97-005 EVALUATION SUMMARY REPORT

NORTH HOLLYWOOD WEST WELL FIELD

(Steps 1-6 of 97-005 Evaluation)

Prepared for

California State Water Resources Control Board, Division of Drinking Water

Prepared on Behalf of

Los Angeles Department of Water & Power

Water Quality Division

Prepared by

Owner's Agent Team led by Hazen and Sawyer (Hazen)

with primary input from Advisian, Worley Group, Inc. (Advisian)

& Water Quality & Treatment Solutions, Inc. (WQTS)

August 2023

SYNOPSIS

The Division of Drinking Water (DDW) 97-005 evaluation process consists of 10 steps (or elements) for assessing proposals, establishing appropriate permit conditions, and approving the use of an extremely impaired drinking water source. Steps 1 through 6 of the evaluation process comprises the technical evaluations with Steps 7 through 10 presenting the administrative components of the evaluation process.

The purpose of this report is to provide a summary of the key information and outcomes of technical evaluations and reports generated for Steps 1 through 6 of the evaluation process for the Los Angeles Department of Water and Power's (LADWP's) owned and operated North Hollywood West (NHW) Well Field and the associated planned treatment facility (the NHW Wellhead Treatment [NHWWT] Facility). The NHWWT Facility will be operated in a manner that draws contaminated groundwater toward designated Remediation Wells, with treatment of the impacted groundwater aboveground to permanently remove contaminants. As groundwater in the vicinity of the NHW Well Field is impaired by hazardous substances, LADWP is required to demonstrate compliance with the DDW Process Memo 97-005-R2020 - Revised Guidance for Direct Domestic Use of Extremely Impaired Sources.

This document provides a summary of the following reports and information:

- **North Hollywood West Interim Remedial Action (NHW IRA)**: The NHW IRA prompted the requirement for an amendment to LADWP's existing water supply permit and application for use of an extremely impaired drinking water source for NHW Well Field; an overview of the selected NHW IRA is provided for context to the 97-005 evaluation conducted for the NHW Well Field and NHWWT Facility.
- **North Hollywood West Water Source and Study Area**: The NHW Well Field water source and Study Area was defined to support data gathering and technical analysis in support of the 97-005 evaluation process for NHW Well Field.
- **Step 1: Drinking Water Source Assessment and Contaminant Assessment (SA/CA)**: The Step 1 Report documents the SA, which determines the extent to which the NHW Well Field is vulnerable to contaminating activities, and the CA, which provides a characterization of the contamination of soils and groundwater, and former contamination sites located within the water source for NHW Well Field.
- **Step 2: Full Characterization of the Raw Water Quality**: The Step 2 Report documents the raw water quality characterization (RWQC) study, which evaluates the NHW Well Field water source and the quality of water that will be delivered to NHWWT Facility, so that the treatment system is properly designed.
- **Step 3: Drinking Water Source Protection**: The Step 3 Report documents programs in place to control the level of contamination within the NHW Study Area and provides an evaluation of cleanups, mitigations, and remediations within the water source.
- **Step 4: Effective Treatment and Monitoring**: The Step 4 Report documents the evaluation of treated water goals for the proposed treatment system, the treatability assessment and proposed treatment process for contaminants within the water source, the proposed treatment and monitoring program for the remediation facility, and the proposed NHW Well Field Water Quality Surveillance Plan (WQSP) to conduct ongoing monitoring of the water source.

- **Step 5: Human Health Risks Associated with Failure of Proposed Treatment**: The Step 5 Report documents an evaluation of the risks of failure and an assessment of potential health risks associated with failure of the proposed NHWWT Facility treatment system.
- **Step 6: Completion of the California Environmental Quality Act (CEQA) Review of the Project**: The Step 6 Report documents the CEQA review for the Project.

In accordance with the DDW Process Memo 97-005-R2020, the evaluation process steps were conducted sequentially, with each step relying upon the findings and conclusions of the prior step. It is important to note this document provides an overview of the individual evaluation steps (Steps 1 through 6 outlined above) and is not intended to be solely relied upon for a complete understanding of the technical evaluations conducted as part of the DDW 97-005 evaluation process for the NHW Well Field and NHWWT Facility. A detailed description of the approach and outcomes to each technical evaluation is documented in each applicable Step report as referenced herein.

TABLE OF CONTENTS

SYNOPSIS I

TABLE OF CONTENTS III

LIST OF ACRONYMS AND ABBREVIATIONS V

1. INTRODUCTION 1
   - 1.1 Report Purpose 1
   - 1.2 Background 2
   - 1.3 Document Organization 3

2. NORTH HOLLYWOOD WEST INTERIM REMEDIAL ACTION 4
   - 2.1 Project Background 4
   - 2.2 Remediation Well Selection and Proposed Pumping 5

3. NORTH HOLLYWOOD WEST WATER SOURCE AND STUDY AREA 8

4. STEP 1: DRINKING WATER SOURCE ASSESSMENT AND CONTAMINANT ASSESSMENT 10
   - 4.1 Purpose 10
   - 4.2 Overview 10

5. STEP 2: FULL CHARACTERIZATION OF THE RAW WATER QUALITY 12
   - 5.1 Purpose 12
   - 5.2 Overview 12
     - 5.2.1 Data Analysis 13
     - 5.2.2 COPC Identification 14
     - 5.2.3 Estimated Treatment Influent Concentrations 14
     - 5.2.4 Trend and Variability Analysis 15

6. STEP 3: DRINKING WATER SOURCE PROTECTION 17
   - 6.1 Purpose 17
   - 6.2 Overview 17

7. STEP 4: EFFECTIVE TREATMENT AND MONITORING 19
   - 7.1 Purpose 19
   - 7.2 Overview 19
     - 7.2.1 Treated Water Goals 19
     - 7.2.2 Treatability Assessment 21

7.2.3 Performance Standards 22

7.2.4 Treatment System Design 22

7.2.5 Operations Plan 26

7.2.6 Reliability Features 28

7.2.7 Compliance Monitoring and Reporting 29

7.2.8 Notification Plan 31

7.2.9 Source Water Quality Surveillance 31

8. STEP 5: HUMAN HEALTH RISKS ASSOCIATED WITH FAILURE OF PROPOSED TREATMENT 33

8.1 Purpose 33

8.2 Overview 33

9. STEP 6: COMPLETION OF THE CALIFORNIA ENVIRONMENTAL QUALITY ACT (CEQA) REVIEW OF THE PROJECT 34

9.1 Purpose 34

9.2 Overview 34

10. REFERENCES 35

Figures within Text

FIGURE 1: 10-STEP DDW 97-005 EVALUATION PROCESS 1

FIGURE 2: NORTH HOLLYWOOD WEST (NHW) WELL FIELD SETTING AND LOCATIONS OF NHW PRODUCTION WELLS 7

FIGURE 3: NORTH HOLLYWOOD WEST (NHW) STUDY AREA 9

FIGURE 4: NORTH HOLLYWOOD WEST (NHW) STUDY AREA, AND PRODUCTION AND MONITORING WELLS INCLUDED FOR THE NHW RAW WATER QUALITY CHARACTERIZATION (RWQC) STUDY 16

FIGURE 5: NHW WELL FIELD FLOW DIAGRAM 20

FIGURE 6: NHWWT FACILITY PROCESS DIAGRAM 25

FIGURE 7: NHWWT FACILITY SAMPLING LOCATIONS 30

FIGURE 8: NORTH HOLLYWOOD WEST (NHW) WATER QUALITY SURVEILLANCE PLAN GROUNDWATER MONITORING NETWORK............ 32

ADDENDUM TO 97-005 EVALUATION SUMMARY REPORT FOR THE NORTH HOLLYWOOD WEST WELL FIELD: ADDITIONAL INFORMATION FOR WELLS NH-34, NH-37, NH-43A, NH-44, NH-4NH-34, NH-37, NH-43A, NH-44, NH-45

LIST OF ACRONYMS AND ABBREVIATIONS

Acronym/Abbreviation	Term
%	Percent
µg/L	Microgram(s) Per Liter
2IR	Second Interim Remedy
1,1-DCE	1,1-Dichloroethene
Advisian	Advisian, Worley Group, Inc.
AFY	Acre-Feet Per Year
AOP	Advanced Oxidation Process
ARARs	Applicable or Relevant and Appropriate Requirements
BAT	Best Available Technology
BC	Brown and Caldwell Consultants
bgs	Below Ground Surface
CA	Contaminant Assessment
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
cis-1,2-DCE	cis-1,2-Dichloroethene
City	City of Los Angeles
COPC	Constituent of Potential Concern
CPO	Chief Plant Operator
Cr(VI)	Hexavalent Chromium
DDW	Division of Drinking Water
DLR	Detection Limit for Reporting
DTSC	Department of Toxic Substances Control
DWSP	Drinking Water Source Protection
ENP	Emergency Notification Plan
EPA	United States Environmental Protection Agency
ft	Feet
GAC	Granular Activated Carbon
GPM	Gallons per Minute
GSIS	Groundwater System Improvement Study
Hazen	Hazen and Sawyer Engineering Consultants
HPL	Hewitt Pit Landfill
IRA	Interim Remedial Action

Acronym/Abbreviation	Term
IRAD	Interim Remedial Action Decision
JMM	James M. Montgomery
L	Liter
LA	Los Angeles
lb.	Pound
LADWP	Los Angeles Department of Water and Power
LIMS	Laboratory Information Management System
LNAPL	Light Non-Aqueous Phase Liquid
LPHO	Low Pressure High Output
LARWQCB	Los Angeles Regional Water Quality Control Board
MCL	Maximum Contaminant Level
mg/L	Milligram(s) Per Liter
MP	Medium Pressure
N	Nitrogen
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NHOU	North Hollywood Operable Unit
NHW	North Hollywood West
NHWWT	North Hollywood West Wellhead Treatment
NL	Notification Level
OCPs	Organochlorine Pesticides
OMMP	Operations Maintenance and Monitoring Manual
OU	Operable Unit
PCE	Tetrachloroethene
PHG	Public Health Goal
PRP	Potential Responsible Party
PSI	Pounds per Square Inch
RAO	Remedial Action Objectives
RIFS	Remedial Investigation/Feasibility Study
RWQC	Raw Water Quality Characterization
SA	Drinking Water Source Assessment
SA/CA	(Drinking Water) Source Assessment / Contaminant Assessment
SCADA	Supervisory Control and Data Acquisition
SFB	San Fernando Basin
SFV	San Fernando Valley
SMCL	Secondary Maximum Contaminant Level

Acronym/Abbreviation	Term
SOCs	Non-Volatile Synthetic Organic Compounds
SPGR	Source Protection & Groundwater Remediation
SVOCs	Semi-Volatile Organic Compounds
SVE	Soil Vapor Extraction
SWRCB	California State Water Resources Control Board
TBC	To Be Considered
TCE	Trichloroethene
TIC	Tentatively Identified Compound
TOCC	Treatment Operations Control Center
UCL95	95 Percent Upper Confidence Limit of the Population Mean
UV	Ultraviolet
UV AOP	Ultraviolet Advanced Oxidation Process
UVT	Ultraviolet Transmittance
VOCs	Volatile Organic Compounds
WQSP	Water Quality Surveillance Plan
WQTS	Water Quality & Treatment Solutions, Inc.

1. INTRODUCTION

The California Water Boards Division of Drinking Water (DDW) has established guidance for drinking water projects that use “extremely impaired” water sources, which is called “97-005” guidance. The 97-005 process consists of 10 steps (also referred to as elements) for DDW to assess proposals, establish appropriate permit conditions, and approve the use of an extremely impaired drinking water source (DDW 2020). The 10 steps of the evaluation process are presented in Figure 1 below. Steps 1 through 6 of the evaluation process comprises the technical evaluations which are summarized herein, with Steps 7 through 10 presenting the administrative components of the evaluation process.

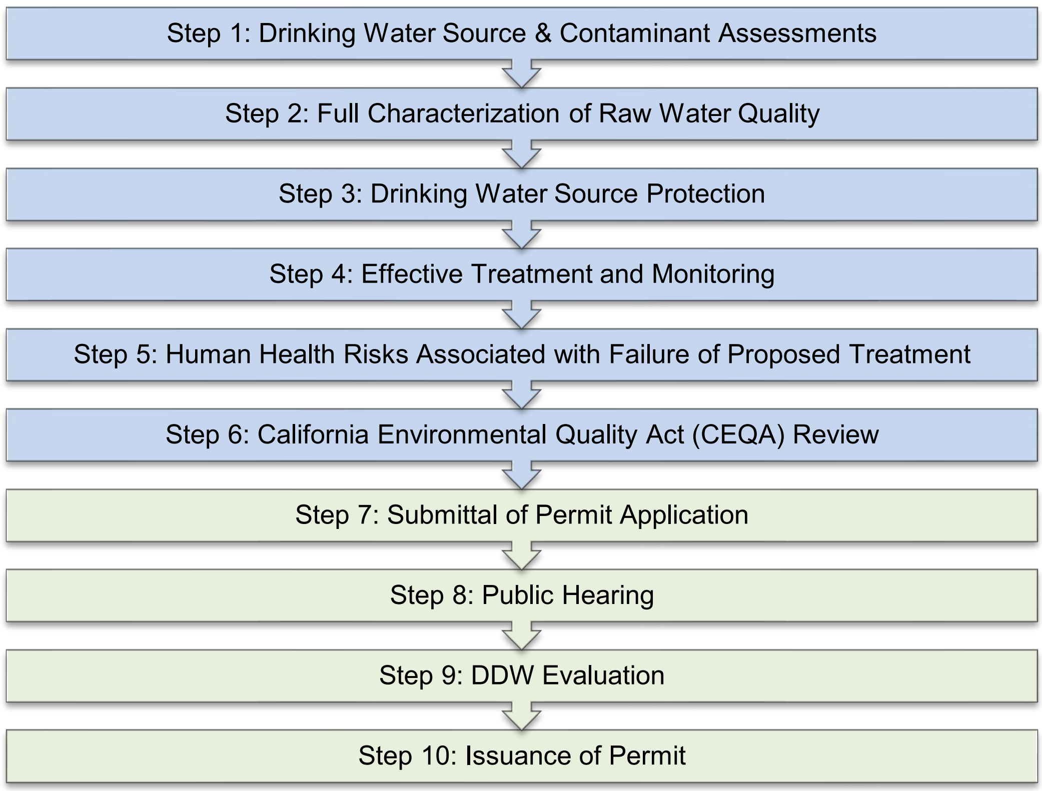


Figure 1: 10-Step DDW 97-005 Evaluation Process

Report Purpose

The purpose of this report is to provide a summary of the outcomes of technical evaluations and reports generated for Steps 1 through 6 of the DDW 97-005 evaluation process for the Los Angeles Department of Water and Power’s (LADWP’s) owned and operated North Hollywood West (NHW) Well Field and the associated planned treatment facility (the NHW Wellhead Treatment [NHWWT] Facility).

The content of this report focuses on summarizing key information and results from the technical evaluation conducted for each of these steps for the NHW Well Field. In accordance with the DDW Process Memo 97-005-R2020 (DDW 2020), the evaluation process steps were conducted sequentially, with each step relying upon the findings and conclusions of the prior step.

Pertinent information from the NHW Well Field Interim Remedial Action (IRA) is also provided in this report, which was selected pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), to address hazardous substances dissolved in groundwater entering the NHW Well Field under active pumping conditions. This information aims to provide project context as the IRA prompted the requirement for an amendment to LADWP's existing water supply permit and application for use of an extremely impaired drinking water source (i.e., groundwater entering the NHW Well Field under active pumping conditions).

It is important to note this document provides an overview of the individual evaluation steps (Steps 1 through 6) and is not intended to be solely relied upon for a complete understanding of the technical evaluations conducted as part of the DDW 97-005 evaluation process for the NHW Well Field and NHWWT Facility. A detailed description of the approach and outcomes for each technical evaluation is documented in the applicable step report as referenced herein.

Background

The NHW Well Field has provided a significant volume of groundwater production to the City of Los Angeles (City); however, in November 2014, LADWP removed seven production wells from service to prevent 1,4-dioxane concentrations from exceeding the DDW Notification Level (NL; 1 microgram per liter [μg/L]) at the LADWP blend point down-stream of the NHW Well Field (Hazen 2016a). The removal of these wells resulted in a combined loss of more than 24,700 AFY or 65 percent (%) of the total production capacity of the NHW Well Field.

As groundwater in the vicinity of the NHW Well Field is impaired by hazardous substances, LADWP is required to demonstrate compliance with the DDW Process Memo 97-005-R2020 - Revised Guidance for Direct Domestic Use of Extremely Impaired Sources (DDW 2020). DDW considers a source to be "extremely impaired" if it meets two or more of 10 DDW-developed criteria. Based on historical water quality data, groundwater in the vicinity of the NHW Well Field meets up to four (4) criteria, as follows:

- Contains a contaminant that exceeds 10 times its NL based on chronic health effects.
  - 1,4-dioxane was present at concentrations exceeding this criterion in the NHW production wells.
- Is extremely threatened with contamination due to known contaminating activities within the long term, steady state capture zone of a drinking water well or within the watershed of a surface water intake.
  - Known contamination sites were identified within NHW Well Field Study Area including the Hewitt Pit Landfill (HPL) and Honeywell Site (Former Bendix Facility).
- Contains a mixture of contaminants of health concern beyond what is typically seen in terms of number and concentration of contaminants.
  - 1,4-dioxane, trichloroethene (TCE), tetrachloroethene (PCE), 1,1-dichloroethene (1,1-DCE), and nitrate as nitrogen (N) were identified within NHW Well Field Study Area.
- Is designed to intercept known contaminants of health concern.
  - The planned treatment facility at NHW Well Field (the NHWWT Facility) will be operated in a manner that draws contaminated groundwater toward designated Remediation Wells (remedy wells) with treatment of the impacted groundwater aboveground to permanently remove

contaminants. The hydraulic control provided by operation of the remedy wells will reduce the likelihood that the other NHW production wells (non-remedy wells) and downgradient groundwater resources will be impacted by contamination.

Document Organization

This report is organized into the following sections:

Section 1 - Introduction: Provides introductory and background information, purpose of this report, and document organization.

Section 2 - North Hollywood West Interim Remedial Action (NHW IRA): Provides an overview of the selected IRA action for the NHW Well Field to provided overall context for the Project.

Section 3 - North Hollywood West Water Source and Study Area: Provides a summary description of the NHW Well Field water source and Study Area.

Section 4 - Step 1: Drinking Water Source Assessment and Contaminant Assessment (SA/CA): Provides an overview of the SA for the NHW Well Field, which determines the extent to which the well field is vulnerable to contaminating activities, and an overview of the CA, which provides a characterization of the contamination of soils and groundwater, and former contamination sites located within the water source.

Section 5 - Step 2: Full Characterization of the Raw Water Quality: Provides an overview of the raw water quality characterization (RWQC) study for the NHW Well Field water source, which is used to characterize the quality of the water that will be delivered to NHWWT Facility, so that the treatment system is properly designed.

Section 6 - Step 3: Drinking Water Source Protection: Provides an overview of programs in place to control the level of contamination within the NHW Study Area and an cleanups, mitigations and remediations within the water source to ensure ongoing source water protection from future instances of groundwater contamination.

Section 7 - Step 4: Effective Treatment and Monitoring: Provides an overview of the treated water goals evaluation for the proposed treatment system, the treatability assessment and proposed treatment process for contaminants within the water source, the proposed treatment and monitoring program for the remediation facility, and the proposed NHW Well Field Water Quality Surveillance Plan (WQSP) to conduct ongoing monitoring of the water source.

Section 8 - Step 5: Human Health Risks Associated with Failure of Proposed Treatment: Provides an overview of the evaluation of the risks of failure of the proposed treatment system and an assessment of potential health risks associated with failure of the proposed treatment system.

Section 9 - Step 6: Completion of the California Environmental Quality Act (CEQA) Review of the Project: Provides an overview of the CEQA review for the Project.

Section 10 - References: Lists the documents and information sources referenced in this report, including the technical reports for Steps 1 through 6 summarized in this report.

2. NORTH HOLLYWOOD WEST INTERIM REMEDIAL ACTION

Project Background

This section provides an overview of the selected IRA for the NHW Well Field. LADWP, in accordance with CERCLA, and the NCP, conducted an Interim Remedial Investigation/Feasibility Study (RIFS) to address the synthetic contaminant 1,4-dioxane dissolved in groundwater at the NHW Well Field. The Interim RIFS Report for the NHW Well Field documented the detailed analysis of interim remedial alternatives (Hazen 2016a).

LADWP's preferred interim remedial alternative was documented in the Proposed Plan for the NHW Well Field (Proposed Plan; Hazen 2016b), describing how the preferred alternative is capable of achieving Remedial Action Objectives (RAOs) and Preliminary Cleanup Goals developed in the RIFS. Collectively, the Proposed Plan, Interim RIFS Report, and other related information were made available for public comment (Hazen 2016a, 2016b). The RAOs for the NHW IRA include the following:

- Protect human health and the environment by reducing the potential for exposure to 1,4-dioxane in groundwater at concentrations exceeding regulatory values or risk-based cleanup goals.
- Limit the migration of 1,4-dioxane in groundwater in the vicinity of the NHW Well Field at concentrations that prevent the beneficial use of the San Fernando Basin (SFB).
- Remove 1,4-dioxane from groundwater in the vicinity of the NHW Well Field to maintain the beneficial uses of the SFB and restore the aquifer to the extent practicable.
- Restore LADWP's capability to operate its existing NHW Well Field consistent with historic and planned use of the NHW Well Field.

The RAOs were developed to address the groundwater entering the NHW groundwater production wells, 1,4-dioxane in the groundwater, the use of the groundwater for domestic and other purposes, and the potential exposure routes including ingestion, inhalation, and dermal contact with groundwater containing contaminant concentrations exceeding regulatory values. The RAOs do not address the HPL (a primary source of 1,4-dioxane in groundwater) and the 1,4-dioxane plume emanating from the HPL. A response action to address this source and the associated 1,4-dioxane plume is the subject of separate and discrete programs by the Los Angeles Regional Water Quality Control Board (LARWQCB) and the United States Environmental Protection Agency (EPA) (Hazen 2017).

LADWP's selected IRA was documented in the Interim Remedial Action Decision (IRAD) for the NHW Well Field (Hazen 2017), presenting the purpose of the selected remedy, summarizing the basis for the decision to select the remedy, and summarizing the responses to comments received from the public. The LADWP Board of Commissioners adopted the IRAD for implementation.

LADWP's selected IRA is a groundwater pump and treatment system intended to reduce the toxicity, mobility, and volume of contaminated groundwater through treatment. Human health will be protected by capturing and removing contaminated groundwater from the NHW Well Field area through hydraulic control and treating the contaminated groundwater aboveground to permanently remove 1,4-dioxane, as well as other contaminants from groundwater. The beneficial use of groundwater will be restored in accordance with the LARWQCB Basin Plan, which conforms with the State of California Antidegradation Policy (i.e., California State Water Resources Control Board [SWRCB] Resolution 68-16 and 92-49), an Applicable Relevant and Appropriate Requirement (ARAR) for the NHW IRA.

Hydraulic control will be implemented in a manner that draws contaminated groundwater toward designated Remediation Wells, and away from the other groundwater production wells within the NHW Well Field and downgradient groundwater resources. Hydraulic control will reduce the likelihood for these other groundwater production wells within the NHW Well Field and downgradient groundwater resources to be impacted by 1,4-dioxane as well as other contaminants in groundwater.

The contaminated groundwater captured by the NHW Remediation Wells will be managed aboveground by implementing a combination of institutional and treatment actions. Institutional actions will include implementation of the bypass, blending, alternative pumping plans, monitoring, and groundwater use restrictions, which are described in Section 3 of the Interim RIFS Report for the NHW Well Field (Hazen 2016a). Treatment actions will include aboveground treatment of the groundwater impacted by 1,4-dioxane, which will be implemented in compliance with ARARs and To Be Considered (TBC) criteria to protect human health. Treatment will include advanced oxidation process (AOP) technology to transform 1,4-dioxane, as well as TCE, and PCE, into innocuous by-products. Carbon quenching will be implemented to remove remaining hydrogen peroxide from water downstream of the AOP.

During the public comment period, DDW submitted a comment letter dated February 23, 2017, which confirmed that DDW would require evaluation in accordance with the DDW Policy Memo 97-005 for Direct Domestic Use of Extremely Impaired Sources.

In addition, LADWP entered into an Agreement with the SWRCB to assist in funding the cost of the NHW IRA (LADWP & SWRCB 2018) via Proposition 1. The Agreement was based on the LADWP’s application for funding, which included the Proposed Plan, Interim RIFS Report, and public comments in support of the Project.

Remediation Well Selection and Proposed Pumping

As discussed in the NHW RIFS (Hazen 2016a), a number of NHW production wells have been removed from service due to contamination since 2014. As part of the NHW RIFS, subsurface characterization, water quality data analysis, contaminant plume mapping, groundwater flow simulations, particle tracking, and fate and transport modeling were used to develop and analyze various remedial alternatives, which included different pumping configurations for NHW production wells. As part of this process, the NHW production wells were separated into three general categories.

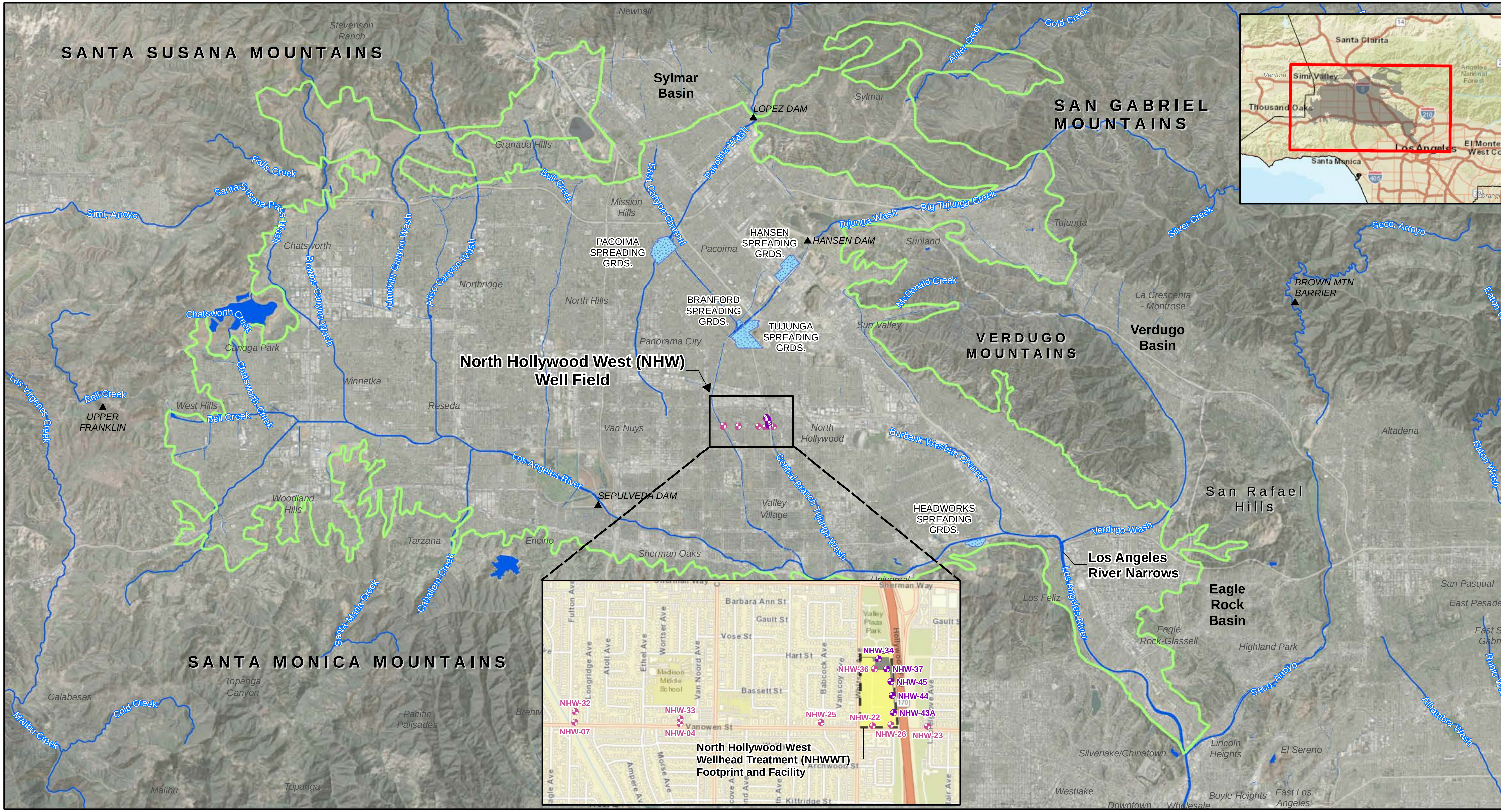
- Remediation Wells – these wells are primarily responsible for capturing the groundwater contaminant plume, are given priority for pumping, and are anticipated to require ongoing water treatment. These wells are anticipated to pump continuously from the onset of the Project to contain the spread and migration of contamination, reduce the size of the contaminant plume, and remove contaminant mass from the groundwater.
- Secondary Wells – these wells are anticipated to be offline for the first two years of operation until the Remediation Wells have removed contaminants from the groundwater in the vicinity of the Secondary Wells and have begun to control the 1,4-dioxane plume. After this time, pumping of the Secondary Wells is anticipated to occur seasonally or when supply demands require. While these wells are not anticipated to require ongoing treatment for 1,4-dioxane, management of pumping from these wells may be required to focus plume capture at Remediation Wells and prevent ongoing capture of the 1,4-dioxane plume by the Secondary Wells.

- Preferred Wells – these wells are anticipated to operate seasonally or when supply demands require their use. These wells are not anticipated to require water treatment for 1,4-dioxane.

Groundwater modeling was used to evaluate options to reduce the number of groundwater production wells needing treatment (to the extent practicable) while meeting other key objectives, as presented in the RIFS Report. Based on the objectives, assumptions, and analysis documented therein, the future pumping plan for the NHW Well Field was refined to demonstrate reasonable hydraulic control of the 1,4-dioxane plume in a manner that draws groundwater contaminated with 1,4-dioxane toward the designated Remediation Wells and away from Preferred Wells within the NHW Well Field. In general, the selected IRA is designed to prioritize pumping at the NHW Remediation Wells over non-remedy wells as a way of maintaining hydraulic control (capture) of the contaminant plumes and minimizing the footprint of those plumes over time. LADWP intends to manage non-remedy pumping to prevent capture of the contaminant plume by these wells and address seasonal water demand.

The proposed pumping plan involves implementing hydraulic control in a manner that draws 1,4-dioxane impacted groundwater toward three designated Remediation Wells (i.e., NH-34, NH-37, NH-45) that were selected through extensive groundwater modeling and alternatives analysis as part of the NHW RIFS. Groundwater modeling shows that pumping of Remediation Wells NH-34, NH-37, NH-45 will draw 1,4-dioxane impacted groundwater away from other production wells within the NHW Well Field and downgradient groundwater resources and will provide sufficient containment to prevent 1,4-dioxane from entering the non-remedy wells. However, impacted groundwater from up to five wells (NH-34, NH-37, NH-45, NH-43A, and NH-44) can be treated at the NHWWT Facility if necessary. The NHWWT Facility and locations of Remediation Wells and other non-remedy production wells are shown in Figure 2. Detailed information relating to the selection of the IRA for the NHW Well Field can be found in the aforementioned RIFS, Proposed Plan, and IRAD documents.

As part of the funding Agreement with the SWRCB (LADWP & SWRCB 2018), LADWP carried out additional modeling (LADWP 2019) using an updated groundwater model that included more recent water quality sampling results and updated pumping information for other remedies in the vicinity of the NHW Well Field, including the HPL and the EPA's North Hollywood Operable Unit (NHOU) Second Interim Remedy (2IR). The results of this updated modeling indicated that no changes were required to the planned pumping rates or the number of Remediation Wells that were intended to achieve the purpose of the NHW IRA.



Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community. CA DWR - B118_BasinBoundaries_v4.1, LA County GIS, LADWP, NHD.

Note:
* - NH-23 is non-operational and will be destroyed in the future
Features shown on this figure are approximate and should be used for indicative purposes only.

N
W E
S
0 5
Miles

Legend

- NHW REMEDIATION WELLS
- NHW PRODUCTION WELLS (NON-REMEDY)
- RIVERS/WASHES
- SPREADING GROUNDS
- SAN FERNANDO VALLEY GROUNDWATER BASIN

LA DWP Los Angeles Department of Water & Power

Hazen ARCADIS Advisian

NORTH HOLLYWOOD WEST (NHW) WELL FIELD SETTING, NHW REMEDIATION WELLS AND PRODUCTION WELL (NON-REMEDY WELL) LOCATIONS, AND APPROXIMATE LOCATION OF THE NORTH HOLLYWOOD WEST WELLHEAD TREATMENT (NHWWT) FACILITY

SWL	SB	11/7/2022
308038-13235 DDW 97-005		2

FILE LOCATION: E:\GIS\Projects\308038-13235\mapdocuments\11-4-2022\Exec_Summary\11-7-2022\Fig 2 - NHW Well Field Setting.mxd

USER NAME: Steven.Lindelof
ISSUING OFFICE: Orange County GIS

PLOT DATE & TIME:11/7/2022 10:25:34 AM
SAVE DATE & TIME:11/7/2022 10:25:10 AM

3. NORTH HOLLYWOOD WEST WATER SOURCE AND STUDY AREA

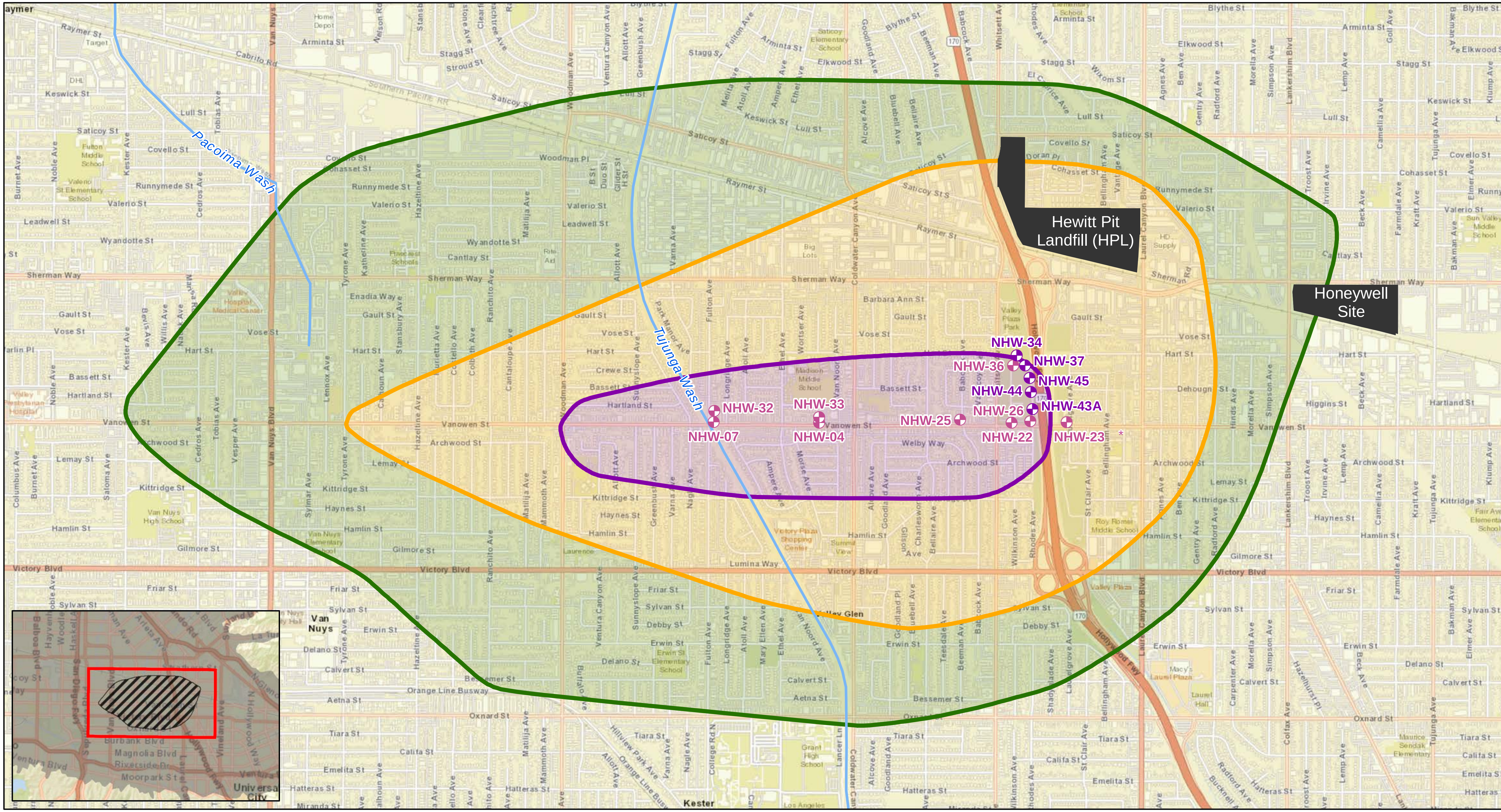
This section provides a summary description of the NHW Study Area, based on the anticipated source water area, to provide context to information provided throughout the remainder of this document. A detailed discussion of the water source and Study Area is provided in the Step 1 and Step 2 Reports.

Groundwater at the NHW Well Field is extracted via production wells which are installed at depths ranging from 130 to 910 feet below ground surface (bgs) at flow rates ranging from 290 to 5,433 acre-feet per year (AFY). The construction details for the NHW Well Field production wells are provided in Table 1.

The NHW Well Field extracts water from the underlying aquifer, which predominantly comprises permeable sands and gravels interbedded with laterally discontinuous lenses of less permeable finer-grained silt and clays and extends to at least 1,200 feet bgs. Groundwater in the vicinity of NHW Well Field is generally encountered at approximately 240 to 250 ft bgs, although it may be deeper in areas where groundwater is actively pumped, or shallower in proximity to active recharge projects such as spreading grounds. Groundwater in this part of the SFB generally flows south to south-east under natural conditions, draining towards the Los Angeles River and the Los Angeles River Narrows in the southeastern part of the SFB. Locally, groundwater hydraulic gradients can vary in magnitude and direction depending on various groundwater stresses, such as groundwater pumping and artificial recharge (e.g., spreading grounds). Further details relating to the geologic and hydrogeological characteristics of the NHW Well Field and surrounding area can be obtained from the RIFS for NHW Well Field (Hazen 2016a) and references cited therein.

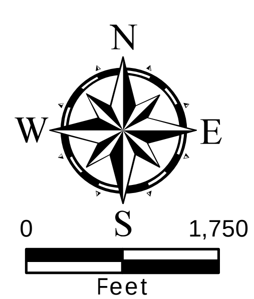
For the purposes the 97-005 evaluation, the NHW Study Area (*refer to* Figure 3) was delineated by using groundwater flow modeling to generate capture zones for the well field as a means of predicting the lateral extent of the groundwater system that will be influenced by NHW Well Field pumping activities over the next 10 years. The model incorporated LADWP’s forecasted pumping plan, and was used to estimate the 2, 5, and 10-year capture zones for each NHW production well. The 2, 5, and 10-year capture zones for each production well were then combined to generate a single (aggregated) capture zone to delineate the NHW Study Area (*refer to* Figure 3).

As the steps of the 97-005 evaluation process are sequential in nature, some changes, or differences in the characterization of the drinking water source are expected to occur over time as understanding evolves due to various factors. These may include additional data collection, further characterization and investigation, variations in pumping and recharge plans, alterations to third party pumping activities locally, and changing baseline groundwater conditions. As a result, the capture zones for the NHW Well Field generated as part of the Step 1 SA/CA were subsequently updated as part of the Step 2 RWQC, primarily to include newly available updates to LADWP and third-party pumping within the basin. However, these changes did not have a significant impact on the findings, interpretations, and conclusions presented in the Step 1 Report, and any additional potential contamination sources identified as a result of the change in capture zones were documented in the Step 2 Report.



Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community. LADWP. All locations approximate

Note:
* - NH-23 is non-operational and will be destroyed in the future
All locations are approximate and are subject to change upon determination of accuracy.



Legend

- NHW REMEDIATION WELLS
- NHW PRODUCTION WELLS (NON-REMEDY)
- MAJOR CLEANUP SITES
- 2 YR CAPTURE ZONE
- 5 YR CAPTURE ZONE
- 10 YR CAPTURE ZONE

LA DWP Los Angeles Department of Water & Power

Hazen ARCADIS Advisian

SWL	SB	11/7/2022

NORTH HOLLYWOOD WEST (NHW) STUDY AREA

308038-13235
DDW 97-005

3

FILE LOCATION: E:\GIS\Projects\308038-13235\mapdocuments\11-4-2022\Exec_Summary\11-7-2022\Fig 3 - North Hollywood West Study Area.mxd

USER NAME: Steven.Lindelof
ISSUING OFFICE: Orange County GIS
PLOT DATE & TIME:11/7/2022 11:42:56 AM
SAVE DATE & TIME:11/7/2022 11:42:32 AM

4. STEP 1: DRINKING WATER SOURCE ASSESSMENT AND CONTAMINANT ASSESSMENT

This section presents a summary discussion of the key outcomes of Step 1 of the 97-005 evaluation process for NHW Well Field, i.e., SA/CA). The detailed SA/CA are documented in the *Source Water Assessment & Contaminant Assessment for North Hollywood West, Rinaldi-Toluca & Tujunga Wellfields (Step 1 of 97-005 Evaluation) Report* (LADWP 2020a) and was conducted in accordance with Section 1 of the DDW Process Memo 97-005-R2020.

Purpose

The purpose of the SA is to determine the extent to which the NHW Well Field is vulnerable to contaminating activities in the area by identifying sources of historical and current contamination to the water source and Study Area. The purpose of the CA is to characterize contamination of soils and groundwater at, and around current and former contamination sites located within the long-term capture zone of the NHW Well Field.

Overview

The SA/CA included an assessment of known and potential contaminant sources to identify the origin of detected contaminants in groundwater and potential contamination sources currently or historically present in the source water capture zones.

Chemicals such as organic compounds (e.g., chlorinated solvents) and inorganic chemicals (e.g., nitrate and perchlorate) have been encountered in the SFB and are consistent with the historical uses of the basin that included agriculture and farming activities (late 1800s), and industrial activities that commenced in the early 1900s. Industrialization occurred rapidly, and included aerospace and defense manufacturing, machinery degreasing, dry cleaning, and metal plating.

The SA/CA identified leaking storage tanks or piping, leaching from sumps or other disposal practices, spills or generally poor housekeeping from aerospace manufacturers and supporting industries as potential sources of chlorinated solvents and hexavalent chromium (Cr[VI]). For some inorganic chemicals, there are multiple potential sources such as agricultural activities and aerospace or munitions manufacturing. Landfills were also identified as potential sources of both organic and inorganic chemicals if they are unlined, or liner failure has occurred. Releases of new contamination have decreased over the last 30 years, generally due to reduced use of chemicals, better housekeeping, and adoption of best management practices to prevent releases. However, it can be assumed that there are operations that continue to impact soil and groundwater due to the size and diverse land uses of the SFB.

The SA/CA identified four major cleanup sites in the SFB based on the occurrence of identified groundwater contamination, the relative locations of these sites, and the LADWP Well Fields that were the subject of the Step 1 report. These four sites are not intended to represent a complete list of the sites that could be past, present, or future sources of contamination to groundwater within the well fields source water / capture zones. Additional work is underway by the LARWQCB, EPA, and LADWP to evaluate these and other sites that may also contribute to the groundwater contamination in this area. The four major cleanup sites and primary constituents of potential concern (COPCs) identified for each of as follows:

- Hewitt Pit Landfill (also referred to as HPL or Hewitt Site):

- 1,4-dioxane, TCE, PCE and 1,2,3-trichloropropane, N-nitrosodimethylamine, Cr(VI), perchlorate.
- AlliedSignal/Bendix Corporation/Honeywell Site:
    - TCE, PCE, 1,4-dioxane, Cr(VI).
- Holchem/Former Chase Chemical Company Site:
    - TCE, PCE, benzene, toluene, vinyl chloride, 1,1,1-trichloroethane, 1,4-dioxane.
- Price Pfister Site:
    - TCE, PCE, 1,4-dioxane, Cr(VI).

Of these sites, only the HPL and a small portion of the Honeywell Site are located within the NHW Study Area, as shown in Figure 3.

5. STEP 2: FULL CHARACTERIZATION OF THE RAW WATER QUALITY

This section presents a summary discussion of the key outcomes of Step 2 of the 97-005 evaluation process for NHW Well Field, i.e., Full Characterization of the Raw Water Quality. The detailed Step 2 raw water quality characterization (RWQC) study is documented in the *Full Raw Water Quality Characterization for the North Hollywood West Well Field (Step 2 of 97-005 Evaluation) Report* (LADWP 2020b) and was conducted in accordance with Section 2 of the DDW Process Memo 97-005-R2020.

5.1 Purpose

The appropriate level of monitoring and treatment to produce safe drinking water cannot be determined unless the raw water quality is fully understood (DDW 2020). The purpose of the RWQC study is to identify and evaluate constituents in the raw water produced by the NHW Well Field, in order to characterize the quality of the water that will be delivered to NHWWT Facility, so that the treatment system is properly designed. The outcome of the RWQC study is also used to support subsequent steps of the DDW evaluation process, e.g., “Effective Treatment and Monitoring” (Step 4) and “Human Health Risks Associated with Failure of Proposed Treatment" (Step 5). For the purposes of the RWQC study, “raw water” is defined as the groundwater extracted from the NHW Well Field.

Overview

As stated in the DDW Process Memo 97-005, the steps (or elements) of the extremely impaired source evaluation process are designed to be sequential. Step 1 of the 97-005 evaluation, i.e., the SA/CA, determined the extent to which groundwater within the SFB is vulnerable to contaminating activities. The RWQC study (Step 2) follows on from Step 1 and includes an evaluation of all contaminants identified in the SA/CA and any other constituents (regulated and unregulated) analyzed from water quality samples collected from NHW Well Field production and monitoring wells.

For the RWQC study, water quality data were compiled into a single database for querying and data analysis. A total of 13 NHW production wells and 33 groundwater monitoring wells located within the NHW Study Area were selected as sources of groundwater data for the RWQC study. The NHW Study Area and locations of selected wells are shown in Figure 4. Over 400 constituents were considered for the RWQC study and were grouped into the following categories:

- General Physical Chemistry.
- Volatile Organic Compounds (VOCs).
- Semi-Volatile Organic Compounds (SVOCs).
- Non-Volatile Synthetic Organic Chemicals.
- Polychlorinated Biphenyls and Organochlorine Pesticides (OCPs).
- Herbicides, Pesticides (excluding OCPs) and Flame Retardants.
- Hydrocarbons and Alcohols.
- Microbial Indicators.
- Inorganic Elements and Chemicals.
- Radionuclides.
- Pharmaceuticals.
- Disinfection By-products.
- Tentatively Identified Compounds (TICs).

After all water quality data were compiled, production wells and monitoring wells data were separated into two groups for evaluation. The resultant data sets were used to conduct analysis as summarized below.

Data Analysis

Production Wells

Production well data was evaluated to characterize current and historical water quality within the well field. The following evaluations were conducted for production well data:

- Statistical analysis was used to derive estimated concentration ranges for each constituent on a well-by-well basis and for the overall well population, including:
  - Total number of observations.
  - Detection frequency.
  - Count of values above regulatory thresholds (MCL, NL, Secondary MCL [SMCL], Public Health Goal [PHG]).
  - Range of detected values.
  - Mean, 95% Upper Confidence Level of the mean (UCL95) and 95th percentile statistics.
  - Maximum Running Annual Average for the study period (2011-2016).
- Trend analysis was undertaken to assess concentration trends and evaluate temporal changes in concentrations for select constituents.
- Water quality concentration variability with pumping rate and time (season and long-term) was evaluated to inform the understanding of future potential variability in concentrations that arrive at the treatment plant.

Monitoring Wells

Monitoring well data was evaluated to characterize potential future concentrations of upgradient constituents in groundwater based on monitoring well data from wells located within the 10-year capture zone of the NHW Well Field (i.e., NHW Study Area). This provides estimated concentrations for the constituents that will be intercepted by the production wells in the future based on monitoring well sample results. The following evaluations were conducted for monitoring well data:

- Statistical analysis was used to derive estimated concentration ranges for each constituent for the monitoring well population, including:
  - Total number of observations.
  - Detection frequency.
  - Count of values above regulatory thresholds (MCL, NL, SMCL, PHG).
  - Range of detected values.
  - Mean, 95% Upper Confidence Level of the mean (UCL95) and 95th percentile statistics.

COPC Identification

From the list of constituents that exceeded either MCL or NL regulatory thresholds in production wells, primary COPCs were identified as follows:

- 1,4-Dioxane.
- TCE.
- PCE.
- 1,1-DCE.
- Nitrate (as N).

From the list of constituents that exceeded either MCL or NL regulatory thresholds in monitoring wells, future COPCs were identified to provide an understanding of water quality that may arrive at the well field in the future as follows:

- 1,1-Dichloroethane.
- 1,2-Dichloroethane.
- 1,4-Dioxane.
- Benzene.
- Chlorate.
- cis-1,2-Dichloroethene (cis-1,2-DCE).
- Bis(2-ethylhexyl)phthalate.
- Nitrate (as N).
- PCE.
- TCE.

Estimated Treatment Influent Concentrations

Estimated (calculated) constituent concentrations in treatment plant influent were evaluated using water quality data analyses incorporating uncertainty associated with the calculated influent concentrations and the associated safety factors. For the purposes of calculating influent concentrations, the following well combinations were considered:

- Three Remediation Wells: combined flow from wells NH-34, NH-37, and NH-45.
- Five Remediation Wells: combined flow from wells NH-34, NH-37, NH-43A, NH-44, and NH-45.

Three Remediation Well Treatment

Using production well statistics, concentrations for the primary COPCs based on the mean, UCL95, and 95th percentile, respectively, are estimated to range between:

- 2.7 and 6.0 μg/L for 1,4-dioxane.
- 2.1 and 7.1 μg/L for TCE.
- 1.1 and 2.9 μg/L for PCE.
- 0.8 and 1.7 μg/L for 1,1-DCE.
- 2.9 and 4.7 milligram(s) per liter (mg/L) for nitrate (as N).

Using monitoring well statistics, concentrations for the COPCs based on the mean, UCL95, and 95th percentile, respectively, are estimated to range between:

- 1.3 and 18.6 μg/L for 1,4-dioxane.
- 6.0 and 21.5 μg/L for TCE.
- 4.6 and 20.2 μg/L for PCE.
- 1.9 and 3.3 mg/L for nitrate (as N).
- 1,1-DCE did not exceed any regulatory thresholds in monitoring wells, thus calculations were not prepared.

Five Remediation Well Treatment

Using production well statistics, concentrations for the primary COPCs based on the mean, UCL95, and 95th percentile, respectively, are estimated to range between:

- 3.7 and 9.6 µg/L for 1,4-dioxane.
- 2.5 and 8.6 µg/L for TCE.
- 1.3 and 4.2 µg/L for PCE.
- 0.7 and 1.5 µg/L for 1,1 DCE.
- 2.8 and 4.8 mg/L for nitrate (as N).

Using monitoring well statistics, concentrations for the COPCs based on the mean, UCL95, and 95th percentile, respectively, are estimated to range between:

- 1.3 and 18.5 µg/L for 1,4-dioxane.
- 6.0 and 21.4 µg/L for TCE.
- 4.6 and 20.1 µg/L for PCE.
- 1.9 and 3.3 mg/L for nitrate (as N).
- 1,1-DCE did not exceed any regulatory thresholds in monitoring wells, thus calculations were not prepared.

Groundwater Flow and Contaminant Fate and Transport Modeling

As part of the NHW RIFS, groundwater flow and fate and transport modeling for 1,4-dioxane were also conducted (Hazen 2016a) to simulate future concentrations at each production well and the plant influent for this constituent. From the modeling results, the 1,4-dioxane plant influent concentration was simulated to be between 2 to 4 µg/L for the first two years of remediation, increasing to a maximum of approximately 8 µg/L after two years of Remediation Well pumping. Following that time, the 1,4-dioxane concentration from Remediation Wells was simulated to decrease through time and decreased below the NL of 1 µg/L after 13 years of remediation, based on the modeling.

Trend and Variability Analysis

Trend analysis for the primary COPCs indicated four production wells (NH-34, NH-36, NH-37, and NH-43A) exhibited either statistically significant or visually identified increasing trends for three or four COPCs (i.e., 1,4-dioxane, TCE, PCE, and/or 1,1-DCE). These four wells are located in the northeastern/eastern part of Whitsett Park, and the results are consistent with COPC plumes migrating toward the well field from the northeast. In the remainder of the well field, concentrations of these four COPCs do not appear to increase over time. Statistically significant increasing nitrate trends were identified at production wells NH-04, NH-07, NH 22, NH-26, and NH-43A. Statistically significant decreasing trends of nitrate were identified at production wells NH-25 and NH-44. No trends were observed at production wells NH-23, NH-32, NH 33, NH-34, NH-36, NH-37, and NH-45.

The assessment of concentration variability generally indicates that concentrations of the primary COPCs (1,4-dioxane, 1,1-DCE, TCE, PCE and nitrate) exhibit some correlation to operational status (i.e., pumping, or non-pumping) of a well or at nearby wells. However, trends are not consistent by COPC, and seasonal patterns are not distinguishable with reference to the data sets that were assessed. Furthermore, no correlation with wet and/or dry periods (longer-term seasonal assessment) is evident in the concentrations of the five COPCs. Although variations in COPC concentrations are present through time, the majority of the changes in concentration appear to be correlated to production (pumping) of the specific production well (or from adjacent wells) and the resulting movement of contaminant plumes.

N
S
W
E

0 1,750
Feet

Legend

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China

Note:
Features shown on this figure are approximate and should be used for indicative purposes
GSIS Monitoring Wells are from NH-MW-05 to NH-MW-11

- USEPA MONITORING WELLS
- NHW REMEDIATION WELLS
- NHW PRODUCTION WELLS (NON-REMEDY)
- GSIS MONITORING WELLS
- NH-MW-08-270 Well ID (Former)
- NH-MW-08-Z1 LADWP Well ID
- MAJOR CLEANUP SITES
- NHW STUDY AREA

LA DWP Los Angeles Department of Water & Power

Hazen ARCADIS Advisian

NORTH HOLLYWOOD WEST (NHW) STUDY AREA, AND PRODUCTION AND MONITORING WELLS INCLUDED FOR THE NHW RAW WATER QUALITY CHARACTERIZATION (RWQC) STUDY

SWL	SB	11/7/2022
308038-13235 DDW 97-005		4

FILE LOCATION: E:\GIS\Projects\308038-13235\mapdocuments\11-4-2022\Exec_Summary\11-7-2022\Fig 4 - North Hollywood West (NHW) Well Field Study Area.mxd

USER NAME: Steven.Lindelof
ISSUING OFFICE: Orange County GIS

PLOT DATE & TIME:11/7/2022 12:49:43 PM
SAVE DATE & TIME:11/7/2022 12:49:19 PM

6. STEP 3: DRINKING WATER SOURCE PROTECTION

This section presents a summary discussion of the key outcomes of Step 3 of the 97-005 evaluation process for NHW Well Field, i.e., Drinking Water Source Protection. The detailed Step 3 evaluation is documented in the *Drinking Water Source Protection for the North Hollywood West Well Field (Step 3 of 97-005 Evaluation) Report* (LADWP 2020c) and was conducted in accordance with Section 3 of the DDW Process Memo 97-005-R2020.

Purpose

The Drinking Water Source Protection (DWSP) Program documents the efforts in place to control the level of contamination within the Study Area and provides an evaluation of cleanups, mitigations, and remediations within the water source to ensure ongoing source water protection from future instances of groundwater contamination.

Overview

The NHW DWSP Program identifies efforts LADWP will undertake to monitor regulatory activities intended to prevent the level of contamination from rising within the NHW Study Area and how the dependence on treatment will be minimized. These efforts include:

- Regular communication with the EPA and RWQCB for the purposes of discussing groundwater contamination issues, environmental cleanups, and to be kept informed of any new sources of contamination in soil and/or groundwater that can potentially impact the quality of the NHW Well Field source water. A key objective of this action is to identify any issues early that may affect the NHWWT Facility, including major clean-up sites identified as part of the SA/CA (Step 1), i.e., HPL and Honeywell Site (Former Bendix Facility). Regular assessment of clean-up and monitoring activities associated with these sites are included in the NHW DWSP Program.
- Quarterly meetings with DDW to brief on updates related to water quality, well field operations, and groundwater remediation activities.
- Attendance at triannual meetings with the EPA, LARWQCB, Department of Toxic Substances Control (DTSC), DDW, and the Cities of Burbank and Glendale to discuss the status of Superfund Projects in the San Fernando Valley (SFV). LADWP briefs the committee on NHOU activities, and the Cities of Burbank and Glendale update the committee on the Burbank OU and Glendale OU, respectively. The EPA, LARWQCB, and DTSC provide updates to the committee on various matters related to groundwater cleanup and remediation efforts in the SFV.
- Executed a memorandum of understanding (MOU) with the RWQCB, whereby LADWP funds ongoing LARWQCB investigations to identify potential responsible parties (PRPs) of groundwater contamination that has adversely impacted LADWP’s well fields in the SFB.
- Monitoring of Remediation Wells, non-remedy production wells, and groundwater monitoring wells within the NHW Study Area in conjunction with third-party groundwater monitoring programs.
- Staying informed on other source protection programs and permitting regulations that govern the management and handling of hazardous materials, storage tanks, and hazardous waste within the NHW Study Area.

The NHW DWSP Program includes a Communication Plan, which identifies LADWP personnel that will act as liaisons with agencies involved with permits involving hazardous materials and wastes as well as remediations or cleanups undertaken by the EPA, DTSC, and LARWQCB. LADWP's agency liaisons are summarized as follows:

- **DDW liaison:** Environmental Affairs Officer, Regulatory Affairs and Consumer Protection.
- **LARWQCB liaison:** Remediation Support Squad Lead, Source Protection & Groundwater Remediation (SPGR) Group
- **EPA liaison:** Remediation Support Squad Lead, SPGR Group.
- **DTSC liaison:** Remediation Support Squad Lead, SPGR Group.

7. STEP 4: EFFECTIVE TREATMENT AND MONITORING

This section presents a summary discussion of the key outcomes of Step 4 of the 97-005 evaluation process for NHW Well Field, i.e., Effective Treatment and Monitoring. The detailed Step 4 evaluation is documented in the *Effective Treatment and Monitoring for the North Hollywood West Well Field (Step 4 of 97-005 Evaluation) Report* (LADWP 2020d) and was conducted in accordance with Section 4 of the DDW Process Memo 97-005-R2020.

7.1 Purpose

The purpose of the Step 4 evaluation is to assess the best available technologies (BATs) for contaminant treatment to non-detectable concentrations or appropriate levels as required by DDW, provide a treatability assessment and the proposed treatment process for contaminants within the water source, establish treated water goals for the proposed treatment system, describe the proposed treatment and monitoring program for the remediation facility, and develop the proposed WQSP to conduct ongoing monitoring of the water source.

Overview

In accordance with the DDW 97-005 Process Memo, the Step 4 Report documents the following:

- Evaluation of treated water goals to ensure the cumulative risk posed by multiple contaminants in plant effluent under anticipated NHWWT Facility operation is addressed, adopting DDW's MCL-equivalent assessment methodology and using water quality characterization results from Step 2.
- Treatability assessment describing the treatment necessary to achieve the treated water goals established for the NHWWT Facility.
- Performance standards outlining the level of treatment per technology used in the facility.
- Operations Plan that identifies operational procedures, failure response triggers, monitoring and optimization procedures, staffing requirements, and routine inspection procedures.
- Reliability features to account for potential future changes to the contaminant plume or treatment requirements.
- Compliance Monitoring and Reporting Program that describes manual and online sampling and analysis.
- Notification Plan presenting contacts for various emergency conditions.
- WQSP developed for monitoring groundwater quality in the NHW Well Field to provide an early warning in case unexpectedly high concentrations or new contaminants are moving towards NHW production wells.

Treated Water Goals

The treated water goals evaluation includes an assessment of cumulative risk posed by multiple contaminants in treatment influent using the MCL-equivalent approach and the development of treated water goals that ensure cumulative risk is addressed.

As stated in the DDW Process Memo 97-005-R2020, DDW has established an MCL-Equivalent approach to provide extra caution in the protection of public health when using extremely impaired sources.

The planned NHWWT Facility includes treatment of three Remediation Wells, with the ability to treat up to five Remediation Wells, as outlined in the Step 2 Report. Therefore, the following two Treated Water flows were considered in the evaluation to represent the bracketed treatment options of the NHWWT:

- NHWWT Treated Water - Three Remediation Wells: combined flow from wells NH-34, NH-37, and NH-45.
- NHWWT Treated Water - Five Remediation Wells: combined flow from wells NH-34, NH-37, NH-43A, NH-44, and NH-45.

Assessments were also conducted for two additional NHW Well Field flows to establish a holistic and robust understanding of the potential risks posed by COPCs in individual and combined NHW flows that will be sent to the North Hollywood Pump Station once the NHWWT Facility is operational. The two flows include:

- Untreated Water: collective flow from eight untreated NHW production Wells.
- Combined Flow: collective flow of Untreated Water plus Treated Water (NHWWT effluent).

The flows considered for the treated water goals evaluation are illustrated in Figure 5 below.

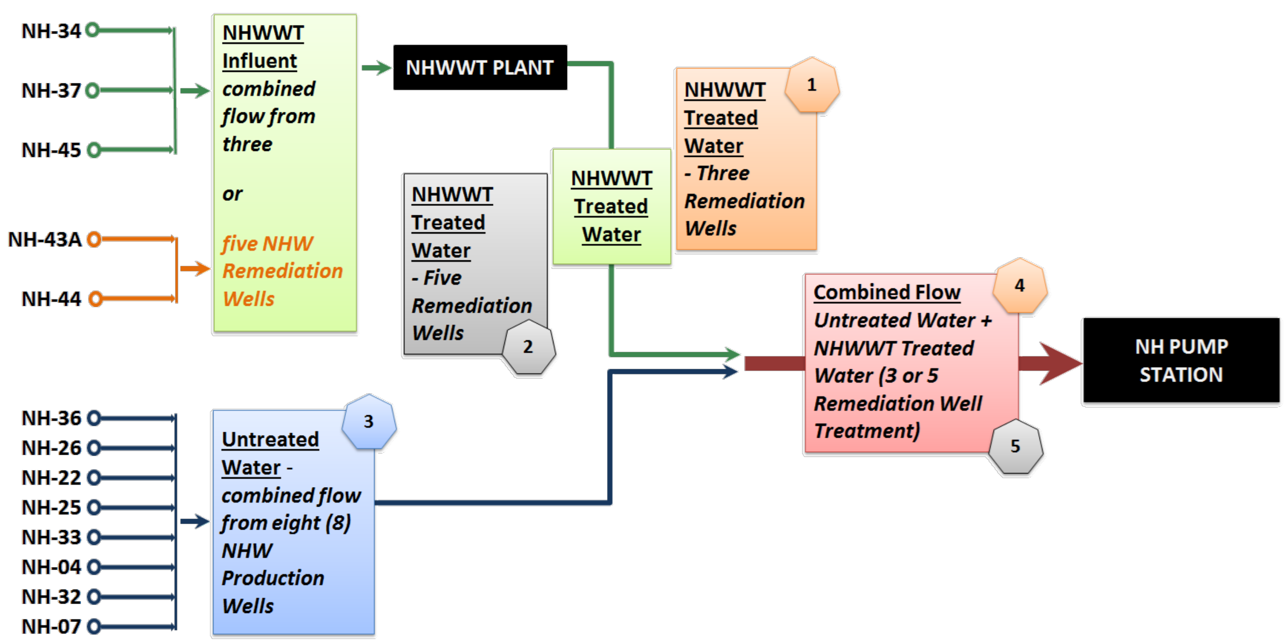


Figure 5: NHW Well Field Flow Diagram

The list of COPCs considered for the treated water goals evaluation includes:

- All COPCs identified in the RWQC (Step 2) for NHW Well Field for production and monitoring wells.
- Constituents that exceeded 10% of their MCL or NL in production wells and fall into one or more of the following categories: SVOCs, VOCs, and inorganic constituents that are known contaminants in the SFB and were identified as COPCs with anthropogenic source(s) within the NHW Study Area, as described in the SA/CA (Step 1) Report.

The MCL-equivalent assessment results show the overall MCL-equivalent for the NHWWT effluent under normal anticipated operations is below the DDW guidance threshold of ≤1.0 for both acute and chronic risk. As such, the level of treatment to be provided by the NHWWT Facility is acceptable and appropriate. Using the results of the MCL-equivalent assessment, the treated water goals comprise treatment of the following COPCs to less than their applicable DDW detection limits for reporting (DLRs):

- 1,4-dioxane (<1 µg/L; DLR = 1 µg/L).
- PCE (<0.5 µg/L; DLR = 0.5 µg/L).
- TCE (<0.5 µg/L; DLR = 0.5 µg/L).
- 1,1-DCE (<0.5 µg/L; DLR = 0.5 µg/L).
- cis-1,2-DCE (<0.5 µg/L; DLR = 0.5 µg/L).

Treatability Assessment

The RIFS (Hazen 2016a) included a screening of 1,4-dioxane and VOCs to achieve the proposed treated water goals. Technologies considered included: ultraviolet (UV) AOP, air stripping, carbon adsorption, carbon quenching pre-filtration, and resin adsorption. The RIFS determined that the groundwater treatment facility would include a pre-filtration system, a UV AOP system consisting of UV and hydrogen peroxide, and a Granular Activated Carbon (GAC) system for peroxide quenching. While air stripping (aeration) and carbon adsorption are DDW BATs for treatment of many VOCs, they are ineffective at removing 1,4-dioxane. Resin adsorption technology is also available to remove 1,4-dioxane from water; however, has not been adequately proven in the Southern California region and for direct domestic use.

AOP technologies use UV light or ozone and a chemical oxidant, which reacts with the UV light or ozone to form hydroxyl radicals. Hydroxyl radicals, which are powerful oxidizers, oxidize (break down) organic contaminants. Hydroxyl radicals can oxidize 1,4-dioxane, PCE, TCE, 1,1-DCE, and cis-1,2-DCE, and have been proven to be effective and reliable in Southern California region potable water applications and at other locations throughout the United States (EPA 2006). The AOP that is proposed for the project involves use of hydrogen peroxide with exposure to UV light (UV AOP). The reliability of this process has been proven at the regulatory level, and it is an effective technology for 1,4-dioxane treatment. The EPA has found UV AOP to be effective at removing 1,4-dioxane with up to greater than 99% effectiveness (EPA 2011).

As part of the treatability assessment, testing was conducted to evaluate UV AOP treatment using NHW well water to provide data for 1,4-dioxane and VOC treatment. The testing studied removal efficiencies for 1,4-dioxane, 1,1-DCE, and TCE removal by UV AOP treatment at varying fluences and hydrogen peroxide concentrations, examined byproduct formation, and assessed blending viability via simulated distribution system testing. Two types of lamps were tested: low pressure high output (LPHO) and medium pressure (MP). The LPHO lamps were selected to avoid nitrite formation that occurred with the MP lamps. The testing confirmed that UV AOP can achieve 1.9 log reduction of 1,4-dioxane, and VOCs can be simultaneously removed. PCE and cis-1,2-DCE were not directly tested but have similar or better hydroxyl radical rate constants that indicate reductions will be similar to or greater than 1,4-dioxane. Testing also showed that minimal disinfectant byproduct formation occurred.

Performance Standards

The NHWWT Facility is designed to treat up to 12,750 gallons per minute (gpm) to accommodate well flows. The facility will treat 1,4-dioxane and other VOCs (i.e., PCE, TCE, 1,1-DCE, and cis-1,2-DCE) present in the Remediation Wells to concentrations outlined in the treated water goals evaluation.

Performance standards for the NHWWT Facility represent the maximum anticipated log reductions that will be achieved for each contaminant. Treatment is based on achieving 1.9-log reduction of 1,4-dioxane at the maximum flow rate. VOC reductions were calculated reductions that will be simultaneously achieved based on the 1,4-dioxane target. Actual treatment levels may vary depending on the measured influent 1,4-dioxane and VOC concentrations during operation and will be selected to achieve the treated water goals.

Treatment System Design

The NHWWT Facility includes advanced oxidation using UV AOP, a proven treatment technology for 1,4-dioxane removal from drinking water. The complete process consists of pre-filtration (consisting of sand separators and cartridge filters) to protect downstream equipment by removing sand and other particles from the wells, UV AOP, and GAC vessels to remove excess hydrogen peroxide. Disinfection will occur off-site using existing chemical facilities. Figure 6 presents a process flow diagram for the NHWWT Facility.

The NHWWT Facility basis of design described in Step 4 includes the purpose of each major unit process, hydraulic loading rate, and other important design criteria needed for effective performance summary of the basis of design for each major unit process is as follows:

- **Well Pumps**: Replacement well pump will be installed to accommodate the additional headloss associated with the NHWWT Facility and the planned flow rates. The estimated combined flow rate from three wells (NH-34, NH-37, and NH-45) is 7,900 gpm, and the estimated combined flow rate from five wells (NH-34, NH-37, NH-45, NH-43A, and NH-44) is 12,500 gpm[1].
- **Treatment Capacity**: The NHWWT Facility will have the capacity to treat the combined flow from the five wells and will be sized to accommodate up to 12,750 gpm raw water flow (rounded up from the five well flow rate to accommodate the GAC vessel flow rates). The treated water is subsequently blended with water from other wells in the NHW Well Field in the collector line and conveyed to the North Hollywood Pump Station where it will mix with flows from LADWP’s Rinaldi-Toluca Well Field and North Hollywood Operable Unit (NHOU), and then collectively with surface water.
- **Sand Separators**: Sand separators are included in the process and used to remove the larger sized particles (sediment/debris) entrained in groundwater extracted from the Remediation Wells and serve to protect the UV reactors and GAC vessels. The sand separators will be periodically purged to remove accumulated particles. When operating under recommended conditions, the sand separator

[1] The flow rates provided are based on pump capacities; however, NHWWT capacity is 12,750 gpm (please refer to 6th bullet point on next page).

units can achieve up to 98% removal of 74 microns or larger particles, and 75% removal of 5 microns and larger particles.

- **Cartridge Filters**: As a second step of pre-filtration, cartridge filters are used to remove smaller and lighter particles that are not captured by the sand separator. Five-micron nominal-rated filter elements are planned for use, which can achieve 90% removal of 5 μm or larger particles.
- **Hydrogen Peroxide Feed**: Hydrogen peroxide is injected upstream of the UV reactors in order to form hydroxyl radicals within the UV reactor. The hydrogen peroxide storage and feed system consist of two peroxide storage tanks (each with a 9,000-gallon capacity), with adequate capacity to accept a full truck delivery of hydrogen peroxide. Combined, the tanks have capacity for at least 30 days of storage under average flow and peroxide dose conditions. Two peristaltic metering pumps in a duty/standby configuration will be used for hydrogen peroxide injection to ensure continuous and consistent dosing.
- **UV Reactors**: UV reactors photolyze hydrogen peroxide to generate hydroxyl radicals that oxidize the contaminants being treated. The UV system consists of four trains of UV reactors. The number of trains and peroxide dose is calculated based on the facility flow rate, UV transmittance (UVT), and target 1,4-dioxane log reduction. Higher log reductions can be achieved at lower flow rates or higher peroxide doses. The expected hydrogen peroxide dosage under normal conditions is 16 mg/L, and the peroxide feed system can deliver a peroxide dose up to 25 mg/L if required for higher levels of treatment.
- **GAC Vessels**: Hydrogen peroxide is added in excess and is not completely photolyzed by the UV light. GAC vessels are used for residual hydrogen peroxide quenching. Hydrogen peroxide reacts with the GAC media in a catalytic reaction that breaks down the hydrogen peroxide into oxygen and water. As such, the GAC adsorption sites are not used up in the reaction and the GAC media lasts longer than with typical adsorption applications. Eighteen GAC vessels will be operated in parallel with a minimum of five minutes of Empty Bed Contact Time (EBCT).
- **GAC Backwash System**: During installation, each 20,000 lb. GAC vessel will be backwashed according to vendor's recommendation using treated water. The process removes GAC fines generated during transit and stratifies the media for operation. Backwash water from the initial installation will be collected in a 40,000-gallon storage tank and metered to the sewer. Due to peroxide breakdown that may lead to GAC air binding, a reduced backwash (backflush) may be implemented. The backflush water is planned to be collected in the same storage tank and then sent to the sewer. The system design also includes the ability to recycle the flow to the head of the treatment process (i.e., upstream of the sand separators), as an option; however, the facility is not intended to recycle at this time.
- **Treatment of Five Wells versus Three Wells**: The NHWWT Facility design will be able to treat up to five wells for a total treatment capacity of up to 12,750 gpm. At 12,750 gpm rather than the three well capacity of 9,750 gpm, 1,4-dioxane concentrations are anticipated to more quickly decrease, resulting in a higher flow but a lower target log reduction to achieve water quality goals.
- **Redundancy**: Unit process redundancy was incorporated in the NHWWT Facility design, including:
    - **Sand Separators**: Four sand separators will be installed at this facility and during normal operation, four units are available for service. The fourth unit allows one separator to be serviced at any given time without impeding the treatment process. In addition to solids purging, other

maintenance such as purge valve and pressure gauge inspection, and hand hole clean out, will be performed on a regular basis.

- **Cartridge Filters**: Five cartridge filters will be installed at this facility and when in normal operation, five units are in service. Four filters can accommodate the design plant flow for the NHWWT Facility, allowing the additional unit to be serviced at any given time without impeding the treatment process.
- **Hydrogen Peroxide Storage and Feed**: At the normal usage rate and operational parameters, the combined 9,000-gallon tank capacity provides greater than 30 days' supply. Hydrogen peroxide is typically delivered in 3,000- to 4,500-gallon deliveries. A transfer pump is available to move peroxide between storage tanks, if required. Two hydrogen peroxide peristaltic feed pumps (one duty, one standby) provide chemical feed to the diffusers in the UV AOP influent pipeline. The standby pump is provided for redundancy.
- **UV Reactors**: During normal operations, the entire flow can be treated through two or three UV reactor trains. Operators may choose to use all 4 trains at a reduced flow per train or put one or more UV trains into standby mode. Hydrogen peroxide concentrations can be increased to facilitate higher levels of treatment, regardless of the number of UV reactors that are in service.
- **GAC Vessels**: The GAC vessels will be taken out of service periodically for backflushing or media changeout. The GAC facility was designed with an extra GAC vessel to allow for one vessel to be taken out of service while maintaining full quenching capacity within the surface loading rate limitations for GAC. If more than one vessel is required to be taken out of service at one time, the flow through the facility can be reduced by taking one well out of service. It is anticipated that the GAC media in each vessel will have to be replaced every two to three years.

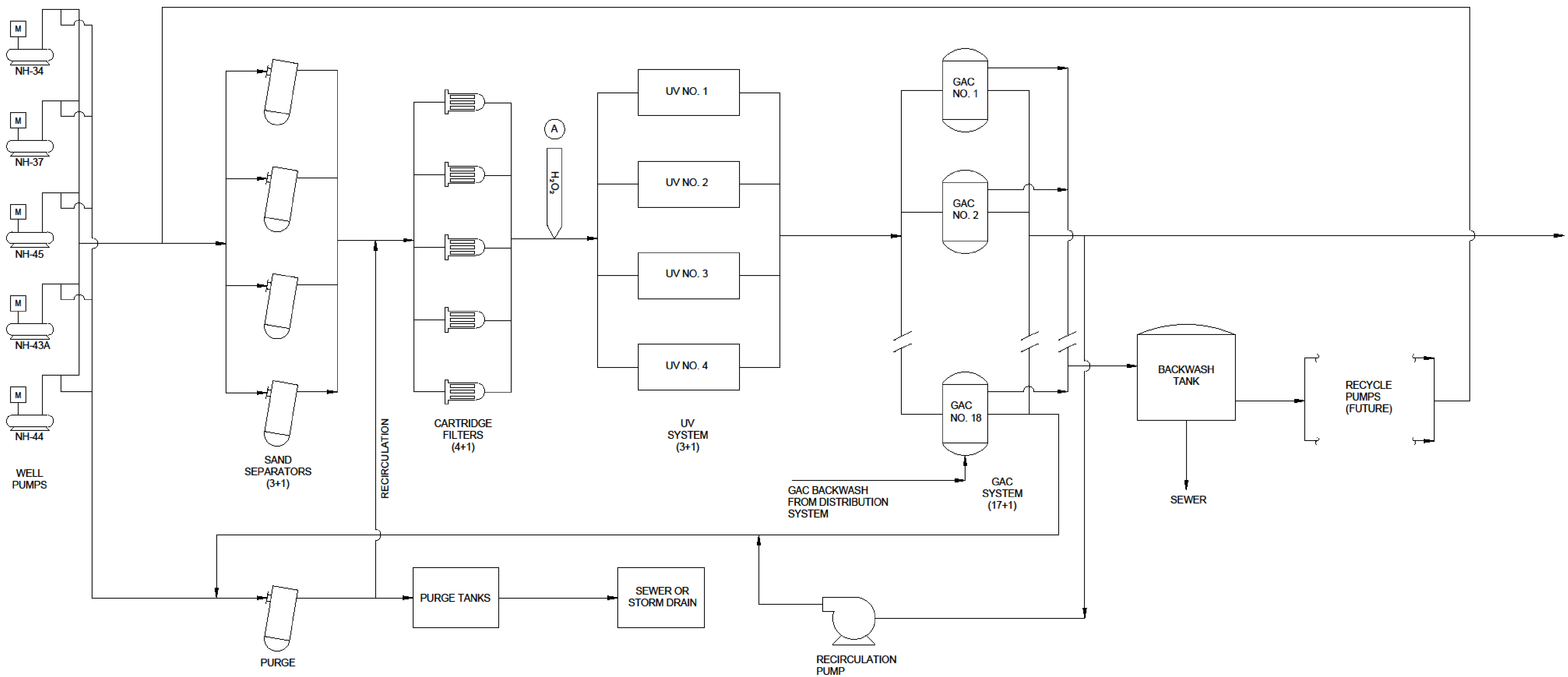


Figure 6: NHWWT Facility Process Diagram

Operations Plan

The Operations Plan identifies operational procedures, failure response triggers, monitoring and optimization procedures, staffing requirements, and routine inspection procedures.

Operational Procedures

The NHWWT Facility is intended to operate 24 hours a day, seven days a week, on a near year-round basis. Planned shutdowns and startups may occasionally occur. Full plant shutdowns can be minimized through partial plant shutdowns and utilizing redundant equipment provided for all treatment processes.

Emergency shutdowns are expected to be rare, and if they do occur, are anticipated to be of short duration. For shorter temporary shutdowns, the raw well water will be sent directly into the treatment system upon start-up. For extended shutdowns (>24 hours), the raw well water will be purged prior to sending water to the treatment system. Operational procedures are provided in the Step 4 report for the following:

- Full-Plant Startup after an Extended Shutdown: During a full-plant startup following a shutdown of more than 24 hours, the first water from the wells will be sent to waste through the purge lines and ultimately disposed in the sanitary sewer.
- Full-Plant Startup after a Temporary Shutdown: During a startup after a shutdown of less than 24 hours, the first water from the wells is sent directly to the treatment system instead of purge lines,
- Full-Plant Shutdown: A full-plant shutdown can be used to conduct more extensive plant maintenance.

Failure Response

The NHWWT Facility will be highly automated and designed to operate with minimal operator attention. The plant features automatic responses to several failure situations. A failure will signal an alarm at the NHWWT Facility control room. Trouble signals will also be transmitted to the Treatment Operations Control Center (TOCC) system where operations can remotely monitor the system. Examples of the automatic responses include alarms for issues relating to the wells, UV system, and GAC system.

No standby generator will be available at the site. A power failure at the site will shut down the wells and treatment facility because they share a common power feed. If the treatment facility fails but the wells are still online, the supervisory control and data acquisition (SCADA) software will shut down the wells to avoid serving untreated water. Normal start-up procedures will be followed to bring the system back online when power resumes, which will be included in the system Operations Maintenance and Monitoring Manual (OMMP).

Monitoring and Optimization

Proper operation of the water treatment plant will be maintained through process monitoring. Process monitoring points and sample collection results will be used calibrate online analyzer results. Key control parameters monitored by online analyzers include UV System controls (UVT, UV intensity, flow rate, and hydrogen peroxide) and GAC system control (differential pressure, flow rate, and hydrogen peroxide).

Plant optimization (the process of fine-tuning operation of each unit process to obtain maximum performance to (1) meet and exceed performance standards, and (2) provide the most efficient method for treatment, with likely focus on adjustments to the number of UV trains online and hydrogen peroxide dose for the given influent water quality of the wells being treated.

The UV AOP component, consisting of UV trains and hydrogen peroxide dosing, will be operated at contaminant design log reduction based on maximum estimated concentrations. Since the dominating contaminant is 1,4-dioxane, the log reductions will be based on this target. The operator-selected target log reduction will depend on the number of wells operated as follows:

- Three (3) wells operating – 1.9- Log reduction.
- Four (4) wells operating – 1.8- Log reduction.
- Five (5) wells operating – 1.7- Log reduction.

Since monthly sampling will be imposed, the data will be evaluated and help determine if the target log reductions need to be optimized.

Staffing Requirements

The NHWWT Facility is designed to be a fully automated, unmanned facility, with approximately 2 hours per day of operator visitation time. The facility is equipped with remote monitoring and control performed by the Water Treatment Operators through the TOCC system. Operator duties include the following:

- Chief Plant Operator (CPO): Oversees the NHWWT Facility and has required State of California certification of Water Treatment Operator T4. Duties include coordinating and reviewing the work of the NHWWT Water Treatment Operators, communicating with the NHWWT Plant Engineer and Superintendent, coordinating major maintenance of all equipment with maintenance personnel, ordering chemicals and equipment, directing implementation of improvements to treatment activities and resources, conducting interviews, providing training, and administering policies and procedures, and discipline and reward of employees.
- NHWWT Facility Operator: Has required State of California certification of Water Treatment Operator T3. Duties include operating automatic and manually controlled equipment and systems, monitoring and coordinating routine and emergency activities of employees and persons on site, reading and evaluating instruments, charts, recorders and process control computer outputs to monitor plant operations, adjusting dosages of treatment chemicals and monitor storage levels, placing chemical orders and receiving chemical deliveries, performing physical and chemical tests using laboratory equipment and automated instruments to monitor the effectiveness of the treatment, investigating operating problems, recommending process changes and equipment repairs, coordinating with maintenance personnel for repair or installation of equipment and systems, and transporting, loading, connecting and handling all water treatment chemicals.

Routine Inspection Procedures

Manufacturer's recommendations for inspection and maintenance of moving parts and rotating equipment will be followed and the OMMP will be updated based on the first-year operations experience. Anticipated inspection and maintenance items for the facility include:

- Sand Separators: purge valves, hand-hole clean out, and pressure gauges.

- Cartridge Filters: pressure gauges and gaskets.
- UV System: duty UV sensor, reference UV sensor, UVT analyzer, UV spectrophotometer, flow meters, UV lamps, lamp sleeves, mechanical cleaning system, and ballast cooling.
- Metering Pumps: wash downs, hose replacements, pump-housing and rotor internals, bearings, shaft and shaft seal.
- GAC Vessels: vessel internals and backwashing vessels.

Reliability Features

The NHWWT system design includes several reliability features to account for potential future changes to the treatment requirements and to allow for flexibility should influent concentrations or treatment flow rate change. These include:

- Safety factors on influent concentrations:
    - For conservatism, the maximum modeled 1,4-dioxane influent concentration was selected as the basis of the design influent concentration and a safety factor was applied to account for uncertainties. The modeling predicted an influent concentration of up to 8 µg/L; the AOP system was sized to treat up to 20 µg/L of 1,4-dioxane.
- Treated water goals less than DLR:
    - The treated water quality goal for 1,4-dioxane is < DLR (1 µg/L) and TCE, PCE, and 1,1-DCE <DLR (0.5 µg/L).
- Conservative design criteria for water quality:
    - The AOP controls will automatically adjust for changes in flow and the operator selected target log reduction. If the treatment goals cannot be met with all UV trains online at the maximum hydrogen peroxide dose, the flow rate to the plant will be reduced or a manual plant shutdown will be triggered. Higher levels of treatment can be achieved if the water quality is better than design, flow is less than design, or the hydrogen peroxide dose is greater than design.
    - The UVT is one factor that determines the treatment capacity; all UVT samples to date have been greater than 98%; however, a design UVT value of 97% was selected for equipment sizing. Treatment capacity will be greater than design if the UVT is greater than 97% during operation.
    - The design hydroxyl radical scavenging demand was based on the most conservative sample collected for any of the production wells to date. The hydroxyl radical scavenging demand will be monitored during the first year of operation to confirm the hydroxyl radical scavenging demand during operation. If the scavenging demand is lower than the design value, the treatment capacity will be increased.
- Hydrogen peroxide feed capacity and equipment redundancy:
    - The UV AOP reactors were designed assuming the lamps operate at near 100% power and a hydrogen peroxide dose of approximately 20 mg/L. For added treatment capacity, the hydrogen peroxide feed system was designed to dose hydrogen peroxide up to 25 mg/L at the maximum flow rate.
    - The NHWWT Facility includes a redundant UV train to account for equipment maintenance. The facility includes three duty UV reactor trains and one redundant UV train. The redundant UV train

can be used during normal operation to minimize the hydrogen peroxide dose or increase treatment capacity.

- After plant start-up is completed and the treatment plant is in operation, contaminant concentrations for all Remediation Wells will be monitored to characterize influent water quality and treatment may be optimized by adjusting log reduction while maintaining treated water goals.

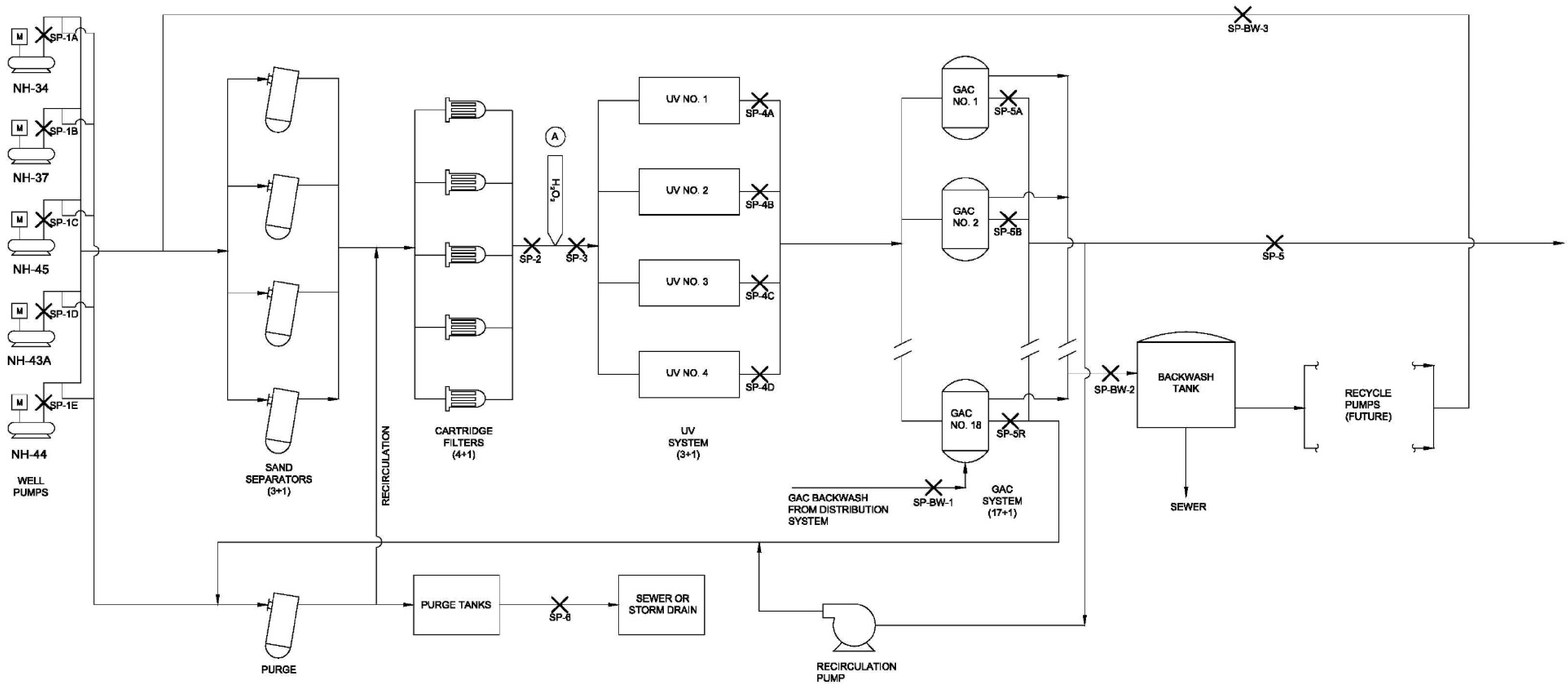
Compliance Monitoring and Reporting

A manual and online sampling and analysis plan for treatment monitoring at the NHWWT Facility was generated. Each unit treatment process has sampling locations at the influent and treated water as shown in Figure 7. Treated water from individual UV reactors will be monitored in addition to the combined treated water from the UV reactors. Treated water from individual GAC vessels will be monitored in addition to the combined treated water from the GAC vessels (the treated water from the NHWWT Facility). Sample ports will be confirmed and if necessary revised as part of construction and commissioning.

Analyte groups that will be monitored for the treatment process include 1,4-dioxane for evaluating removal by UV AOP, VOCs for evaluating removal by UV AOP, hydrogen peroxide for evaluating the dose as a part of UV AOP and quenching as part of GAC, general physical characteristics (e.g., pH, temperature, turbidity, alkalinity, hardness, calcium, iron, manganese, and UVT) for water quality monitoring and UV lamp fouling, and other contaminants with regulatory limits that require routine monitoring. In addition to the water quality analytes above, operational parameters will be monitored throughout the treatment process, including but not limited to flow rate, water pressure, and parameters for UV performance (e.g., UV lamp status) and GAC operation (e.g., backwash frequency).

Manual sampling frequencies will vary between weekly and monthly or as needed dependent on the sampling port and/or the parameter being monitored. In the event that a detection above the DLR is observed for parameters with treated water goals, more frequent monitoring will be triggered, which may include a period of daily monitoring if certain criteria are met. Quality control samples will also be collected in the field and laboratory for evaluating precision, accuracy, representativeness, comparability, and instrument sensitivity.

Monthly reports will be prepared and submitted to DDW that will detail the amount of water treated and the amount of water produced and delivered to the distribution system. A summary of all required analytical results will be included in the monthly report. The report will also state the production wells in operation, duration of operation, and pumping volume for each well. The monthly report will include, Daily UV AOP Reactor Operational Reports, Daily Operational Summary Reports, Monthly Operational Summary Reports, Quarterly UV Sensor Calibration Check Reports, and Weekly UVT Analyzer Calibration Check Reports.



Note: *Sampling locations are marked as "SP".*

Figure 7: NHWWT Facility Sampling Locations

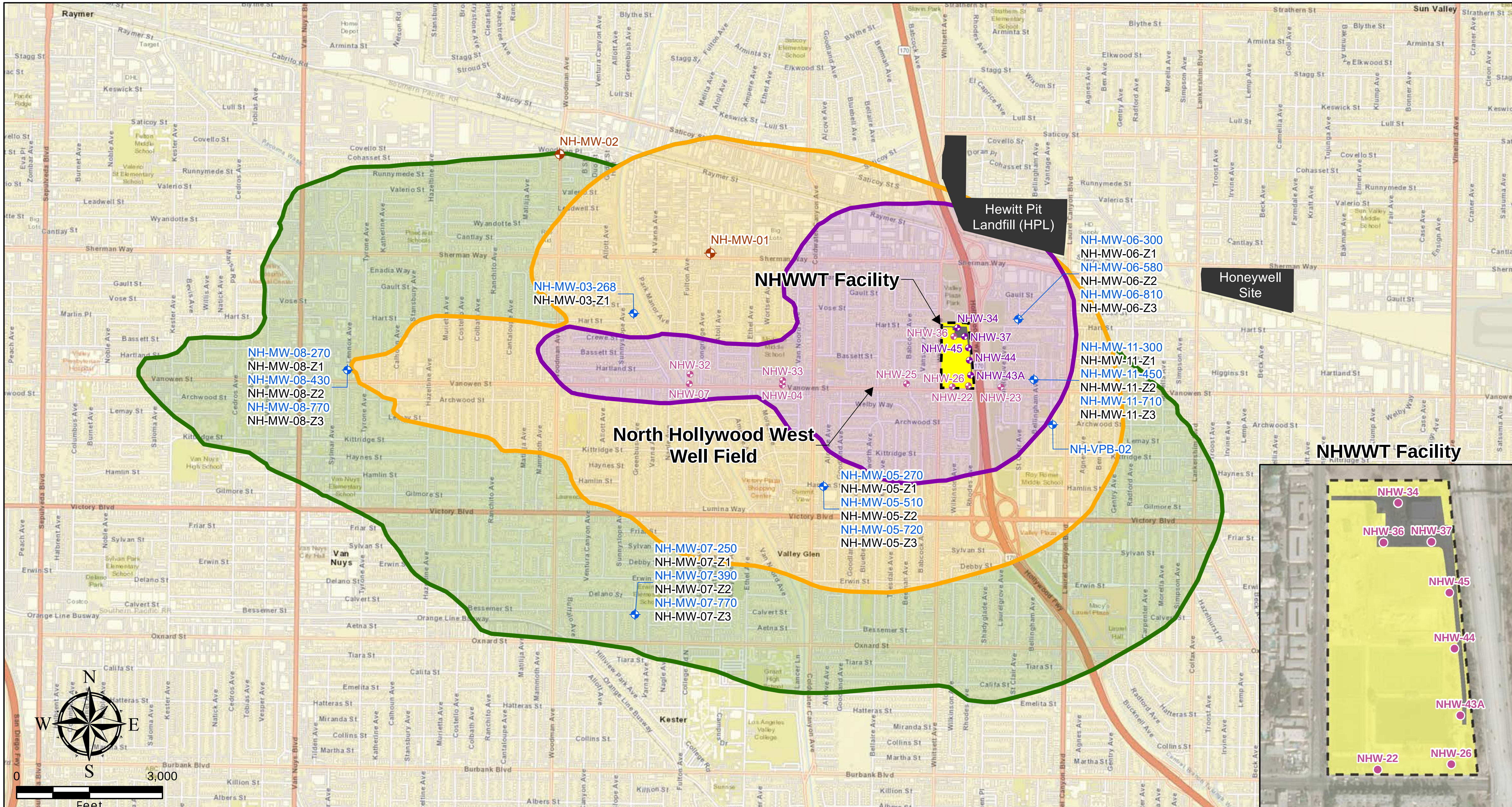
Notification Plan

The Notification Plan provides the contacts for various emergency conditions for the NHWWT Facility. LADWP has an Emergency Notification Plan (ENP) that provides contacts for LADWP and the regulatory agencies in the event of an emergency. The ENP is included in the Step 4 Report and covers emergency scenarios such as injury, fire, significant system damage, spill or release of untreated water outside of the containment area, and discharge violations.

Source Water Quality Surveillance

The NHW WQSP is designed to monitor groundwater quality between the origin of the contamination and the NHW Well Field production/remediation wells. The WQSP identifies monitoring wells within the 2, 5, and 10-year capture zones of the NHW Well Field that will serve as sentinel wells to provide early warning of any unexpected increases in contaminant concentration or detection of additional contaminants. The groundwater monitoring wells selected for the NHW WQSP are shown in Figure 8.

The WQSP identifies the groundwater monitoring network, rationale for selection of wells comprising the monitoring network, analytical and monitoring schedules, sampling frequency, data quality objectives, field sampling plan, quality assurance project plan, and reporting process for sampling of groundwater within the NHW Well Field capture zones and Study Area. The WQSP is detailed in the Step 4 Report.



Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community. LADWP Capture Zones from DDW Interim MW Sampling Plan Presentation pg 6- April 2015. Treatment Plant footprint and facility area from "North Hollywood West Wells 1,4-Dioxane Remediation Site Plan, Figure 1." USEPA 2017 TCE, PCE, 1,4-Dioxane Plumes ≥MCL (TCE ≥ 5.0, PCE ≥ 5.0, 1,4-Dioxane ≥1.0).

Notes: Non-operational monitoring wells are currently being evaluated by LADWP. Future plans include the removal of existing pumping systems installed in these wells, and replacing them with bladder pumps for low-flow sampling purposes. Features shown on this figure are approximate and should be used for indicative purposes only

Legend

- NHW REMEDIATION WELLS
- NHW PRODUCTION WELLS (NON-REMEDY)
- MONITORING WELLS
- NH-MW-08-270 Well ID (Former) / NH-MW-08-Z1 LADWP Well ID
- NON-OPERATIONAL MONITORING WELLS
- MAJOR CLEANUP SITES
- 2 YR CAPTURE ZONE
- 5 YR CAPTURE ZONE
- 10 YR CAPTURE ZONE
- NHW WELLHEAD TREATMENT (NHWWT) FACILITY FOOTPRINT

LA DWP Los Angeles Department of Water & Power

Hazen ARCADIS Advisian

NORTH HOLLYWOOD WEST (NHW) WELL FIELD
WATER QUALITY SURVEILLANCE PLAN
GROUNDWATER MONITORING WELL NETWORK

SWL	SB	11/7/2022
308038-13235 DDW 97-005		8

FILE LOCATION: E:\GIS\Projects\308038-13235\mapdocuments\11-4-2022\Exec_Summary\11-7-2022\Fig 8 - NHW Well Field Water Quality Surveillance Plan Groundwater Monitoring Network.mxd

USER NAME: Steven.Lindelof
ISSUING OFFICE: Orange County GIS
PLOT DATE & TIME: 11/7/2022 11:47:09 AM
SAVE DATE & TIME: 11/7/2022 11:46:44 AM

8. STEP 5: HUMAN HEALTH RISKS ASSOCIATED WITH FAILURE OF PROPOSED TREATMENT

This section presents a summary discussion of the key outcomes of Step 5 of the 97-005 evaluation process for NHW Well Field, i.e., Human Health Risks Associated with Failure of Proposed Treatment. The detailed Step 5 evaluation is documented in the *Human Health Risks Associated with Failure of Proposed Treatment for the North Hollywood West Well Field (Step 5 of 97-005 Evaluation)* (LADWP 2020e) and was conducted in accordance with Section 5 of the DDW Process Memo 97-005-R2020.

Purpose

The purpose of Step 5 of the 97-005 evaluation process is to evaluate the risks of failure and assess potential health risks associated with failure of the proposed treatment system.

Overview

The Step 5 report contains an evaluation of the probability of NHWWT Facility failure and assesses the potential health risk associated with such failure. The evaluation of failure, which includes an assessment of each NHWWT Facility component mode of failure, concluded that the sand separators, cartridge filters, and GAC contactors do not affect the treatment performance and therefore do not pose a health risk to the public under a failure scenario. Failure of these components may result in increased maintenance activities. Peroxide feed and UV reactor failure would pose a limited and brief increase in risk to the public; however, online monitoring and a four-hour window of operator troubleshooting of the equipment would limit potential of elevated exposure.

Human health risk calculations used the approach described in the DDW Process Memo 97-005, which includes the use of maximum calculated COPC concentrations in untreated NHWWT effluent. The results indicate that, even in the event of total NHWWT Facility failure, incremental cancer and non-cancer risks are small and within accepted risk limits described in the DDW Process Memo 97-005. Multiple failures spanning several years, presented as a “worst-case” scenario that is not expected to reasonably occur, showed cancer risk below de minimis levels (1×10^{-6}), and the cumulative non-cancer hazard (i.e., the ratio of the maximum estimated concentrations of COPCs to non-cancer PHGs) below the DDW target value of less than 1.0.

9. STEP 6: COMPLETION OF THE CALIFORNIA ENVIRONMENTAL QUALITY ACT (CEQA) REVIEW OF THE PROJECT

This section presents a summary of the key outcomes of Step 6 of the 97-005 evaluation process for NHW Well Field, i.e., Completion of the CEQA Review of the Project. This was conducted in accordance with Section 6 of the DDW Process Memo 97-005-R2020.

Purpose

The purpose of Step 6 of the 97-005 evaluation process is to document the California Environmental Quality Act (CEQA) review for the Project.

Overview

The CEQA was established in 1970. The law requires public agencies and local governments to evaluate the environmental impacts of projects, and to limit or avoid those impacts when possible.

Specifically, the objectives of a CEQA review and evaluation are as follows:

- Inform decision makers and the public about potential significant environmental impacts of a project.
- Prevent significant, avoidable damage to the environment by requiring changes to a project, if determined to be needed.
- Identify ways that environmental impacts can be avoided or reduced.
- Disclose to the public the reasons why decisions are made.

LADWP conducted an initial assessment of potential environmental impacts associated with the planned NHWWT Facility and identified potentially significant environmental impacts.

Responding to the initial study, LADWP identified specific mitigation measures that would reduce the environmental impacts to less than significant. In December 2016, LADWP prepared for public review and comment a Mitigated Negative Declaration (MND) for the planned NHWWT Facility (LADWP 2016).

During the public review period ending March 2017, there were a limited number of comments submitted. Generally, comments that expressed an opinion on the project were supportive, including more than 10 letters. Following the public comment period, the MND for the NHWWT Facility was adopted by the City of Los Angeles Board of Water Commissioners.

10. REFERENCES

BC (Brown and Caldwell). 2015. Groundwater System Improvement Study Remedial Investigation Report. Prepared for Los Angeles Department of Water and Power; Groundwater System Improvement Study – Agreement No. 47786. February 26, 2015.

Division of Drinking Water (DDW). 2020. Process Memo 97-005-R2020; Revised Guidance for Direct Domestic Use of Extremely Impaired Sources. Revised September 21, 2020.

EPA (Environmental Protection Agency). 2006. Treatment Technologies for 1,4-Dioxane: Fundamentals and Field Applications. EPA-542-R-06-009. December 2006.

EPA (Environmental Protection Agency). 2011. 1,4-Dioxane/Ultraviolet Irradiation + Hydrogen Peroxide. June 2011.

Hazen (Hazen and Sawyer), 2016a. Interim Remedial Investigation / Feasibility Study Report, North Hollywood West Well Field. December 2016.

Hazen (Hazen and Sawyer), 2016b. Proposed Plan for Interim Remedial Action, North Hollywood West Well Field. December 2016.

Hazen (Hazen and Sawyer), 2017. Interim Remedial Action Decision, North Hollywood West Well Field. July 2017.

LADWP (Los Angeles Department of Water and Power). 2016. Mitigated Negative Declaration. North Hollywood West Well Field Water Treatment Project. December 2016.

LADWP (Los Angeles Department of Water and Power). 2019. Updated Groundwater Modeling Report. Exhibit A - Scope of Work Item 7 for Proposition 1 Groundwater Los Angeles Department of Water and Power and California State Water Resources Control Board Construction/Implementation Grant for The North Hollywood West Remediation Project Agreement No. D1712509. Submitted by Hazen and Sawyer (Hazen) under Agreement No. 47329-6 (Owner's Agent for the SFB Remediation), prepared by WorleyParsons. May 2019.

LADWP (Los Angeles Department of Water and Power). 2020a. Source Water Assessment & Contaminant Assessment for North Hollywood West, Rinaldi-Toluca & Tujunga Wellfields (Step 1 of 97-005 Evaluation). December 2020.

LADWP (Los Angeles Department of Water and Power). 2020b. Full Raw Water Quality Characterization for the North Hollywood West Well Field (Step 2 of 97-005 Evaluation). December 2020.

LADWP (Los Angeles Department of Water and Power). 2020c. Drinking Water Source Protection for the North Hollywood West Well Field (Step 3 of 97-005 Evaluation). December 2020.

LADWP (Los Angeles Department of Water and Power). 2020d. Effective Treatment and Monitoring for the North Hollywood West Well Field (Step 4 of 97-005 Evaluation). December 2020.

LADWP (Los Angeles Department of Water and Power). 2020e. Human Health Risks Associated with Failure of Proposed Treatment for the North Hollywood West Well Field (Step 5 of 97-005 Evaluation). December 2020.

.

LADWP (Los Angeles Department of Water and Power) & (SWRCB) California State Water Resources Control Board. 2018. Proposition 1 Groundwater, Los Angeles Department of Water and Power and California State Water Resources Control Board. Grant: Groundwater Construction/Implementation for the North Hollywood West Remediation Project. Agreement No. D1712509 January 2018.

ADDENDUM: INFORMATION SUMMARY FOR WELLS NH-34, NH-37, NH-43A, NH-44, NH-45

Introduction

This addendum provides a summary of well information for the following North Hollywood West (NHW) Well Field production wells: NH-34, NH-37, NH-45, NH-43A, NH-44, including:

- Well construction information.
- Drinking water source assessment and protection information.
- Well water quality information.

The information presented is primarily sourced from the NHW Well Field DDW 97-005 Source Assessment (SA) / Contaminant Assessment (CA) Report (Step 1, LADWP 2020a), the Full Raw Water Quality Characterization Report (Step 2, LADWP 2020b), and the Drinking Water Source Protection Report (Step 3, LADWP 2020c).

Well Construction

A well construction summary is provided below for each of the five wells. Tabulated well information is provided in Table A1.

Well NH-34

Well NH-34 was drilled in 1964 by cable tool method. It has a 20-inch diameter inner casing to a depth of 760 feet (ft) and a 26-inch diameter conductor casing to a depth of 42 ft. The well is surface sealed and has a 50 ft sanitary seal that was retrofitted in 2020 using the permeation grouting method. The inner casing perforations extend below ground surface from 202-263 ft, 280-290 ft, 308-398 ft, 430-462 ft, 494-505 ft, 510-561 ft, 563-574 ft, 608-642 ft, and 675-720 ft. The well utilizes a constant speed submersible pump with a designed capacity of 2,300 gallons per minute (GPM). The pump intake is set at 425 ft. The water level in this well was 251 ft below reference point (512 ft above mean sea level [AMSL]) in April 2019 and 244 ft below reference point (519 ft AMSL) in October 2019. The well is located ~320 ft east of Whitsett Avenue and 1,300 ft north of Vanowen Street, Los Angeles. The top of well casing is approximately 18 inches above the local ground surface (730.6 ft AMSL) and appears free of flooding hazards.

Well NH-37

Well NH-37 was drilled in 1968 by cable tool method. It has a 20-inch diameter inner casing to a depth of 944 ft and a 26-inch diameter conductor casing to a depth of 42 ft. The well is surface sealed and has a 50 ft sanitary seal that was retrofitted in 2020 using the permeation grouting method. The inner casing perforations extend below ground surface from 430-460 ft, 505-550 ft, 620-640 ft, 700-720 ft, 850-860 ft, and 875-910 ft. The well utilizes a constant speed submersible pump with a designed capacity of 2,800 GPM. The pump intake is set at 425 ft. The water level adjacent to this well (in NH-34) ranged from 251 to 244 ft below reference point (512 to 519 ft AMSL) from April to October 2019. The well is located ~150 ft east of Whitsett Avenue and ~1,300 ft north of Vanowen Street, Los Angeles. The top of well casing is approximately 18 inches above the local ground surface (729.6 ft AMSL) and appears free of flooding hazards.

Well NH-43A

Well NH-43A was drilled in 1982 by cable tool method. It has a 20-inch diameter inner casing to a depth of 650 ft and a 26-inch diameter conductor casing. The well is surface sealed and has a 12 ft sanitary seal. The inner casing perforations extend below ground surface from 280-370 ft, 380-390 ft, 420-460 ft, 475-496 ft, 506-565 ft, and 690-630 ft. The well utilizes a constant speed submersible pump with a designed capacity of 2,800 GPM. The pump intake is set at 425 ft. The water level adjacent to this well (in NH-34) ranged from 251 to 244 ft below reference point (512 to 519 ft AMSL) from April to October 2019. The well is located ~630 ft east of Whitsett Avenue and ~280 ft north of Vanowen Street, Los Angeles. The top of well casing is approximately 18 inches above the local ground surface (721.0 ft AMSL) and appears free of flooding hazards.

Well NH-44

Well NH-44 was drilled in 1984 by reverse circulation rotary method. It has a 20-inch diameter inner casing to a depth of 800 ft and a 36-inch diameter conductor casing to a depth of 100 ft. The well is surface sealed and has a 100 ft sanitary seal. The well is gravel packed and the inner casing is screened from 340-780 ft below ground surface. The well utilizes a constant speed submersible pump with a designed capacity of 2,300 GPM. The pump intake is set at 425 ft. The water level adjacent to this well (in NH-34) ranged from 251 to 244 ft below reference point (512 to 519 ft AMSL) from April to October 2019. The well is located ~600 ft east of Whitsett Avenue and ~600 ft north of Vanowen Street, Los Angeles. The top of well casing is approximately 18 inches above the local ground surface (722.5 ft AMSL) and appears free of flooding hazards.

Well NH-45

Well NH-44 was drilled in 1984 by reverse circulation rotary method. It has a 20-inch diameter inner casing to a depth of 810 ft and a 36-inch diameter conductor casing to a depth of 100 ft. The well is surface sealed and has a 100 ft sanitary seal. The well is gravel packed and the inner casing is screened from 340-780 ft below ground surface. The well utilizes a constant speed submersible pump with a designed capacity of 2,300 GPM. The pump intake is set at 425 ft. The water level adjacent to this well (in NH-34) ranged from 251 to 244 ft below reference point (512 to 519 ft AMSL) from April to October 2019. The well is located ~580 ft east of Whitsett Avenue and ~860 ft north of Vanowen Street, Los Angeles. The top of well casing is approximately 18 inches above the local ground surface (725.2 ft AMSL) and appears free of flooding hazards.

Table A1: Construction Information Summary

Well Name	Easting (ft)	Northing (ft)	Ground Surface Elevation (ft AMSL)	Top of Casing Elevation (ft AMSL)	Date Drilled (Year)	Drilling Method	Total Depth (ft bgs)	Conductor Casing (Inches)	Casing Diameter (Inches)	Sanitary Seal (ft bgs)	Depth to Pump Intake (ft bgs)	Perforation / Screen Interval Depths (ft bgs)	Pump Type	Motor Type	Pump Capacity (GPM)
NH-34	6439487	1894489	730.6	732.2	1964	Cable Tool	760	26	20	0-50*	425	202-263, 280-290, 308-398, 430-462, 494-505, 510-561, 563-574, 608-642, 675-720	Submersible	Constant Speed	2,300
NH-37	6439640	1894310	729.6	731.1	1968	Cable Tool	944	26	20	0-50*	425	230-260, 278-390, 430-460, 505-550, 620-640, 700-720, 850-860, 875-910	Submersible	Constant Speed	2,800
NH-43A	6439772	1893518	721.0	722.5	1982	Cable Tool	650	26	20	0-12	425	280-370, 380-390, 420-460, 475-496, 506-565, 690-630	Submersible	Constant Speed	2,800
NH-44	6439745	1893823	722.5	724.0	1984	Reverse Circulation Rotary	800	36	20	0-100	425	340-780	Submersible	Constant Speed	2,300
NH-45	6439721	1894078	725.2	726.7	1984	Reverse Circulation Rotary	810	36	20	0-100	425	340-780	Submersible	Constant Speed	2,300

Abbreviations: *ft = feet, bgs = below ground surface, AFY = acre feet per year, AMS) = Above Mean Sea Level; NA = Not Applicable, conductor casing not utilized*

Notes: *Coordinate projection is North American Datum (NAD) of 1983 (State Plane California V FIPS 0405 [US Feet]). *Sanitary seal retrofitted in 2020 using the permeation grouting method (State Water Resources Control Board, Division of Drinking Water, 2018. System No. 1910067 – Approval of Proposal to Install Sanitary Seals for North Hollywood Production Wells, October 19, 2018).*

Drinking Water Source Assessment and Protection

A summary of information relating to the drinking water source assessment and source protection is provided below for each of the five wells.

Well NH-34

Well NH-34 is most vulnerable to contamination in groundwater beneath two major cleanup sites, i.e., the Hewitt Pit Landfill (referred to as HPL or Hewitt Site) and the AlliedSignal/Bendix Corporation/Honeywell Site. At its closest, the HPL is located ~1,865 ft north of NH-34, and the AlliedSignal/Bendix Corporation/Honeywell Site ~5,000 ft east. From the constituents monitored and the SA/CA, the well source is considered immediately vulnerable to contamination.

Constituents of potential concern (COPCs) identified at the HPL includes 1,4-dioxane, trichloroethene (TCE), tetrachloroethene (PCE), 1,2,3-trichloropropane (1,2,3-TCP), N-nitrosodimethylamine (NDMA), hexavalent chromium (Cr[VI]), and perchlorate. COPCs identified at the AlliedSignal/Bendix Corporation/Honeywell Site includes TCE, PCE, 1,4-dioxane, and Cr(VI).

Given the elevated concentrations of COPCs (VOCs and 1,4-dioxane) reported for samples collected from Well NH-34, it is considered vulnerable to known groundwater contaminant plumes associated with the two major cleanup sites. Source protection measures are being implemented at the cleanup sites. LADWP has implemented the DDW Interim Sampling Plan since 2015 to evaluate groundwater conditions and will continue to monitor groundwater conditions per the NHW Water Quality Surveillance Plan (WQSP) once the North Hollywood West Wellhead Treatment (NHWWT) Facility is online. Implementation of the NHW WQSP will serve as an early warning of any unexpected increases in contaminant concentration or detection of additional contaminants.

Well NH-37

Well NH-37 is most vulnerable to contamination in groundwater beneath two major cleanup sites, i.e., the HPL and the AlliedSignal/Bendix Corporation/Honeywell Site. At its closest the HPL is located ~1,873 ft north of NH-37, and the AlliedSignal/Bendix Corporation/Honeywell Site ~5,200 ft east. From the constituents monitored and the SA/CA, the well source is considered immediately vulnerable to contamination.

COPCs identified at the HPL includes 1,4-dioxane, TCE, PCE, 1,2,3-TCP, NDMA, Cr(VI), and perchlorate. COPCs identified at the AlliedSignal/Bendix Corporation/Honeywell Site includes TCE, PCE, 1,4-dioxane, and Cr(VI).

Given the elevated concentrations of COPCs (VOCs and 1,4-dioxane) reported for samples collected from Well NH-37, it is considered vulnerable to known groundwater contaminant plumes associated with the two major cleanup sites. Source protection measures are being implemented at the sites. LADWP has implemented the DDW Interim Sampling Plan since 2015 to evaluate groundwater conditions and will continue to monitor groundwater conditions per the NHW WQSP once the NHWWT Facility is online. Implementation of the NHW WQSP will serve as an early warning of any unexpected increases in contaminant concentration or detection of additional contaminants.

Well NH-43A

Well NH-43A is most vulnerable to contamination in groundwater beneath two major cleanup sites, i.e., the HPL and the AlliedSignal/Bendix Corporation/Honeywell Site. At its closest the HPL is located ~2,760 ft north of NH-43A, and the AlliedSignal/Bendix Corporation/Honeywell Site ~5,000 ft east. From the constituents monitored and the SA/CA, the well source is considered immediately vulnerable to contamination.

COPCs identified at the HPL includes 1,4-dioxane, TCE, PCE, 1,2,3-TCP, NDMA, Cr(VI), and perchlorate. COPCs identified at the AlliedSignal/Bendix Corporation/Honeywell Site includes TCE, PCE, 1,4-dioxane, and Cr(VI).

Given the elevated concentrations of COPCs (VOCs and 1,4-dioxane) reported for samples collected from Well NH-43A, it is considered vulnerable to known groundwater contaminant plumes associated with the two major cleanup sites. Source protection measures are being implemented at the sites. LADWP has implemented the DDW Interim Sampling Plan since 2015 to evaluate groundwater conditions and will continue to monitor groundwater conditions per the NHW WQSP once the NHWWT Facility is online. Implementation of the NHW WQSP will serve as an early warning of any unexpected increases in contaminant concentration or detection of additional contaminants.

Well NH-44

Well NH-44 is most vulnerable to contamination in groundwater beneath two major cleanup sites, i.e., the HPL and the AlliedSignal/Bendix Corporation/Honeywell Site. At its closest the HPL is located ~2,460 ft north of NH-44, and the AlliedSignal/Bendix Corporation/Honeywell Site ~4,830 ft east. From the constituents monitored and the SA/CA, the well source is considered immediately vulnerable to contamination.

COPCs identified at the HPL includes 1,4-dioxane, TCE, PCE, 1,2,3-TCP, NDMA, Cr(VI), and perchlorate. COPCs identified at the AlliedSignal/Bendix Corporation/Honeywell Site includes TCE, PCE, 1,4-dioxane, and Cr(VI).

Given the elevated concentrations of COPCs (VOCs and 1,4-dioxane) reported for samples collected from Well NH-44, it is considered vulnerable to known groundwater contaminant plumes associated with the two major cleanup sites. Source protection measures are being implemented at the sites. LADWP has implemented the DDW Interim Sampling Plan since 2015 to evaluate groundwater conditions and will continue to monitor groundwater conditions per the NHW WQSP once the NHWWT Facility is online. Implementation of the NHW WQSP will serve as an early warning of any unexpected increases in contaminant concentration or detection of additional contaminants.

Well NH-45

Well NH-45 is most vulnerable to contamination in groundwater beneath two major cleanup sites, i.e., the HPL and the AlliedSignal/Bendix Corporation/Honeywell Site. At its closest the HPL is located ~2,200 ft north of NH-45, and the AlliedSignal/Bendix Corporation/Honeywell Site ~4,680 ft east. From the constituents monitored and the SA/CA, the well source is considered immediately vulnerable to contamination.

COPCs identified at the HPL includes 1,4-dioxane, TCE, PCE, 1,2,3-TCP, NDMA, Cr(VI), and perchlorate. COPCs identified at the AlliedSignal/Bendix Corporation/Honeywell Site includes TCE, PCE, 1,4-dioxane, and Cr(VI).

Given the elevated concentrations of COPCs (VOCs and 1,4-dioxane) reported for samples collected from Well NH-45, it is considered vulnerable to known groundwater contaminant plumes associated with the two major cleanup sites. Source protection measures are being implemented at the sites. LADWP has implemented the DDW Interim Sampling Plan since 2015 to evaluate groundwater conditions and will continue to monitor groundwater conditions per the NHW WQSP once the NHWWT Facility is online. Implementation of the NHW WQSP will serve as an early warning of any unexpected increases in contaminant concentration or detection of additional contaminants.

Well Water Quality Summary

A summary of water quality information is provided below for each of the five wells.

Well NH-34

Water quality data for well NH-34 collected between 2011 and 2016 (evaluation period) reported trichloroethene (TCE) concentrations above the maximum contaminant level (MCL) of 5 µg/L. Also, 1,4-dioxane exceeded the notification level (NL) of 1 µg/L consistently during the evaluation period. Other constituents of concern (COCs; PCE, 1,1-DCE, 1,2,3-TCP and nitrate) were either non-detect (not detected at or above the detection limit for the purpose of reporting [DLR]), or below applicable MCLs as presented in Table A2.

Table A2: Summary of Water Quality Results for Well NH-34 for Primary COPCs (*Data Source: Step 2 of 97-005 Evaluation Process)*

Well ID	Constituent	Guideline (µg/L)	Detected Range (µg/L)	
			Minimum	Maximum
NH-34	TCE	MCL: 5	0.697	**10.5**
	PCE	MCL: 5	0.752	3.13
	Nitrate	MCL: 10,000	1,401	6,438
	1,4-Dioxane	NL: 1	**1.17**	**3.17**
	1,2,3-TCP	MCL: 0.005	Non-Detect	Non-Detect
	1,1-DCE	MCL: 6	0.514	4.69

Notes:** All concentrations in µg/L; MCL = maximum contaminant level; NL = notification level; non-detect = constituent was not detected at or above the applicable detection limit for the purpose of reporting (DLR); TCE = trichloroethylene; PCE = tetrachloroethene; 1,2,3-TCP = 1,2,3-trichloropropane; 1,1-DCE = 1,1-dichloroethene;* ***bold *values indicate exceedance of MCL or NL.*

Well NH-37

Water quality data for well NH-37 collected for the evaluation period reported PCE and TCE concentrations above MCLs (5 µg/L for both COCs). The maximum reported 1,4-dioxane concentration was greater than 10 times the NL. Other COCs (1,1-DCE, 1,2,3-TCP and nitrate) were either non-detect (not detected at or above the applicable DLR) or below the applicable MCL as presented in Table A3.

Table A3: Summary of Water Quality Results for Well NH-37 for Primary COPCs (*Data Source: Step 2 of 97-005 Evaluation Process*)

Well ID	Constituent	Guideline (µg/L)	Detected Range (µg/L)	
			Minimum	Maximum
NH-37	TCE	MCL: 5	0.737	**14.3**
	PCE	MCL: 5	0.666	**8.54**
	Nitrate	MCL: 10,000	1,220	5,580
	1,4-Dioxane	NL: 1	0.614	**16.1**
	1,2,3-TCP	MCL: 0.005	Non-Detect	Non-Detect
	1,1-DCE	MCL: 6	0.518	2.9

Notes: *All concentrations in µg/L; MCL = maximum contaminant level; NL = notification level; non-detect = constituent was not detected at or above the applicable detection limit for the purpose of reporting (DLR); TCE = trichloroethylene; PCE = tetrachloroethene; 1,2,3-TCP = 1,2,3-trichloropropane; 1,1-DCE = 1,1-dichloroethene;* ***bold*** *values indicate exceedance of MCL or NL.*

Well NH-43A

Water quality data for well NH-43A collected for the evaluation period reported PCE and TCE concentrations above MCLs (5 µg/L for both COCs). The maximum reported 1,4-dioxane concentration was greater than 30 times the NL. All other identified NHW Well Field COCs (1,1-DCE, 1,2,3-TCP and nitrate) were reported above their respective DLRs but did not exceed an MCL as presented in Table A4.

Table A4: Summary of Water Quality Results for Well NH-43A for Primary COPCs (*Data Source: Step 2 of 97-005 Evaluation Process*)

Well ID	Constituent	Guideline (µg/L)	Detected Range (µg/L)	
			Minimum	Maximum
NH-43A	TCE	MCL: 5	0.505	**25.5**
	PCE	MCL: 5	0.527	**15.6**
	Nitrate	MCL: 10,000	1,462	7,545
	1,4-Dioxane	NL: 1	0.65	**35.2**
	1,2,3-TCP	MCL: 0.005	0.0021	0.0021
	1,1-DCE	MCL: 6	0.581	1.96

Notes: *All concentrations in µg/L; MCL = maximum contaminant level; NL = notification level; non-detect = constituent was not detected at or above the applicable detection limit for the purpose of reporting (DLR); TCE = trichloroethylene; PCE = tetrachloroethene; 1,2,3-TCP = 1,2,3-trichloropropane; 1,1-DCE = 1,1-dichloroethene;* ***bold*** *values indicate exceedance of MCL or NL.*

Well NH-44

Water quality data for well NH-44 collected during the evaluation period, reported maximum TCE concentrations just above the MCL of 5 µg/L. Maximum 1,4-dioxane concentrations were reported at levels twice the NL. All other identified NHW Well Field COCs (PCE, 1,1-DCE, 1,2,3-TCP and nitrate) were either non-detect (not detected at or above the applicable DLR) or below an applicable MCL as presented in Table A5.

Table A5: Summary of Water Quality Results for Well NH-44 for Primary COPCs (*Data Source: Step 2 of 97-005 Evaluation Process*)

Well ID	Constituent	Guideline (µg/L)	Detected Range (µg/L)	
			Minimum	Maximum
NH-44	TCE	MCL: 5	0.538	**5.67**
	PCE	MCL: 5	0.2	1.88
	Nitrate	MCL: 10,000	973.7	3,118
	1,4-Dioxane	NL: 1	0.079	**2.2**
	1,2,3-TCP	MCL: 0.005	Non-Detect	Non-Detect
	1,1-DCE	MCL: 6	0.37	0.747

Notes: *All concentrations in µg/L; MCL = maximum contaminant level; NL = notification level; non-detect = constituent was not detected at or above the applicable detection limit for the purpose of reporting (DLR); TCE = trichloroethylene; PCE = tetrachloroethene; 1,2,3-TCP = 1,2,3-trichloropropane; 1,1-DCE = 1,1-dichloroethene;* ***bold*** *values indicate exceedance of MCL or NL.*

Well NH-45

Water quality data for well NH-45 collected during the evaluation period, reported TCE concentrations just above the MCL of 5 µg/L. Maximum 1,4-dioxane concentrations were reported greater than seven times the NL. All other identified NHW Well Field COCs (PCE, 1,1-DCE, 1,2,3-TCP and nitrate) were either non-detect (not detected at or above the applicable DLR) or below an applicable MCL as presented in Table A6.

Table A6: Summary of Water Quality Results for Well NH-45 for Primary COPCs (*Data Source: Step 2 of 97-005 Evaluation Process*)

Well ID	Constituent	Guideline (µg/L)	Detected Range (µg/L)	
			Minimum	Maximum
NH-45	TCE	MCL: 5	0.708	**5.9**
	PCE	MCL: 5	0.504	2.31
	Nitrate	MCL: 10,000	1,281	3,253
	1,4-Dioxane	NL: 1	0.541	**7.59**
	1,2,3-TCP	MCL: 0.005	Non-Detect	Non-Detect
	1,1-DCE	MCL: 6	0.647	0.787

Notes: *All concentrations in µg/L; MCL = maximum contaminant level; NL = notification level; non-detect = constituent was not detected at or above the applicable detection limit for the purpose of reporting (DLR); TCE = trichloroethylene; PCE = tetrachloroethene; 1,2,3-TCP = 1,2,3-trichloropropane; 1,1-DCE = 1,1-dichloroethene;* ***bold*** *values indicate exceedance of MCL or NL.*