

8.1 Not Applicable.

9. Quality Assurance Guidelines

9.1 Not Applicable.

10. Method Performance

10.1 Not Applicable.

11. References

11.1 Laboratory Section: Procedures for the Characterization of Water and Wastes, 4th Edition, 1989, James D. Lehner.

11.2 QED Flow Cell User's Guide, March 2004.

**Sanitation Districts of Los Angeles County  
Laboratories Section**

**METHOD APPROVAL FORM**

*Method Number*      Not Applicable  
*Method Name*        Lysimeter Sampling of Groundwater  
*Version*              10.1.0  
*Method Date*        April 28, 2010  
*Reasons for  
Method Revision*      Annual review; no revisions were made

*Written by:*

Julie Randol  
Laboratory Technician II  
Lancaster Sample Receiving

  
\_\_\_\_\_  
Signature

04-28-10  
Date

*Approved by:*

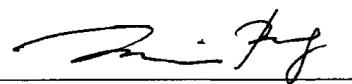
Lavern Tamera  
Supervising Chemist  
QA/Sample Receiving

  
\_\_\_\_\_  
Signature

4/28/10  
Date

*Final Approval:*

Maria Pang  
Assistant Manager of  
Laboratories

  
\_\_\_\_\_  
Signature

4/28/10  
Date

## LYSIMETER SAMPLING OF GROUNDWATER

### INTRODUCTION

LACSD utilizes lysimeters in Palmdale to sample vadose zone water quality in sites used for both effluent land application and water recycling through agricultural reuse. The vadose zone monitoring stations (VZ) are located within the authorized effluent management site, and consist of pressure-vacuum (p-v) samplers and passive capillary (pcap) lysimeters. Several samplers are installed at each station at depths of approximately 5 feet and 15 feet in order to provide a vertical distribution of vadose zone pore-fluid chemistry (see the District's amended Vadose Zone Monitoring Plan for lysimeter specifications and approximate locations).

#### 1. Scope and Application

- 1.1 This procedure is applicable to vadose-zone groundwater.
- 1.2 This procedure explains the limiting factors involved in sampling lysimeters, lists the hazards and appropriate safety precautions needed, and identifies what is required of personnel performing these tasks.
- 1.3 This procedure describes the protocol for LACSD sampling of lysimeters in Lancaster and Palmdale. It explains the proper procedures to collect samples for laboratory analysis.

#### 2. Summary of Procedure

- 2.1 Connect the sample line for the passive capillary lysimeter to the portable pump using the vacuum flask and appropriate hose.
- 2.2 Turn on the portable pump, and use the vacuum flask to collect any water present in the system.
- 2.3 For pressure-vacuum samplers, use the vacuum line attachment to set a vacuum, which allows the lysimeter to draw water from the surrounding area. The following day, use the pressure hose attachment to retrieve any water collected over the previous 24 hours.

#### 3. Sample Handling and Preservation

- 3.1 Lysimeter samples are collected using appropriate containers and preservation methods as directed in Standard Methods for the Examination of Water and Wastewater.

- 3.2 After collection, and as soon as possible, place samples into an ice chest with ice to keep the temperatures at 0-6°C during transport from the sample location to Sample Receiving.
  - 3.3 Once removed from the ice chest, the samples are placed into a refrigerator or walk-in cooler to maintain the cold temperature for storage.
4. Interferences
    - 4.1 The samplers are located in agricultural reuse areas, so the amount of water present is significantly affected by the amount of water being applied at that time. Fallow pivot areas may produce no moisture until crops are reintroduced.
    - 4.2 Blowing sand can affect sampling by contaminating the samples being collected. It can also damage the equipment, as sand particles can become lodged in the pressure relief valves, preventing the required pressure from being available for sampling.
    - 4.3 Agricultural equipment may occasionally cause damage by tearing through the sample lines during routine maintenance of the crop area.
5. Apparatus
    - 5.1 Portable Electric P-V Pump Model 2008 (Soil Moisture Equipment Corp.)
    - 5.2 Vacuum flask
    - 5.3 Pressure/Vacuum Gauges
6. Reagents
    - 6.1 Not Applicable.
7. Procedure
    - 7.1 Use and Care of the Equipment
      - 7.1.1 Check all equipment connections, gauges and lines prior to and after each use to ensure that no damage has occurred.

7.1.2 All equipment should be stored securely in the vehicle lock boxes to prevent possible theft or damage from the elements.

## 7.2 Calibration

7.2.1.1 Not applicable

## 7.3 Procedural Guidelines

### 7.3.1 Assembly of Sampling Equipment -

7.3.1.1 P-V Pump – The pump has two attachment sites, labeled “pressure port” and “vacuum port”.

7.3.1.1.1 The pressure port is used exclusively for collection with the p-v samplers. It should be connected to the tubing of the lysimeter via the pressure gauge.

7.3.1.1.2 The vacuum port is used when producing a vacuum on the lysimeter sample lines. Attach the vacuum gauge to the appropriately labeled connector on the pump. Connect the gauge to the pressure-vacuum line if sampling a p-v lysimeter, or to a vacuum flask if collecting water from a pcap.

7.3.1.2 Vacuum Flask – This is only used when sampling pcap lysimeters, and allows for the collection of water samples while maintaining a vacuum on the sampling line.

7.3.1.2.1 Connect the vacuum gauge to the portable p-v pump. Attach the gauge to the flask via the short piece of black tubing attached to the hose barb.

7.3.1.2.2 Remove the o-ring from the pcap lysimeter blue sample line, and attach the sample line to the stopper of the flask via the attached green tubing.

7.3.2 Lysimeter Sampling – At the top of the lysimeter are two lines with 3/16” tubing attached to the end of each. These ends are folded over, and held in place with an o-ring that maintains the vacuum (where applicable) within the sample line. Note: the tubing may remain pinched after removing the o-rings. Roll or manipulate the tubing to allow for free flow of air/water.

7.3.2.1 Passive Capillary Lysimeters – Pcap lysimeters use a tipping spoon to collect water without applying pressure to the system.

The lysimeters contain a calibration line and a vacuum sampling line.

- 7.3.2.1.1 Attach the vacuum gauge to the p-v pump, and connect it to the blue sample line via the vacuum flask.
  - 7.3.2.1.2 Turn on the pump, making sure to keep the flask in an upright position to prevent any sample from accidentally entering the pump via the gauge.
  - 7.3.2.1.3 Any water present in the system will register on the gauge as an increase in in-Hg, and enter the vacuum flask via the sample line.
  - 7.3.2.1.4 When all the water has been cleared from the system, turn the p-v pump off and record the amount of water collected in the flask. Remove the connections, and dispense the collected sample into the appropriate containers.
  - 7.3.2.1.5 Replace the o-ring on the end of the sample line.
- 7.3.2.2 Pressure-Vacuum Sampler – P-V samplers collect water by first applying a vacuum to the line, and then using pressure to force the collected water to the surface. They consist of a p-v line and a separate sample line.
- 7.3.2.2.1 Connect the black p-v line to the pump via the vacuum gauge. Remove the o-ring at this time.
  - 7.3.2.2.2 Turn on the pump, and allow it to run until the vacuum gauge reads approximately 20in-Hg.
  - 7.3.2.2.3 Fold over the end of the p-v line to maintain the vacuum. Turn off the pump and replace the o-ring.
  - 7.3.2.2.4 Wait 24 hours to allow the vacuum in the line to pull the interstitial moisture from the surrounding soil. This provides a sufficient period for collection without exceeding the holding time for required constituents.
  - 7.3.2.2.5 Attach the black p-v line to the pump via the pressure gauge. Remove the o-ring from both the p-v line and the corresponding green sample line.

- 7.3.2.2.6 Turn on the pump, and allow it to run until no more moisture comes through the sample line.
- 7.3.2.2.7 Any sample present should be collected directly into the sample container(s). Debris can build up on the ends of the sample line, so allow it to run a second or two before directing the flow into the collection jar.
- 7.3.2.2.8 When there is no more moisture present in the system, turn off the pump. Remove the connections and replace the o-rings on the ends of the p-v and sample lines.

#### 7.4 Troubleshooting Procedure

7.4.1 For lysimeters that fail to produce water, try the following:

- 7.4.1.1 Examine the tubing for kinks or tears. Depending on outside temperatures, the water may also freeze in the lines, which will prevent sampling from occurring.
- 7.4.1.2 Ensure that the correct gauge is being used, and that it is attached to the appropriate location on the p-v pump.
- 7.4.1.3 For p-v samplers, check that the vacuum has not been lost. If the vacuum was not maintained during the 24-hour period, it is possible that there may be a break in the line.

#### 7.5 Hazard Control Measures and Limitations

- 7.5.1 Take proper precautions when approaching lysimeter sites to prevent vehicles from becoming trapped in the sand. Examine the ground if necessary, and contact the project engineer if the site is inaccessible.
- 7.5.2 ***Sampling cannot be conducted under extreme climatic conditions. Freezing temperatures prevent sampling, as the water remains in the tubing at or above ground level.***
- 7.5.3 When opening lysimeter covers, do so carefully and open away from you to avoid possible contact with any animals, spiders, etc, which may be present.

- 7.5.4 Always carry a first-aid kit, and know the protocol to follow (contact persons, location of emergency care facilities, etc) in case of emergency. Familiarizing oneself with these procedures **in advance** may aid in avoiding confusion should incidents occur.
- 7.5.5 Snakes, coyotes, and other animals may be encountered, and spiders (black widows in particular) are an almost certainty. Vagrants are known to occasionally frequent areas near some of the lysimeter sites, so it is advisable to be alert to one's surroundings.

8. Calculations

- 8.1 Not Applicable.

9. Quality Assurance Guidelines

- 9.1 Not Applicable.

10. Method Performance

- 10.1 Not Applicable.

11. References

- 11.1 Laboratory Section: Procedures for the Characterization of Water and Wastes, 4th Edition, 1989, James D. Lehner.
- 11.2 Vadose Zone Monitoring System Installation Report, October 2005, Cascade Earth Sciences.

## **Appendix C**

---

# **Chain of Custody / Login Sheet**

# San Jose Creek Water Quality Laboratory Chain of Custody/Login Sheet

162722		Collect Date: 09/01/2010	Matrix: W
WO: PALM_WELL_Q	Profile: Sci-Palm Wells SR	Sample ID: Palmdale Qntry Well Template	
Project Manager: Lavern Tamoria	Ext: 3038	BU: 2013002	UID: B669
Collector: Julie Randol	Receive Temperature: _____ °C		
<b>Container List</b>			
Work Lab: FLD - Field	Container Type: FLD	Preservative: None	

FLD - Field  
 FLDDO - Dissolved Oxygen (membrane) FLD  
 FLDDTW - Field Depth To Water  
 FLDPH - Field pH  
 FLDSM2510B - Conductivity, Field  
 FLDTMP - Field Temperature (Water)  
 FLDTURB - Field Turbidity

<b>Work Lab:</b> WETE - Wet Chem	<b>Container Type:</b> P500ML	<b>Preservative:</b> H2SO4 to pH<2
E351.2 - Nitrogen, Kjeld, Total, FIA (TKN) SM4500NH3G - Ammonia, FIA		
<b>Work Lab:</b> WETE - Wet Chem	<b>Container Type:</b> P1L	<b>Preservative:</b> None
SM2540C - Residue, Filterable (TDS) SM4500NO3F - Nitrite-nitrate, Total, FIA		
<b>Work Lab:</b> WETE - Surfactants (MBAS)	<b>Container Type:</b> P1L	<b>Preservative:</b> None
SM5540C - Surfactants (MBAS)		
<b>Work Lab:</b> ICMK - Metals EPA 200.8 ICPMS (water)	<b>Container Type:</b> P500ML	<b>Preservative:</b> HNO3 to pH<2
E200.8 W - Metals EPA 200.8 ICPMS (water)		
<b>Work Lab:</b> WETA - Total Organic Carbon	<b>Container Type:</b> AG250MLP	<b>Preservative:</b> H3PO4 Pre-acidified
SM5310C - Total Organic Carbon		
<b>Work Lab:</b> SCWK - TPH as Diesel/TPH as Oil (Sub)	<b>Container Type:</b> CG1LW	<b>Preservative:</b> HCl to pH<2
SUB8015BDO - TPH as Diesel/TPH as Oil (Sub)		
<b>Work Lab:</b> SCWK - Subcon to Work Lab	<b>Container Type:</b> EG40MLP	<b>Preservative:</b> HCl, Pre-acidified
SUB8015GRO - TPH as Gasoline (Sub) TOTAL TPH - Total Petroleum Hydrocarbons		
<b>Work Lab:</b> Duplicate Container	<b>Container Type:</b> CG40MLP	<b>Preservative:</b> HCl, Pre-acidified
<b>Work Lab:</b> MSVA - EPA 625 Semi-Volatiles	<b>Container Type:</b> CG1LN	<b>Preservative:</b> None
E625 - EPA 625 Semi-Volatiles		
<b>Work Lab:</b> WETA - Anions by IC, EPA 300.0	<b>Container Type:</b> P500ML	<b>Preservative:</b> None
E300.0 - Anions by IC, EPA 300.0		

**Sample Inspection:** (If "No" selected for any parameter, enter comment on sample and notify PM)

All Containers Intact?	Yes	No	N/A	<b>NOTES:</b>
Containers labeled correctly (match COC)?	Yes	No	N/A	
Proper containers for requested analyses?	Yes	No	N/A	
Containers preserved properly?	Yes	No	N/A	
VOA vial(s) free of headspace?	Yes	No	N/A	
Samples received on Ice?	Yes	No	N/A	
Metals sample preserved with HNO3?	Yes	No	N/A	If N/A, directly from:
Special Handling Instructions?	Yes	No	N/A	If No, report to bench analyst immediately If Yes, report to bench analyst

Relinquished by: \_\_\_\_\_ Date: \_\_\_\_\_ Received by: \_\_\_\_\_ Date: \_\_\_\_\_

Relinquished by: \_\_\_\_\_ Date: \_\_\_\_\_ Received by: \_\_\_\_\_ Date: \_\_\_\_\_

## **Appendix D**

---

# **Minimum Reporting Levels for Priority Pollutants**

## Minimum Levels for Individual Priority Pollutants As Listed in MRP, Attachment E

### Inorganic Constituents

Name of Constituent	Minimum Level	Unit
Antimony	5	µg/L
Arsenic	1	µg/L
Asbestos*	0.2	MFL >10 µm
Beryllium	1	µg/L
Cadmium	0.25	µg/L
Chromium, Total	2	µg/L
Chromium, Hexavalent	5	µg/L
Copper	0.5	µg/L
Cyanide, Total	5	µg/L
Lead	0.5	µg/L
Mercury	0.0005	µg/L
Nickel	5	µg/L
Selenium	5	µg/L
Silver	1	µg/L
Thallium	1	µg/L
Zinc	10	µg/L

\* Monitoring not required, according to MRP

### Pesticides and PCBs

Name of Constituent	Minimum Level	Units
4,4-DDD	0.05	µg/L
4,4-DDE	0.05	µg/L
4,4-DDT	0.01	µg/L
Alpha-Endosulfan	0.02	µg/L
Alpha-BHC	0.01	µg/L
Aldrin	0.005	µg/L
Beta-Endosulfan	0.01	µg/L
Beta-BHC	0.005	µg/L
Chlordane	0.1	µg/L
Delta-BHC	0.005	µg/L
Dieldrin	0.01	µg/L
Endosulfan Sulfate	0.05	µg/L
Endrin	0.01	µg/L
Endrin Aldehyde	0.01	µg/L
Heptachlor	0.01	µg/L
Heptachlor Epoxide	0.01	µg/L
Lindane (Gamma-BHC)	0.02	µg/L
Aroclor 1016*	0.5	µg/L
Aroclor 1221*	0.5	µg/L
Aroclor 1232*	0.5	µg/L
Aroclor 1242*	0.5	µg/L
Aroclor 1248*	0.5	µg/L
Aroclor 1254*	0.5	µg/L
Aroclor 1260*	0.5	µg/L
Toxaphene	0.5	µg/L
2,3,7,8-TCDD (dioxin)*	$5.00 \times 10^{-6}$	µg/L

\* Monitoring not required, according to MRP

### Volatile Organic Constituents

Name of Constituent	Minimum Level	Units
1,1-Dichloroethane	1	µg/L
1,1-Dichloroethene	0.5	µg/L
1,1,1-Trichloroethane	2	µg/L
1,1,2-Trichloroethane	0.5	µg/L
1,1,2,2-Tetrachloroethane	0.5	µg/L
1,2-Dichlorobenzene	2	µg/L
1,2-Dichloroethane	0.5	µg/L
1,2-Dichloropropane	0.5	µg/L
1,2,4-Trichlorobenzene	5	µg/L
1,3-Dichlorobenzene	2	µg/L
1,3-Dichloropropylene (cis & trans)	0.5	µg/L
1,4-Dichlorobenzene	2	µg/L
Acrolein	5	µg/L
Acrylonitrile	2	µg/L
Benzene	0.5	µg/L
Bromoform	2	µg/L
Bromomethane (Methyl Bromide)	2	µg/L
Carbon Tetrachloride	0.5	µg/L
Chlorobenzene (monochlorobenzene)	2	µg/L
Chloroethane	2	µg/L
2-Chloroethyl vinyl ether	1	µg/L
Chloroform	0.5	µg/L
Chloromethane (Methyl Chloride)	2.0	µg/L
Dibromochloromethane	0.5	µg/L
Dichlorobromomethane	0.5	µg/L
Dichloromethane (Methylene Chloride)	2	µg/L
Ethylbenzene	2	µg/L
Hexachlorobenzene	1	µg/L
Hexachlorobutadiene	1	µg/L
Hexachlorethane	1	µg/L
Naphthalene	10	µg/L
Tetrachloroethylene	0.5	µg/L
Toluene	2	µg/L
Trans 1,2-Dichloroethylene	1	µg/L
Trichloroethylene	2	µg/L
Vinyl Chloride	0.5	µg/L

**Semi-Volatile Organic Constituents (Base/Neutral and Acid Extractable)**

<b>Name of Constituent</b>	<b>Minimum Level</b>	<b>Units</b>
1,2-Benzanthracene (Benzo(a)Anthracene)	5	µg/L
1,2-Diphenylhydrazine	1	µg/L
2-Chlorophenol	2	µg/L
2,4-Dichlorophenol	1	µg/L
2,4-Dimethylphenol	2	µg/L
2,4-Dinitrophenol	5	µg/L
2,4 Dinitrotoluene	5	µg/L
2,4,6 Trichlorophenol	10	µg/L
2,6 Dinitrotoluene	5	µg/L
2-Nitrophenol	10	µg/L
2-Chloronaphthalene	10	µg/L
3,3-Dichlorobenzidine	5	µg/L
3,4-Benzo(a)fluoranthene (Benzo(b)fluoranthene)	10	µg/L
4-Chloro-3-Methylphenol	5	µg/L
4,6-Dinitro-2-methylphenol	10	µg/L
4-Nitrophenol	10	µg/L
4-Bromophenyl phenyl ether	10	µg/L
4-Chlorophenyl phenyl ether	5	µg/L
Acenaphthene	1	µg/L
Acenaphthylene	10	µg/L
Anthracene	10	µg/L
Benzidine	5	µg/L
Benzo(a)pyrene	2	µg/L
Benzo(g,h,i)perylene	5	µg/L
Benzo(k)fluoranthene	2	µg/L
Bis(2-chloroethoxy)methane	5	µg/L
Bis(2-chloroethyl)ether	1	µg/L
Bis(2-chloroisopropyl)ether	10	µg/L
Bis(2-ethylhexyl)phthalate	5	µg/L
Butyl benzyl phthalate	10	µg/L
Chrysene	5	µg/L
di-n-Butyl phthalate	10	µg/L
di-n-Octyl phthalate	10	µg/L
Dibenzo(a,h)-anthracene	0.1	µg/L
Diethyl phthalate	2	µg/L
Dimethyl phthalate	2	µg/L
Fluoranthene	10	µg/L
Fluorene	10	µg/L
Hexachlorocyclopentadiene	5	µg/L
Indeno(1,2,3,cd)-pyrene	0.05	µg/L
Isophorone	1	µg/L
N-Nitrosodiphenyl amine	1	µg/L
N-Nitrosodimethyl amine	5	µg/L
N-Nitroso-di-n-propyl amine	5	µg/L
Nitrobenzene	10	µg/L
Pentachlorophenol	1	µg/L
Phenanthrene	5	µg/L
Phenol	1	µg/L
Pyrene	10	µg/L

# **ENCLOSURE 2**

This page is blank intentionally.

**From:** "DeHollan, Erika" <edehollan@lacsds.org>  
**To:** "ETaxer@waterboards.ca.gov" <ETaxer@waterboards.ca.gov>  
**CC:** Scott Ferguson <SFerguson@waterboards.ca.gov>, "Tremblay, Ray" <RTrembla...>  
**Date:** 12/8/2011 4:00 PM  
**Subject:** Tentative Master Recycling Permit for the Palmdale WRP

Eric,

The Sanitation District appreciates the opportunity to provide comments on the Tentative Master Recycling Permit for the Palmdale WRP; however, we will not be submitting any formal comments at this time. We would also like to recognize your and any other Lahontan Regional Board staff efforts that went into preparation of the draft permit. We also appreciate your efforts to have the permit considered at the January Board Members meeting, since we anticipate customers to be ready to use recycled water from the Palmdale WRP in Spring 2012.

Please feel free to contact me if you have any questions or concerns.

Thank you,  
Erika

Erika de Hollan, PE  
Civil Engineer  
Sanitation Districts of Los Angeles County  
1955 South Workman Mill Road  
Whittier, CA 90601  
Phone: (562) 908-4288 Ext. 2836  
Fax: (562) 908-4293