United Water CONSERVATION DISTRICT

Technical Memorandum

To: OPV Facilitated Process Core Stakeholder Group via Gina Bartlett, Consensus Building Institute

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Subject: Optimization Concepts for Groundwater Pumping and Surface Water Diversions in Oxnard and Pleasant Valley Basins to Increase Sustainable Yield

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The purpose of this technical memorandum is to provide a brief introduction to concepts that have been considered for optimizing pumping of groundwater and use of diverted Santa Clara River surface water to increase the sustainable yield of the Oxnard and Pleasant Valley basins (OPV basins). This memorandum focuses on optimization of *existing sources* of groundwater and surface water. Other new sources of water to the region may also play an important role, but are not the subject of this memorandum.

An important lesson learned by United Water Conservation District (United) during 90 years of operating artificial recharge and related facilities is that sustainable yield of the OPV basins is dependent not only on the quantity of water available for replenishment, but also on where and how that water is applied. A water budget alone cannot indicate whether planned groundwater withdrawals will be sustainable, avoiding "undesirable results" as defined by California's Sustainable Groundwater Management Act (SGMA).

Seawater intrusion in the confined aquifers of the OPV basins has been recognized for approximately 80 years, and is now the primary driver behind the groundwater sustainability plans developed by the Fox Canyon Groundwater Management Agency (FCGMA). From the 1930s through the 1970s, saline intrusion under the Oxnard coastal plain was limited to the aquifers of the upper aquifer system (UAS), from which most groundwater production occurred. Over time, production increased from the aquifers of the lower aquifer system (LAS) as drilling technology improved and groundwater users recognized the better water quality in some of the deeper aquifers.

The management objective for seawater intrusion is, in summary, to prevent farther inland (northward) migration of high-chloride, seawater-impacted groundwater in the UAS and LAS. One approach widely used to achieve this objective is to induce a neutral to seaward hydraulic gradient at the seawater-intrusion "fronts." This is conceptually the simplest approach, and has historically and recently been the focus of efforts to achieve safe/sustainable yield in the OPV basins. This approach can be simplified to **"Recharge**

more, pump less—especially near the coast," and it has been successful to some degree in the past, especially following consecutive years of above-average rainfall. **An alternative approach to control seawater intrusion is to construct an extraction well field near the coast** that would both reverse the inland movement of seawater that has already intruded past the coastline, while simultaneously providing hydraulic containment that can intercept seawater as it intrudes from the ocean. While not commonly used as a seawater-intrusion mitigation tool in coastal basins, this is a very common approach for controlling migration of other contaminants in groundwater. This is the concept being considered by United in its Brackish Water Extraction and Treatment Design planning effort, in cooperation with the U.S. Navy.

Past Optimization Projects

"One of the most effective management strategies in reducing overdraft is to supply water directly to overdrafted areas" (FCGMA's 2007 Groundwater Management Plan Update).

By 1950, United recognized that artificial recharge at Saticoy, located 8 to 10 miles inland from the coast, was—by itself—insufficient to prevent seawater intrusion from reaching water-supply wells located much closer to the coast, especially those wells just inland from the Hueneme and Mugu submarine canyons. In response, United diversified its operations in the late 1950s to include direct delivery of diverted surface water via the Pleasant Valley pipeline **(PVP)** to farms located in the central Oxnard coastal plain. The farms, in turn, used this water in lieu of some of the groundwater pumped from wells in the area, reducing extractions and reducing the rate of seawater intrusion to some degree. United also constructed the O-H well field and pipeline, together with the El Rio recharge facility, to deliver what was essentially surface water (following a brief existence as artificial recharge) to municipal water purveyors and agricultural users in the Oxnard and Port Hueneme areas. Again, delivery of water from the Forebay reduced demand for groundwater from wells located near the coast and mitigated inland hydraulic gradients.

Both the O-H Pipeline and PVP projects succeeded in reducing groundwater extractions in areas of the Oxnard and Pleasant Valley basins where declining groundwater levels were accelerating seawater intrusion. However, by the 1970s it was recognized that a major pumping depression or "trough" persisted in the Upper Aquifer System (UAS) in the agricultural area immediately east of Oxnard. Concerns that seawater could advance as far inland as the Oxnard Forebay prompted the State Water Resources Control Board in 1979 to threaten adjudication of the basin unless local interests could make meaningful progress towards mitigating the persistent overdraft and seawater intrusion problem. In response, United partnered with Ventura County to design and construct the PTP project. The PTP project was designed and constructed in the early 1980s to reduce groundwater pumping from the UAS pumping trough area by delivering surface water directly to farmers in-lieu of pumping groundwater, similar to the PVP project. During times when surface water supplies are insufficient to meet demand, five Lower Aquifer System (LAS) wells (the PTP well field) were constructed and are operated by United to supply groundwater for irrigation without pumping from the Upper Aquifer System (UAS), which has been impacted more by seawater intrusion. The surface water deliveries via the PTP and pumping from United's PTP well field have greatly reduced pumping from the Upper Aquifer System in this area, and slowed the rate of seawater intrusion. Unfortunately, pumping from the Lower Aquifer System at the PTP wells was only intended as an interim solution, but it has continued longer than expected, exacerbating seawater intrusion in the Lower Aquifer System.

Although these deliveries of surface water to the PVP and PTP, as well as to the El Rio spreading grounds (for pumping and delivery via the O-H pipeline), reduced the quantity of water available for recharge at Saticoy, the benefit has been a significant reduction in seawater intrusion. The overall water budget was unchanged, but changes to how and where water was delivered and pumped has helped to mitigate the primary "undesirable result" (to use SGMA language) that was driving groundwater sustainability concerns in the OPV basins. Although these projects were labeled "conjunctive use" projects, in effect they were optimizing delivery of surface water and pumping of groundwater in the OPV basins, thereby increasing sustainable yield.

Optimization Concepts for the Future

In recent years, both United and the FCGMA have developed concepts for new optimization projects that have the potential to increase sustainable yield of the OPV basins, relying primarily on existing groundwater and surface-water (from the Santa Clara River) supplies.

In 2007, the FCGMA (in their groundwater management plan update) suggested pumping more groundwater from the northwest Oxnard Plain, where groundwater elevations were commonly above sea level, and delivering that water to the central and southern portions of the OPV basins, where groundwater elevations were consistently below sea level and seawater intrusion was a known problem, as a way to optimize groundwater resources. This was considered a "15-year strategy" back in 2007. Although similar in concept to United's PTP and PVP conjunctive-use projects that rely on surface-water, this FCGMA proposal recognized the potential benefit of shifting groundwater extractions away from impacted areas and into unimpacted areas and aquifers of the OPV basins. In other words, pumping a specified volume of groundwater in a location not prone to seawater intrusion would cause less seawater intrusion than pumping that same volume of groundwater in the southern OPV basins.

United expanded on this concept in its **GSP-Lite Open-File Report** (and Addendum A) of 2017, which included assumed pumping scenarios that restricted most pumping in the coastal area of OPV basin while allowing historic average pumping rates to continue in the Forebay. These scenarios also assumed that conveyance infrastructure (pipelines or canals) would be built to supply water from the Forebay and western Oxnard Plain in lieu of pumping near the coast. Effectively, they were shifting pumping away from the coastal areas, to unimpacted areas inland from the coast.

When compared to a **pumping scenario that assumed uniform reductions in pumping** throughout the OPV basins, the sustainable yields (estimated by modeling) under the "shift pumping away from the coast" scenarios were approximately 10,000 acre-feet per year (AF/yr) greater than the "uniform reduction" scenario.

Furthermore, in a **scenario that involved *increasing* pumping from the Upper Aquifer System by 50 percent compared to historic average pumping rates while reducing**

pumping in the Lower Aquifer System, sustainable yield of the basins increased by another 10,000 AF/yr. It must be emphasized, however, that although no “new water projects” were required to increase sustainable yield under these scenarios, shifting pumping away from the coast would require development of new well fields and conveyance infrastructure that would come with a significant price tag.

A relatively new project under evaluation by United is based on the old concept of delivering more surface water to coastal areas of the OPV basins. Modeling of United’s “Alternative Supply Assurance Pipeline Project” (ASAPP) concept indicated that a more direct conveyance (via pipeline) of surface water stored in Lake Piru to the southern OPV basins would improve opportunities for optimizing use of surface water and reducing groundwater extractions in impacted areas. The model indicated that although ASAPP would provide a significant benefit for optimizing existing water supplies, it’s **greatest benefit would be to allow more optimal use of additional imported water purchased from the State Water Project**. United’s 2019 open-file report on the ASAPP noted that “United’s regional groundwater flow model predicts significant increases in groundwater elevations and reductions in lateral seawater intrusion compared to baseline for all ASAPP scenarios. ASAPP increases groundwater levels more significantly in the LAS, and especially near Point Mugu and within the PTP service area.”

Conclusion

It was recognized 70 years ago that simply “getting more water in the ground” via artificial recharge in the Forebay wouldn’t, by itself, stop seawater intrusion in the coastal areas of the OPV basins. Since then, some of the most important water-supply projects in the region have involved optimizing where (and from what depth) groundwater is pumped and surface water is delivered, with the goal of getting the most use out of the existing, available volumes of these limited resources, while mitigating seawater intrusion. Looking forward, even though new sources of supply will likely be required to meet future needs, further optimization efforts have the potential to fill a significant portion of the gap between supply and demand.