Recomputation of Ambient Water Quality in the Santa Ana River Watershed for the Period 1999 to 2018

SAWPA Commission Meeting – July 21, 2020
Item No. 6.C.
Definition of Terms

Groundwater Quality Objectives

• The Porter-Cologne Act defines water quality objectives as “…the limits or levels of water quality constituents or characteristics which are established for the reasonable protection of beneficial uses of water or the prevention of nuisance within a specific area.”

Ambient Water Quality

• Ambient is defined as the “surrounding environment.” In the context of this study, ambient nitrate and TDS refers to concentrations that are representative of a given volume of groundwater (water in storage in an MZ) for a given period (20-year period evaluated triennially).
In 1995, a Task Force was formed to study the impacts that salt and nitrate have on the long-term sustainability of groundwater supply. The Task Force administered by SAWPA included the Regional Board:

- revised groundwater basin boundaries
- set new water quality objectives based on a better data set
- developed a rigorous scientific method for computing the volume-weighted ambient water quality
2004 Basin Plan Amendment (Resolution R8-2004-001)

Requires the implementation of a watershed-wide monitoring program to:

• determine ambient water quality in groundwater
• assess compliance with groundwater quality objectives, and
• determine if assimilative capacity exists in groundwater management zones.
• Completed the ambient water quality computation six times:
  • 1984 to 2003
  • 1987 to 2006
  • 1990 to 2009
  • 1993 to 2012
  • 1996 to 2015, and
  • 1999 to 2018
Groundwater Management Zone Boundaries and AWQ Objectives
# Triennial AWQ Recomputation Phases

<table>
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<th>Phase</th>
<th>Description</th>
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| **1: Data Gathering** | ✓ Data Compilation  
✓ QA/QC, Process, and Upload recent data |
| **2: Point Statistics** | ✓ Calculate Water Quality Point Statistics  
✓ Shapiro-Wilk Test for Normality |
| **3: Computations** | ✓ Groundwater Elevation Contours  
✓ Nitrate, TDS Concentrations  
✓ Compute ambient water quality for GMZ’s |
| **4: Interpretive Tools** | ✓ Innovative Interpretive Tool |
Location of Wells with TDS Data
Location of Wells with Nitrate Data

Explaination:
- Green square: 1999-2018 NO$_3$-N Point Statistic
- Green circle: 1999-2018 NO$_3$-N Average

Note: As requested by CBVM, private well locations used in the 1999-2018 AISQ recoputation are not shown.

- Red: RWQCB Boundary
- Yellow: Groundwater Management Zone Boundary
- Blue: Recharge Basin
- Dashed line: Rivers and Streams
Volume of Groundwater

\[ V = \sum_{i=1}^{n} A_i \cdot (GWE_i - BOA_i) \cdot SY_i \]

where
- \( V \) = volume of groundwater in the GMZ
- \( A_i \) = area of the ith grid cell
- \( GWE_i \) = groundwater elevation (feet msl)
- \( BOA_i \) = bottom of the aquifer of the ith grid cell (feet msl)
- \( SY_i \) = specific yield of the ith grid cell
- \( n \) = number of grid cells

Source: WEI, 2014
Volume Weighted Estimate of AWQ

\[ C_{avg} = \frac{\sum_{i=1}^{n} C_i \cdot V_i}{\sum_{i=1}^{n} V_i} \]

where
- \( C_{avg} \) = the volume-weighted current ambient concentration in a GMZ
- \( C_i \) = the current ambient concentration of groundwater in the ith grid cell
- \( V_i \) = the volume of groundwater in the ith grid cell
- \( n \) = number of grid cells

Source: WEI, 2014
2018 Ambient Water Quality
Nitrate as N

Explanation
Riverside-A
Groundwater Management Zone
1996-2015 NO₃-N AWQ (mg/L)
*SWO: Surface Water Objectives Apply
N/A: Not enough data were available to calculate AWQ values.

- RWQCB Boundary
- Groundwater Management Zone Boundary
- Recharge Basin
- Rivers and Streams

- NO₃-N Concentration
  - < 1.0 mg/L
  - 10 mg/L
  - > 20 mg/L
- Concentration undefined

Note: Grid cell size is 400 x 400 meters. For layered GMZs (Orange County, Chino-North, & Bunker-Hill Pressure Zones) the volume-weighted concentrations are calculated and displayed.
Interpretive Tools for each Groundwater Management Zone

- Atlas Style Maps
- Nitrate Map
- Nitrate Change Map from 2015 version
- TDS Map
- TDS Change Map from 2015 version
Interactive Interpretive Tools

Accessible to the Task Force Members for further Analysis

- Trend Maps
- Well Attrition Analysis
Summary of Ambient Water Quality

The ambient water quality recomputation is a powerful tool to assist the stakeholders in managing the water resources in the Santa Ana Watershed:

- aids the Regional Board in identifying TDS and nitrate trends
- the assessment of assimilative capacity is critical in permitting projects, such as groundwater replenishment reuse projects
- assists the stakeholders in identifying areas of potential concern
- supports Santa Ana River wasteload allocation and discharge permits
- collaboration of stakeholders and Regional Board
- Scoping Committee being formed in BMPTF to evaluate AWQ to comply with the updated Recycled Water Policy