Proposed Plan for Interim Remedial Action

North Hollywood West Well Field

December 2016

Los Angeles Department of Water & Power

Los Angeles Department of Water & Power

Proposed Plan for North Hollywood West (NHW) Well Field

Introduction

This fact sheet presents the Los Angeles Department of Water and Power's (LADWP) Proposed Plan to conduct an interim remedial action (IRA) to address the synthetic contaminant 1,4-dioxane dissolved in groundwater at the North Hollywood West (NHW) Well Field located within the San Fernando Valley Groundwater Basin (SFB). The NHW Well Field is 1 of 11 well fields in the SFB that have been used or are currently being used to extract groundwater for the cities of Los Angeles, Burbank, and Glendale.

LADWP seeks your feedback on this Proposed Plan. Your comments and suggestions may result in changes to the plan.

After LADWP reviews all public comments on the plan and related documents, it may adopt and implement the IRA. The IRA is intended to remove 1,4-dioxane from the groundwater, treat the groundwater impacted by 1,4-dioxane, and restore the beneficial uses of water pumped by wells affected or threatened by 1,4-dioxane. One or more additional response actions will be evaluated at a future date to address the broader volatile organic compound (VOC) groundwater plume that exists in the area.

LADWP's preferred IRA is to design and construct water treatment systems, pipelines, and other facilities needed to limit the migration of 1,4-dioxane contaminated groundwater into uncontaminated and less contaminated areas of the NHW Well Field, remove and treat the contaminated groundwater and provide the treated water for direct-domestic use. This plan describes the importance of the groundwater as a source of drinking water to residents and businesses in Los Angeles, the nature and extent of 1,4-dioxane contamination in the vicinity of the NHW Well Field, risks to human health and the environment posed by the 1,4-dioxane contamination, and the preferred IRA. This plan summarizes the preferred IRA's objectives, as well as its relative effectiveness, cost, and feasibility compared to other cleanup options considered by LADWP.

How You Can Comment

The LADWP encourages the public to comment on the proposed IRA at the North Hollywood West Wellfield. The comment period is December 7, 2016 through January 23, 2017. You can comment in person at a public meeting or in writing to the LADWP Community Involvement Coordinator. Please send comments, post-marked no later than January 23, 2017 by mail, fax or email to:

Los Angeles
Department of Water and Power
Attn: Evelyn Cortez-Davis
111 North Hope Street, Rm 1345
Los Angeles, CA 90012
Fax: (213) 367-0928
Email: remediation@ladwp.com

Public Meeting

January 4, 2017
Public Meeting
6:00 – 8:00 pm

Valley Plaza Library
12311 Vanowen St.
North Hollywood, CA 91605

LADWP, the United States Environmental Protection Agency (EPA), the Los Angeles Regional Water Quality Control Board (LARWQCB), the cities of Glendale and Burbank, and other agencies, such as the State Water Resources Control Board (SWRCB), Division of Drinking Water (DDW) have been working jointly to investigate and clean up contamination within the SFB. In 1986, the EPA placed four sites (or Areas of Concern [AOCs]) in the eastern SFB on the National Priorities List (NPL). Since that time, the EPA has selected several response actions to address the release of contaminants located in certain portions of the SFB. Primary AOCs within the SFB include the Tujunga, Rinaldi-Toluca, North Hollywood, and Pollock well fields. Due to the specific nature of the contamination in certain areas, LADWP decided on a discrete response action approach that consists of analyzing and developing responses tailored for each localized AOC (*e.g.*, individual wells and well fields). Thus, treatment method or other response action will vary by individual wells and well fields across the SFB.

The IRA for the NHW Well Field is a discrete, localized response action to address the release of 1,4-dioxane contamination to groundwater migrating to the NHW Well Field that is currently contaminating the NHW production wells. While contaminants other than 1,4-dioxane are present in other wells in the NHW Well Field (such as trichloroethene [TCE] and tetrachloroethene [PCE], that contamination is part of a larger groundwater plume that will be addressed as part of a separate response action at a later date. In the interim, wells containing those contaminants that are not connected to the treatment plant will only be used if the contaminants are present at levels that are low enough that they can be safely addressed through approaches allowed under the existing *State of California Domestic Water Supply Permit* issued by DDW to LADWP.

LADWP is leading this IRA. For a detailed description of the information and analyses upon which this plan is based, see the Interim Remedial Investigation and Feasibility Study (RI/FS) Report and other documents available in the Information Repositories.

Background

The City of Los Angeles (the City) encompasses an area of 456 square miles with a population of nearly 4 million residents and a current water demand of more than 500,000 acre-feet per year (AFY). Local groundwater is a key resource that the City has relied upon as a major component of its local water supply portfolio. Over the last five years, local groundwater has provided approximately 12 percent of the total water supply for Los Angeles, and since 1970 has provided up to 23 percent of total supply during extended dry periods when imported supplies become less reliable. The City plans to obtain 50 percent of water locally by 2035. The primary source of local water is groundwater, and the primary source of local groundwater is the SFB.

The SFB underlies most of the San Fernando Valley (SFV) and is approximately 175 square miles (112,000 acres) in area (**Figure 1**). It serves as the primary source of groundwater for the City, providing more than 90 percent of the City's local groundwater supply. There are 11 well fields in the SFB that have been used or are currently being used to produce groundwater for the cities of Los Angeles, Burbank, and Glendale.

The NHW Well Field includes 14 groundwater production wells that extract

groundwater from depths ranging from 130 to 910 feet below ground surface (bgs) at flow rates ranging from 290 to 5,433 AFY. The combined maximum production capacity of the 14 wells is approximately 38,178 AFY.

The NHW Well Field is operated in accordance with the *State of California Domestic Water Supply Permit* issued by DDW to LADWP.

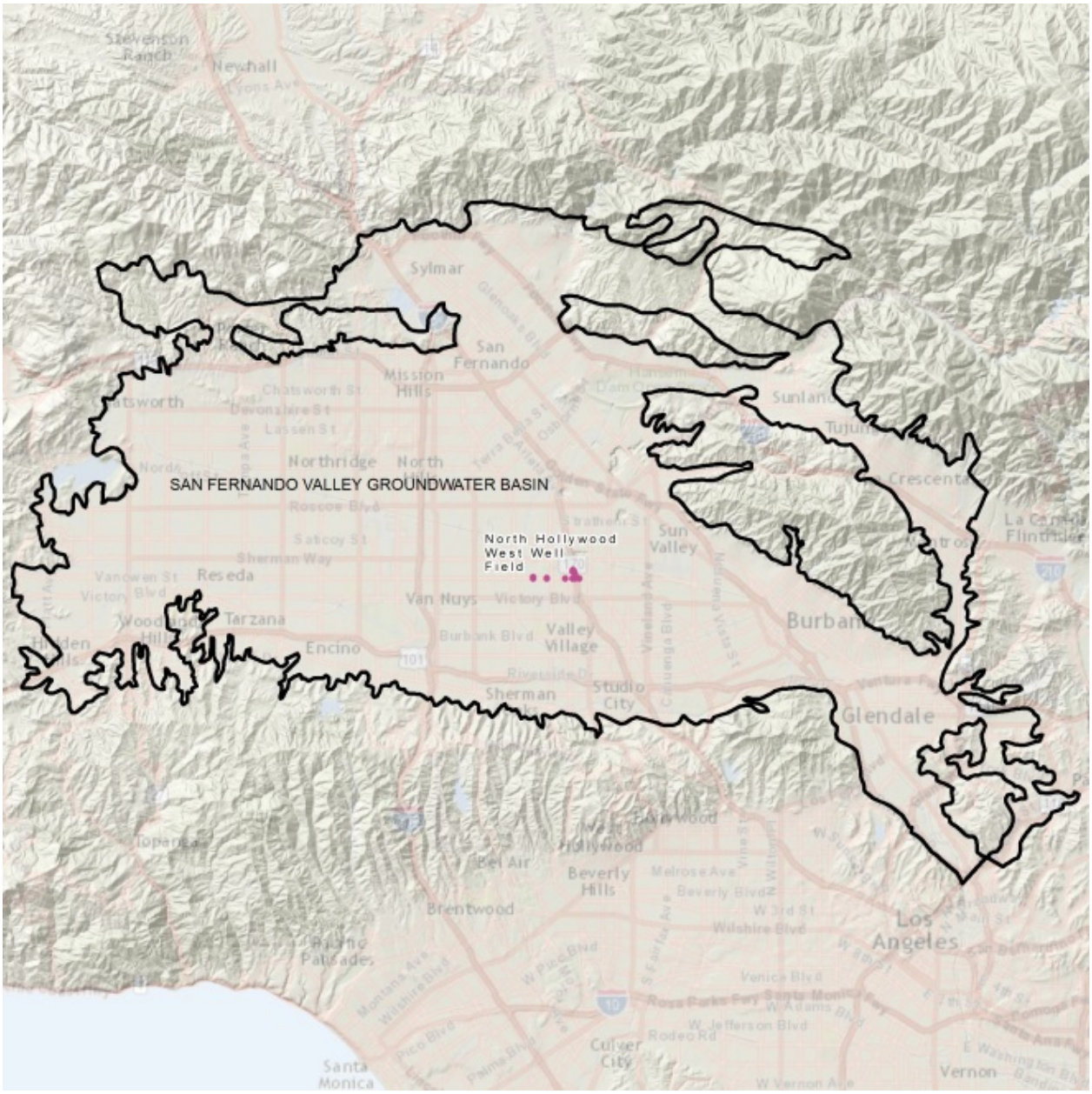

Figure 1 – The San Fernando Valley Groundwater Basin

Under the current Permit, "if any constituent is present at the well effluent at a concentration exceeding ten times its Maximum Contaminant Level (MCL) or Notification Level (NL) based on chronic health effects, then the constituent may not be treated by blending alone." The DDW establishes MCLs and NLs for drinking water contaminants in California. NLs are established for chemicals that do not have MCLs. NLs are health-based advisory levels.

Well field operations are carried out in accordance with the DDW-approved *Well Blending Operations Plan (Blending Plan)* to manage groundwater contaminants entering the NHW Well Field. DDW reviews this plan each year and intends the LADWP to reduce its reliance on blending over time, particularly for synthetic or emerging contaminants such as 1,4-dioxane. Under the Blending Plan, operational changes such as removing production wells from service are required when the well significantly contributes to a contaminant concentration exceeding 80% of the MCL or NL at the LADWP blend point down-stream of the NHW Well Field. The aforementioned blend point is an entry point to the LADWP distribution system, which provides a mixture of water from multiple wells in the NHW Well Field. The DDW response level (RL) is the level prompting a recommendation for a production well being removed from service. For 1,4-dioxane, this recommendation occurs at 35 times the NL or 35 µg/L (or 35 ppb). The result of the Blending Plan requirement at the LADWP blend point is that production wells may be removed from service at 1,4-dioxane concentrations less than the DDW RL of 35 µg/L.

LADWP has implemented a DDW-approved *Interim Sampling Plan* (LADWP 2015c) to collect contaminant concentration and other water quality data from the NHW production wells to support the implementation of the Blending Plan. Substances detected in production wells at concentrations exceeding MCLs (TCE, PCE, 1,1-DCE) and NLs (1,4-dioxane) were identified as primary contaminants of concern in the Blending Plan. TCE, PCE, 1,1-DCE have been detected at concentrations that can be managed by LADWP through its existing Permit and Blending Plan; however, 1,4-dioxane cannot be managed by LADWP through its existing Permit and Blending Plan as described below.

The results of the implementation of the *Interim Sampling Plan* show 1,4-dioxane was detected in water pumped from production wells at concentrations exceeding both the NL of 1 µg/L and the DDW Permit limit of 10 µg/L. As a result of 1,4-dioxane concentrations at the NHW productions wells and the conditions of the Permit and Blending Plan, seven NHW production wells (i.e., NH-23, NH-34, NH-36, NH-37, NH-43A, NH-44 and NH-45) were removed from service between November 2014 and March 2015, which impaired the beneficial use of groundwater.

The production wells were removed from service to prevent 1,4-dioxane concentrations from exceeding the NL at the LADWP blend point down-stream of the NHW Well Field. During this time, other groundwater contaminant concentrations in the NHW Well Field, such as TCE and PCE, were able to be effectively managed by blending water from select production wells.

The removal from service of the seven production 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. The value of this volume of replacement water for the seven production wells at a current wholesale water price of $942 per AF is in excess of $23 million per year.

Elevated concentrations of 1,4-dioxane detected in monitoring wells located up-gradient of the seven production wells indicate that use of the seven production wells would result in elevated concentrations of 1,4-dioxane being detected in the groundwater pumped from these production wells. The 1,4-dioxane groundwater plume also threatens to impact other wells in the NHW well field.

Site Characteristics

The EPA collects groundwater quality data from various stakeholders for sites in the vicinity of the NHW Well Field to support its characterization of the SFB. The groundwater quality data collected in the vicinity of the NHW Well Field between January 1, 2010 and September 30, 2014 was used to produce distribution maps of 1,4-dioxane, PCE and TCE in groundwater (also called plume maps). The 1,4-dioxane distribution map produced by EPA, dated February 2015, is presented as **Figure 2**. In particular, the 1,4-dioxane plume map illustrates that 1,4-dioxane concentrations in groundwater greater than 10 times the NL are located in the general area bounded by Saticoy Street to the North, Vanowen Street to the South, Highway 170 to the West, and Laurel Canyon Boulevard to the East, and data collected by LADWP from its production wells in the NHW Well Field

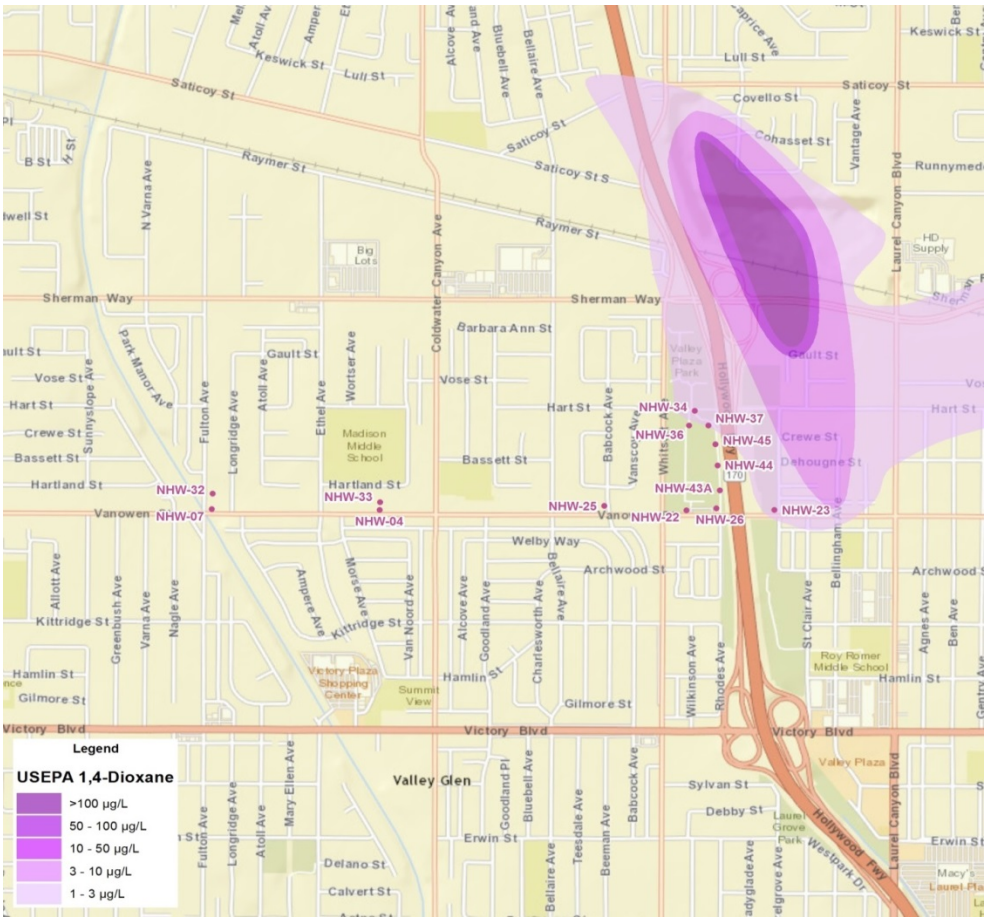

Figure 2 – EPA 1,4-dioxane Plume Map

show that the portion of the plume in excess of 10 µg/L now extends into the NHW Well Field.

This distribution of 1,4-dioxane concentrations in groundwater greater than 10 times the NL (*i.e.*, >10 µg/L) and groundwater modeling presented in the Interim RI/FS Report indicates that continued use of the seven production wells would result in elevated concentrations of 1,4-dioxane in the production wells.

Groundwater

The groundwater basin is comprised predominantly of permeable sands and gravels interbedded with laterally discontinuous lenses of less permeable finer-grained silts and clays. The unconsolidated sediments in the eastern SFB, which is where the NHW Well Field is located, are generally coarser-grained and extend to at least 1,200 feet below ground surface (bgs) in the central area. Groundwater is generally encountered in the groundwater basin at approximately 240 to 250 feet 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 entering the NHW Well Field generally flows south to south-east. Locally, groundwater hydraulic gradients can vary in magnitude and direction depending on various stresses (e.g. production well pumping for water supply, SFB recharge, changes in water table elevations). There are several shallow and deeper hydrostratigraphic zones that have been used to describe the aquifer system within the groundwater basin, which collectively extend to over 1,000 feet bgs. These various zones are defined based on interpreted geologic and hydraulic characteristics. Further details relating to the geologic and hydrologic characteristics of the SFB and the NHW Well Field are provided in a range of sources including the *Report of Referee - Los Angeles v. San Fernando*, the *San Fernando Valley Remedial Investigation*, the *Focused Feasibility Study, North Hollywood Operable Unit, San Fernando Valley Area 1 Superfund Site, Los Angeles County, California*, and the *Interim Action Record of Decision for the North Hollywood Operable Unit,* the *Groundwater System Improvement Study Remedial Investigation Update Report*, and the *Interim Remedial Investigation/Feasibility Study Report.*.

Extent of 1,4-Dioxane Contamination

Based on previous investigations and analysis of the groundwater basin, EPA plume mapping has provided evidence of widespread 1,4-dioxane contamination within the vicinity of the NHW Well Field, as shown in **Figure 2**, which is based on data collected from 2010 through 2014. The area of highest concentration of 1,4-dioxane is located up-gradient, north-east of the NHW Well Field. Given the elevated concentrations of 1,4-dioxane detected in monitoring wells located up-gradient of the seven production wells, the continued use of the seven production wells threatens to result in elevated concentrations of 1,4-dioxane being detected in the groundwater pumped from these production wells.

The physical and chemical properties and behavior of 1,4-dioxane in groundwater creates challenges for its characterization and treatment. It is miscible in water, which renders it highly mobile, and it has not been shown to readily biodegrade in the environment. It is weakly retarded by sorption to aquifer materials and may

migrate rapidly in groundwater, ahead of other contaminants.

As 1,4-dioxane is highly mobile within groundwater, it has migrated from an area of higher concentrations (e.g., greater than 10 times the NL) in a southerly direction, following the natural groundwater flow paths. Furthermore, historical pumping at the NHW Well Field has changed the natural groundwater flow field, creating a radial cone of depression around the well field, thereby increasing the groundwater flow gradient towards the production wells. The combination of natural southerly groundwater flow and the radial cone of depression has resulted in 1,4-dioxane contaminated groundwater being pulled toward or captured by the production wells. Thus, a number of the NHW production wells have pumped 1,4-dioxane impacted groundwater from the SFB.

Given the proximity of the 1,4-dioxane plume relative to the NHW Well Field and the groundwater flow pattern across the general area as a result of pumping, it is anticipated that 1,4-dioxane contamination would continue to be captured by the NHW production wells. In the absence of groundwater pumping in the general area, there is also a potential for 1,4-dioxane impacted groundwater to migrate farther south, leading to further migration of 1,4-dioxane in groundwater and potential to impact other groundwater production wells.

Operable Unit and Study Area

For the NHW Well Field, the Operable Unit (OU) is defined as the groundwater entering the NHW production wells under active pumping conditions. The source of groundwater entering the NHW production wells can be delineated by developing a pumping plan and using this pumping plan to delineate a potential capture zone. A potential capture zone can then be used to delineate the area of water captured by production wells within a given period of time (e.g., 10- or 30-year capture zones). The area of water captured by production wells within a given period of time is dependent on the volume of water extracted from the production wells during that period, and other factors such as the volume of water extracted from other nearby pumping wells, the volume of water recharged at various local spreading grounds and hydraulic characteristics of the geologic formations.

The capture zones can be used to delineate the Study Area. The Study Area represents the lateral extent of the NHW OU based on the LADWP pumping plan. In this case, the 10-year capture zone was used for shorter-term planning and remedial design while the 30-year capture zone was used for longer-term planning including risk evaluation, fate and transport modeling, and groundwater recharge. The LADWP pumping plan is subject to change based on a number of factors such as supply and demand, climatic conditions, and maintenance activities. The goals of the pumping plan are described in the Sustainable City Plan and the Urban Water Management Plan.

Summary of Risks

An initial baseline human health risk assessment (HHRA) was conducted as part of the RI/FS to assess whether the contaminated groundwater poses a risk to human health if human receptors (e.g., local residents, commercial and construction workers, under future potential scenarios) were exposed to untreated groundwater. Based on the results of the HHRA, it was concluded that concentrations of 1,4-dioxane and VOCs in production wells resulted in potential risks from cancer and non-cancer endpoints within the Study Area,

which further supports the evaluation of IRAs.

1,4-Dioxane has been measured in groundwater at concentrations exceeding 10 times the NL, both at the NHW production wells and at numerous locations up-gradient of the NHW production wells. This magnitude of exceedance falls outside the levels that permit the water to be served even with blending pursuant to the current *Blending Plan* and *State of California Domestic Water Supply Permit* issued by DDW to LADWP. These levels also exceed the cleanup goal set by EPA at nearby areas in the SFB (set at the NL). While contaminants other than 1,4-dioxane are present in other wells in the NHW Well Field, that contamination is part of a larger groundwater plume that will be addressed as part of a separate response action at a later date. In the interim, wells containing those contaminants that are not connected to the treatment plant will only be used if the contaminants are present at levels that are low enough that they can be safely addressed through the current *Blending Plan* and *State of California Domestic Water Supply Permit* issued by DDW to LADWP.

The concentrations of 1,4-dioxane detected in groundwater exceeding health-based levels (i.e., EPA Health Advisory [HA] Level of 0.35 µg/L; OEHHA Public Health Protective Concentration of 3 µg/L, and DDW NL of 1 µg/L) impacts the beneficial use of groundwater, as addressed in the *LARWQCB Basin Plan*, which conforms to the *State of California Antidegradation Policy* (i.e., SWRCB Resolution 68-16 [SWRCB, 1968]). The impact to the beneficial use of groundwater by 1,4-dioxane in the vicinity of the NHW Well Field justifies the evaluation of IRAs.

Scope and Role of Response Action

This IRA is proposed to protect human health and the environment, to help to restore and maintain the beneficial uses of the SFB. The IRA is proposed to limit the migration of 1,4-dioxane in groundwater at concentrations that prevent beneficial uses of the groundwater, remove 1,4-dioxane from the groundwater at and downgradient of the NHW Well Field area, and restore the capability to operate the well field consistent with its historic and planned use.

It is LADWP's current judgment that the IRA identified in this Proposed Plan is necessary to protect human health and the environment from actual or threatened releases of 1,4-dioxane into the environment.

Remedial Action Objectives and Cleanup Goals

This Proposed Plan presents LADWP's preferred IRA for the remediation of 1,4-dioxane contaminated groundwater at the NHW Well Field. The IRA recommended in this Proposed Plan is intended to achieve the following Remedial Action Objectives (RAOs):

- 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 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.

These 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 regulator values (e.g., MCLs, NLs, etc.) or risk-based cleanup levels. These RAOs do not address the source and the associated 1,4-dioxane plume in close proximity to the source. A response action to address the source and the associated 1,4-dioxane plume is the subject of separate and discrete programs by the LARWQCB and the EPA.

Cleanup Goals

Based on the RAOs, preliminary cleanup goals were developed for 1,4-dioxane, TCE and PCE in SFB groundwater. The preliminary cleanup goal for the IRA to address the 1,4-dioxane plume was set equal to the California NL, which is the same criteria identified by EPA for the North Hollywood Operable Unit (NHOU). For groundwater that would be served for domestic use, additional preliminary cleanup goals are developed based on applicable California MCLs. The preliminary cleanup goals are presented in Table 1.

Table 1-Preliminary Cleanup Goals For Treated Water Served for Domestic Use

COC	Preliminary Cleanup Goal	Basis of Goal
1,4-Dioxane	1 µg/L	California NL
PCE	5 µg/L	California MCL
TCE	5 µg/L	California MCL
1,1-DCE	6 µg/L	California MCL

Summary of Remedial Alternatives

Based on the available information about the current nature and extent of 1,4-dioxane groundwater contamination in the vicinity of the NHW Well Field and projections for future water withdrawals, LADWP developed a range of IRA alternatives for achieving the RAOs described above. Three IRA alternatives (Alternatives 1 through 3) that incorporate different combinations of technologies and process options (described in detail in the Interim RI/FS) have been developed.

The IRA alternatives developed include the No Action alternative (Alternative 1) and two action alternatives (Alternatives 2 and 3). The IRA alternatives were carried forward for evaluation against the criteria specified in EPA regulations and guidance.

Alternative 1 – No Action

EPA guidance requires that a No Action alternative be considered and compared to the action alternatives. In the No Action alternative, LADWP would implement its pumping plan for the NHW Well Field in accordance with its long--term water rights and historical use. The LADWP pumping plan includes the extraction of up to 38,178 AFY of groundwater from the 14 existing groundwater production wells in accordance with the *State of California Domestic Water*

Supply Permit issued by DDW to LADWP and the *Blending Plan*. However, no containment or treatment actions would be implemented to protect human health and the environment in compliance with any federal or state environmental standards, requirements, criteria, or limitations that are determined to be legally applicable or relevant and appropriate or other criteria to be considered. These applicable or relevant and appropriate requirements are referred to as ARARs and the to-be-considered criteria as TBCs. As a result, seven groundwater production wells would be removed from service due to 1,4-dioxane concentrations in groundwater exceeding the DDW NL. Removing these wells from service would result in a loss of potable water for the City, allow 1,4-dioxane to migrate to down-gradient groundwater resources and other groundwater production wells, and would not achieve the RAOs. No incremental cost is associated with this alternative.

Alternative 2 – Alternate Water Supply

For Alternative 2, LADWP would implement institutional actions, including engineering and administrative controls to mitigate direct exposure pathways to protect human health in compliance with ARARs and TBCs. Institutional actions would include blending, alternate pumping plans, alternate water supply, monitoring, and groundwater use restrictions.

Blending would be implemented in accordance with the existing *Blending Plan* to prevent drinking water contaminants regulated by the DDW from exceeding the MCLs and NLs within the LADWP system at the blend point down-stream of the NHW Well Field.

An alternate pumping plan would be implemented to support the *Blending Plan* by providing a mixture of water from multiple wells within the NHW Well Field as needed to prevent contaminants from exceeding MCLs and NLs at the LADWP blend points. The alternate pumping plan would involve pumping production wells in accordance with the operational priority presented in the *Blending Plan*. The operational priority would minimize pumping from the more contaminated production wells.

An alternate water supply would be secured from the Metropolitan Water District of Sothern California (MWD) to replace water lost from removing seven groundwater production wells from service. Replacement water would be secured in the amount of 22,800 AFY or 60 percent of the total capacity of the NHW Well Field. The replacement water would be secured for a period of at least 13 years, based on groundwater modeling for Alternative 3 provided in the Interim RI/FS.

Monitoring would be implemented for a period of at least 13 years to provide data to support the blending, alternate pumping plan, and alternate water supply institutional actions, and to monitor the fate and transport of 1,4-dioxane from the NHW Well Field capture zone to the NHW Well Field production wells.

Groundwater use restrictions would be implemented to prevent human exposure to contaminated groundwater and maintain the integrity of the remedial alternative. Groundwater use restrictions would be primarily overseen by the ULARA Watermaster, which provides centralized control over groundwater use in the NHW Well Field capture zone.

Alternative 3 – Groundwater Pump and Treat for Direct Domestic Use

Alternative 3 differs from Alternative 2 in that containment and treatment actions would be taken to reduce the toxicity, mobility, and volume of contaminated groundwater through treatment. Human health would be protected by capturing and removing 1,4-dioxane 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 PCE, TCE, and 1,1-DCE from groundwater. The beneficial use of groundwater would be restored in accordance with the *LARWQCB Basin Plan*, which conforms with the *State of California Antidegradation Policy* (i.e., SWRCB Resolution 68-16 and 92-49), an ARAR for this IRA.

Hydraulic control would be implemented in a manner that draws contaminated groundwater toward designated remediation wells, and away from other groundwater production wells within the NHW Well Field and down-gradient groundwater resources. Hydraulic control would reduce the likelihood for these other groundwater production wells within the NHW Well Field and down-gradient groundwater resources to be impacted by 1,4-dioxane.

The contaminated groundwater captured by the NHW remediation wells would be managed aboveground by implementing a combination of institutional and treatment actions. Institutional actions would include implementation of the bypass, blending, alternative pumping plans, monitoring and groundwater use restrictions; which are described in Alternative 2.

Treatment actions would include aboveground treatment of the groundwater impacted by 1,4-dioxane, which would be implemented in compliance with ARARs and TBCs to protect human health. Treatment would include AOP technology to transform 1,4-dioxane, as well as TCE, PCE, and 1,1-DCE, into innocuous byproducts. Carbon quenching would be implemented to remove remaining hydrogen peroxide from water downstream of an AOP.

The blended and treated groundwater would be conveyed to the LADWP potable water distribution system for direct domestic use.

Evaluation of Remedial Alternatives

To determine which alternative to select, LADWP will evaluate and compare the remedial alternatives using EPA's nine evaluation criteria. The nine criteria are summarized in **Figure 3**. EPA categorizes the nine criteria into three groups: (1) threshold criteria, (2) balancing criteria, and (3) modifying criteria.

In the following discussion, the alternatives are evaluated in relation to the threshold criteria and the balancing criteria. A more detailed description of this evaluation is provided in the RI/FS report. LADWP will consider the modifying criteria (*i.e.*, State and Community Acceptance) after review of public comments on this proposal. The alternatives are evaluated and assigned qualitative ratings of poor, fair, and good for performance in relation to each other and the criteria. **Table 2** summarizes LADWP's ranking of the alternatives in relation to EPA's threshold and balancing evaluation criteria.

Figure 3 – EPA Nine Evaluation Criteria

Overall Protection of Human Health and the Environment

Alternative 1 does not take action to prevent the migration of 1,4-dioxane in groundwater and is not protective of human health and the environment. This alternative does not include remedial action, does not monitor the condition of the groundwater basin, and would not meet the RAOs. Alternative 1 is eliminated from further consideration on this basis.

Alternative 2 is similar to Alternative 1 in that remedial action is not take action to prevent the migration of 1,4-dioxane in groundwater, however, Alternative 2 includes the institutional action of securing an alternate water supply to mitigate exposure to 1,4-dioxane contaminated groundwater. Alternative 2 would not maintain the beneficial use of the SFB as LADWP would not be able to extract its current and future groundwater rights from any combination of production wells in the NHW Well Field and SFB. Alternative 2 would not protect the environment because the contamination would remain in the aquifer and not be remediated. Alternative 2 is assigned an Overall Protection of Human Health and the Environment rating of 'poor'.

Alternative 3 provides the best overall protection of the environment and meets the RAOs. This alternative eliminates direct exposure pathways, reduces the migration of contaminated groundwater, and reduces the toxicity, mobility and volume of contaminated groundwater through treatment. This alternative remediates and removes mass from the groundwater entering the NHW production wells, limits the migration of 1,4-dioxane in groundwater, and restores LADWP's capability to operate its existing NHW Well Field consistent with historic and planned use in a flexible

manner. The City would be able to extract groundwater from wells affected or threatened by 1,4-dioxane from the NHW Well Field and the mass of 1,4-dioxane in the groundwater would be reduced. Alternative 3 is assigned an Overall Protection of Human Health and the Environment rating of 'good'.

Compliance with ARARs

No chemical-, location-, or action-specific ARARs apply to Alternative 1, therefore Alternative 1 is not assigned a Compliance with ARARs rating.

Alternative 2 would comply with some of the ARARs and TBCs identified in the RI/FS but would not effectively remove or abate 1,4-dioxane in groundwater, and would not comply with SWRCB Resolution No. 92-49. Alternative 2 is assigned a Compliance with ARARs rating of 'poor'.

Alternative 3 would comply with the action-specific ARARs and TBCs identified in the RI/FS. Alternative 3 is assigned a Compliance with ARARs rating of 'good'.

Long-term Effectiveness and Permanence

Alternatives 1 and 2 would not provide long-term effectiveness and permanence as neither alternative reduces the migration of contaminated groundwater to groundwater production wells and down-gradient water resources. Potential risks to human health and the environment would remain. Alternatives 1 and 2 are assigned a Long-Term Effectiveness and Permanence rating of 'poor'.

Alternative 3 would provide effective and reliable control of 1,4-dioxane migration in the vicinity of the NHW Well Field and would be the most effective and robust alternative for reducing residual risk since it would result in significant reduction in 1,4-dioxane concentrations in groundwater and can function over a range of hydrologic conditions.

Alternative 3 would also prevent further downgradient migration of the 1,4-dioxane plume to other groundwater production wells and down-gradient water resources. The remediation facility in Alternative 3

Table 2- How Do the Alternatives Compare to EPA's Evaluation Criteria?

Evaluation Criteria	Alternative 1 No Action	Alternative 2 Institutional Actions	Alternative 3 Groundwater Pump and Treat for Direct Domestic Use
Protection of Human Health and the Environment	NA	Fair	Good
Compliance with ARARs	NA	Poor	Good
Long-term Effectiveness and Permanence	Poor	Poor	Good
Reduction of Toxicity, Mobility, or Volume through Treatment	Poor	Poor	Good
Short-term Effectiveness	NA	Fair	Good
Implementability	NA	Fair	Good
Cost (Net Present Value)	$0	$249,200,000	$100,400,000

would provide a long-term, effective treatment solution for contaminated groundwater. Compared to Alternatives 1 and 2, Alternative 3 also provides the highest degree of certainty that the NHW wells, a critical source of potable water, could operate over its 13-year duration or longer under a wide range of conditions. Alternative 3 is assigned a Long-Term Effectiveness and Permanence rating of 'good'.

Reduction of Toxicity, Mobility or Volume through Treatment

Alternatives 1 and 2 do not include treatment, therefore, the alternatives would not reduce the toxicity, mobility, or volume of contaminated groundwater. These alternatives do not meet this criterion and are therefore assigned a Reduction of Toxicity, Mobility, or Volume through Treatment rating of 'poor'.

Alternative 3 would reduce the volume and mass of 1,4-dioxane in groundwater, and would reduce the migration of the 1,4-dioxane plume. Alternative 3 is assigned a Reduction of Toxicity, Mobility, or Volume through Treatment rating of 'good'.

Short-term Effectiveness

Alternatives 1 does not involve the implementation of a remedial action, therefore, the alternative was not assigned a Short-term Effectiveness rating. However, it does not achieve any RAOs and therefore is not effective over the short term.

Implementation of Alternative 2 would not involve remedial actions other than blending operations and the removal of production wells from service, therefore, the implementation of the alternative does not pose additional potential hazards to the community, workers, or the environment. Alternative 2 would not achieve the RAOs in the short term, with the exception of preventing exposure to 1,4-dioxane in groundwater through institutional actions. Otherwise, the alternative is not effective over the short term. Alternative 2 is assigned a Short-Term Effectiveness rating of 'fair'.

Implementation of Alternative 3 would involve the construction of a remediation facility, which has the potential to create short-term impacts typical of construction projects, including potential hazards to the community, workers, and the environment. However, environmental impacts during construction and operation of the facility can be mitigated. Alternative 3 does not pose any un-mitigatable risks to the community during construction and implementation, nor do any of the alternatives pose un-mitigatable risks to workers beyond the typical risks associated with a construction project. No un-mitigatable negative environmental impacts are anticipated in the area in which the facilities would be built. Alternative 3 will be effective over the short term in achieving RAOs by capturing the 1,4-dioxane contamination at the NHW wells, limiting the migration of 1,4-dioxane (and other contaminants), removing contaminant mass, restoring the beneficial use of the water served from the treatment system and restoring the capability of LADWP to operate the NHW Well Field. Alternative 3 is assigned a Short-Term Effectiveness rating of 'good'.

Implementability

Alternative 1 does not involve the implementation of a remedial response; therefore, the alternative was not assigned an Implementability rating.

Alternative 2 is implementable from a technical and institutional standpoint, however, the water the City imports is a decreasingly reliable source due to increasing uncertainties in seasonal availability, environmental conditions, and political influences (LADWP, 2015a). In addition, there is the risk that DDW could restrict blending in the future, which would further limit the options for this alternative. The long-term implementability of this alternative thus faces greater risks. Alternative 2 is therefore assigned an Implementability rating of 'fair'.

Alternative 3 involves implementation steps typical of projects of this nature, from both a technical and institutional standpoint. Permitting would involve completing the CEQA, and DDW permit processes, which could take over a year. The process options of AOP for 1,4-dioxane removal and GAC for hydrogen peroxide removal are effective and reliable treatment technologies. Specialty contractors, equipment, and materials would not be required and there is adequate labor and materials in the City to implement this alternative. Design and construction could take longer than two years to complete. O&M of the facility would require monitoring of operational performance for 13 years. While this alternative assumes that non-remediation wells could rely on blending, no blending is used for the remediation wells that will capture the 1,4-dioxane plume. Thus, the risk that blending might be more restricted in the future should not adversely affect ability to implement Alternative 3 to capture the 1,4-dioxane plume. Alternative 3 is assigned an Implementability rating of 'good'.

Cost

Alternative 1 would not involve the implementation of a remedial action, therefore, there are no incremental costs associated with this alternative.

Alternative 2 involves institutional actions including the purchase of an alternate water supply of 22,800 AFY for a period of approximately 13 years for comparison, and therefore has a comparatively higher cost than Alternative 3.

Alternative 3 involves containment and treatment actions for a period of approximately 13 years, and has a comparatively lower cost than Alternative 2. The direct, recurring and total NPV costs estimated for each alternative are summarized in the table below and described in detail in the RI/FS.

If 1,4-doxane persists in the groundwater in the vicinity of the NHW production wells for more than 13 years, the cost of Alternative 3 will increase; however, the relative cost of Alternative 3 compared to Alternative 2 will decrease as the annual cost of treatment operations is estimated to be significantly less than the cost of replacement water.

For projects to be implemented by the federal government, EPA guidance recommends the use of the discount rate issued by the federal Office of Management and Budget (OMB), which is currently 1.5% (net of inflation) for a 30-year project (OMB 2015). For similar reasons, the updated OMB discount rate of 1.5% provides an appropriate discount rate for projects to be implemented by public agencies, which have lower costs of capital than private sector entities. Given the many pressures on water in the area, it is likely that the costs of water will increase at a greater rate than inflation, such that a lower real discount rate

could be appropriate for Alternative 2. The effect of a lower real discount rate would be to increase the cost of Alternative 2 relative to Alternative 3. The cost estimate accuracy range is within a -30 % to +50 % order-of-magnitude guideline range (USEPA 1988).

Table 3- Cost Summary of Remedial Alternatives

Alt	Capital Cost	Recurring Cost	NPV
Alt 1	$0	$0	$0
Alt 2	$0	$22,000,000	$249,200,000
Alt 3	$77,700,000	$2,010,000	$100,400,000

Abbreviations:
Alt = alternative
NPV = Net Present Value
Notes:
NPV is calculated based on a 1.5% rate (net of inflation) and 13 year project life.

Preferred IRA Alternative

LADWP's preferred IRA is Alternative 3, which includes the implementation of institutional controls, containment and treatment actions. The preferred IRA would be designed to hydraulically-capture 1,4-dioxane groundwater within the NHW Well Field area, provide above ground treatment and management of the 1,4-dioxane, PCE, TCE and 1,1-DCE contaminated groundwater and then provide the treated water to LADWP for direct domestic use.

Key components of Alternative 3 depicted in Figures 4 and 5 include groundwater production wells, conveyance piping, treatment facilities, distribution piping and monitoring wells.

Based on information currently available, LADWP believes the preferred IRA meets the threshold criteria and provides the best balance of tradeoffs among the other alternatives with respect to the balancing and modifying criteria. LADWP expects the preferred IRA to satisfy the following statutory requirements of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) as amended: 1) be protective of human health and the environment; 2) comply with ARARs; 3) be cost-effective; 4) utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; 5) satisfy the preference for treatment as a principal element, and 6) otherwise best satisfy the NCP remedy selection criteria. The preferred IRA can change, however, in response to public comment and/or new information.

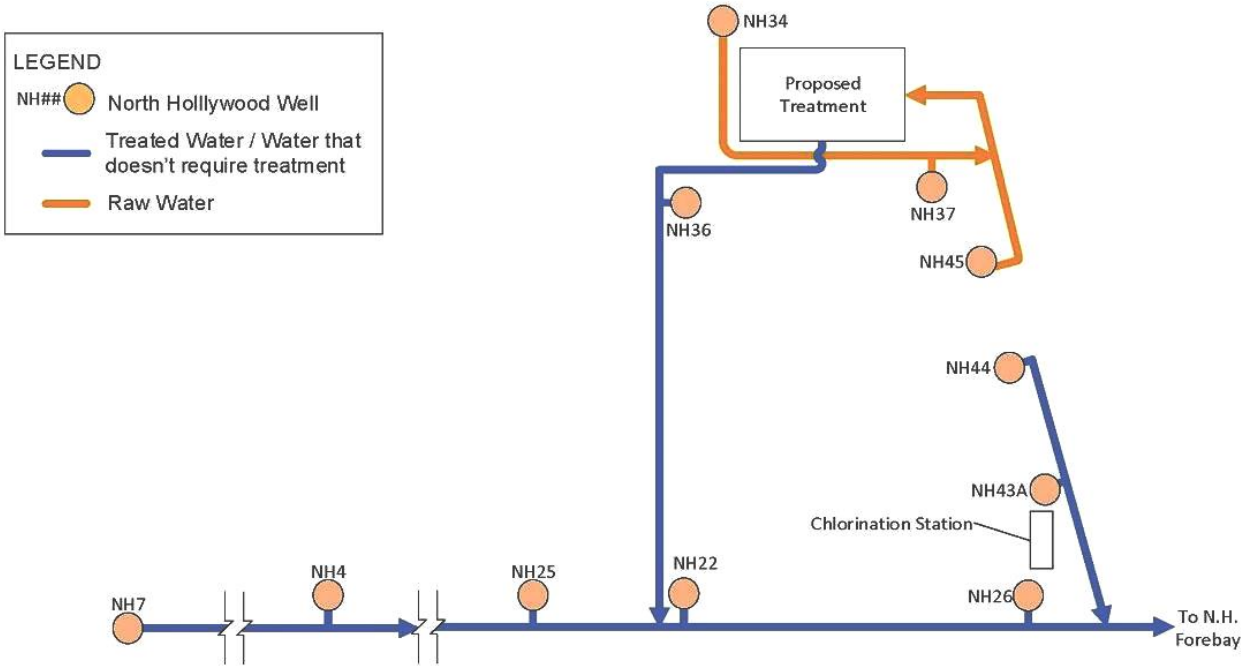

Figure 4- Alternative 3 Wells, Pipelines, Treatment Facility, Distribution System

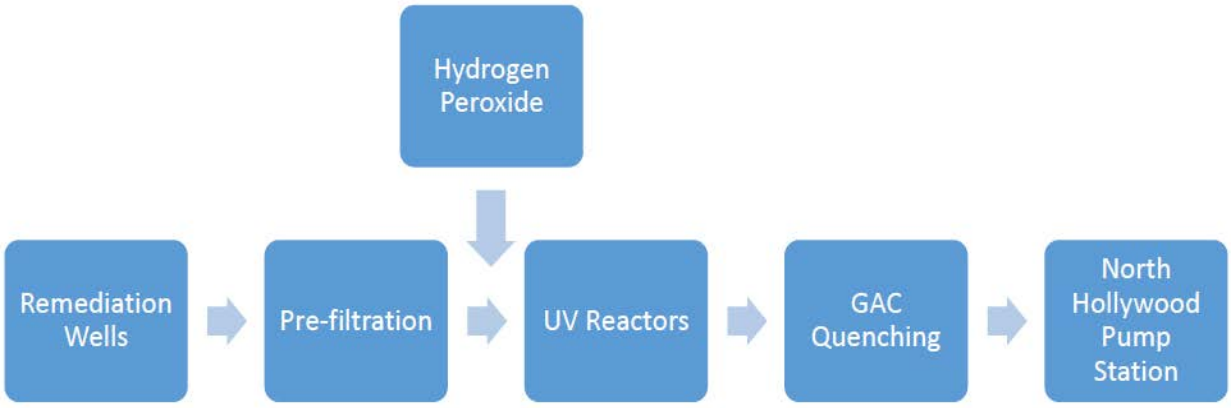

Figure 5- Alternative 3 Simplified Process Flow Diagram

Los Angeles Department of Water & Power

Information Repositories

LADWP maintains site information at the following repositories. These repositories contain the Administrative Record, project documents, fact sheets, and reference materials. LADWP encourages you to review these documents to gain a more complete understanding of the site.

LADWP also has a site information web page at www.ladwp.com/remediation

For additional information about community involvement opportunities related to this response action, please see the NHW Community Involvement Plan available at the repositories and LADWP website identified above.

City of Los Angeles Central Library
Science and Technical Department
630 West 5th Street
Los Angeles, CA 90071
(213)228-7216

City of Burbank Public Library
110 North Glenoaks Street
Burbank, CA 91502
(818) 238-5880

City of Glendale Public Library
222 East Harvard Street
Glendale, CA 91205
(818) 548-2021

Panorama City Public Library
14345 Roscoe Boulevard
Panorama City, CA 91402
(818) 894-4071

LADWP Contacts

Los Angeles Department of Water and Power
Attn: Evelyn Cortez-Davis
Community Involvement Coordinator
111 North Hope Street, Rm 1345
Los Angeles, CA 90012
Fax: (213) 367-0928
Email: remediation@ladwp.com

Community Relations Office: (213) 367 - 1361

LADWP Website: www.ladwp.com/Remediation

Los Angeles Department of Water & Power