EXHIBIT 1

Technical Memorandum November 14, 2019

To: John Farrow
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From: Timothy K. Parker, PG, CEG, CHG, Parker Groundwater

Subject: Groundwater impacts from increased pumping to support Del Rey Oaks housing development in the Ord Community

At your request, I have reviewed the Draft Initial Study/Negative Declaration for the City of Del Rey Oaks Housing Element (DRO Negative Declaration) together with the documents cited below. Del Rey Oaks is proposing to adopt a housing program that would call for rezoning of land in the former Fort Ord to be used for up to 86 housing units.

This letter reiterates and updates the conclusions set out in my October 8, 2016 memorandum regarding the proposal to increase groundwater pumping to support the Monterey Downs project in the Fort Ord community and in my February 15, 2018 letter regarding the proposal to increase groundwater pumping through annexation of additional areas within Fort Ord into the service area for Marina Coast Water District (MCWD). Consistent with my earlier conclusions and as updated in the discussion below, increased pumping to support the Del Rey Oaks housing development in the Ord Community would aggravate existing seawater intrusion and further deplete the Deep Aquifers.

I am a California Professional Geologist (License #5584), Certified Engineering Geologist (License # EG 1926), and Certified Hydrogeologist (License #HG 12), with over 28 years of geologic and hydrologic professional experience. I served as a member of the Technical Advisory Committee to the Monterey County Water Resources Agency (MCWRA) in connection with its study of the Salinas Valley Groundwater Basin that is mandated by Policy PS 3.1 of the 2010 Monterey County General Plan. The purpose of that study is to evaluate historic data and trends in seawater intrusion and groundwater levels in the Salinas Valley Groundwater Basin, to evaluate the likely future groundwater demand, to determine whether groundwater level declines and seawater intrusion are likely to continue through 2030, and to make recommendations for action. This study has not been concluded, but a preliminary report was released in January 2015 by the prime consultant for the PS-3.1 study.[1] My Resume and Project Experience are attached.

[1] MCWRA, State of the Salinas River Groundwater Basin, January, 2015, available at

1. The affected subbasins and management subarea

The water system that MCWD uses to supply groundwater for Marina and Fort Ord development relies on an intertied set of wells in the 400-Foot Aquifer and the Deep Aquifers within what is now termed the Monterey Subbasin.[2] The California DWR's Bulletin 118, which defines basin and subbasin boundaries, was updated in 2018 to divide the areas previously identified as the Seaside Subbasin into two separate subbasins, the Seaside Subbasin and the Monterey Subbasin.[3] The reasons for this revision is that hydrologic studies of the Marina and Seaside areas have shown that the northern portion of the area formerly designated as the Seaside Subbasin and now designated as the Monterey Subbasin is connected to the 180/400 Foot Aquifer Subbasin, while the southern portion is separate from the Salinas Valley due to a ridge in the water-bearing formations.[4]

Monterey County Water Resources Agency (MCWRA) designates management subareas in the Salinas Valley Groundwater Basin, the boundaries of which are not identical to the DWR subbasin boundaries. The MCWRA-designated Pressure Subarea includes the DWR-defined 180/400-Foot Aquifer Subbasin and most of the DWR-defined Monterey Subbasin and includes part of the DWR-defined Seaside Subbasin.[5]

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https://digitalcommons.csumb.edu/cgi/viewcontent.cgi?article=1020&context=hornbeck_cgb_6_a.

[2] Marina Coast Water District, 2015 Urban Water Management Plan, June 6, 2016 (MCWD, 2015 UWMP), pp. 31-38,75 available at https://www.mcwd.org/docs/engr_files/MCWD_2015_UWMP_Final.pdf.; City of Seaside, Campus Town Specific Plan DEIR, p. 4.9-5, available at https://www.ci.seaside.ca.us/DocumentCenter/View/9742/Seaside-Campus-Town-Specific-Plan-DEIR-July-2019.

[3] Department of Water Resources, Basin Boundary Description, 3-004.10 Salinas Valley – Monterey, February 5, 2018, available at https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Bulletin-118/Files/B118-Basin-Boundary-Descriptions-2016/B118-Basin-Boundary-Description-2016---3_004_10.pdf; see also Department of Water Resources, California's Groundwater Bulletin 118 – Interim Update 2016, available at http://www.water.ca.gov/groundwater/bulletin118/docs/Bulletin_118_Interim_Update_2016.pdf.

[4] MCWD, 2015 UWMP, p. 34.

[5] Salinas Valley Groundwater Basin Groundwater Sustainability Agency (SVGBGSA), Draft 180/400-Foot Aquifer Subbasin GSP, October 1, 2019, pp. 5-15 and 5-28, available at https://svbgsa.org/wp-content/uploads/2019/10/4-Updated-Volume-2.pdf; see also MCWD, 2015 UWMP, p. 35; WRIME, Deep Aquifer Investigative Study, May 2003, p. 3-13.

MCWRA's 2016 State of the Salinas Valley Groundwater Basin reports basin hydrogeology, aquifer interactions, groundwater level trends and groundwater balance for the aquifers in the management subareas, including the 180-Foot Aquifer, the 400-Foot Aquifer, and the Deep Aquifers in the Pressure Subarea.[6] Because the 180-Foot Aquifer, the 400-Foot Aquifer, and the Deep Aquifers in the Pressure Subarea are shared by both the Monterey Subbasin and the 180/400-Foot Aquifer Subbasin, reported statistics for the Pressure Subarea are relevant to both Subbasins. In some instances, the aggregate data for the Pressure Subarea can be disaggregated as between the Monterey Subbasin and the 180/400-Foot Aquifer Subbasin. For example, the annual volume of seawater intrusion can be allocated between the Monterey Subbasin and the 180/400-Foot Aquifer Subbasin based on the relative length of their coastlines that are subject to seawater intrusion:

> The State of the Salinas River Groundwater Basin report estimated that approximately 11,000 acre-feet of seawater flows into the Pressure subarea every year. Previous estimates have ranged between 14,000 and 18,000 acre-feet per year (AF/yr.) of seawater intrusion (Brown and Caldwell, 2016). These seawater inflow estimates include portions of the Monterey Subbasin. The length of coastline subject to seawater intrusion is approximately 75% in the 180/400-Foot Aquifer Subbasin and therefore we estimate the flow into the 180/400-Foot Aquifer Subbasin is approximately 8,250 to 13,500 AF/yr.[7]

However, disaggregation of these statistics should not obscure the fact that the 180-Foot Aquifer, the 400-Foot Aquifer, and the Deep Aquifers are common to the Monterey Subbasin and the 180/400-Foot Aquifer Subbasin.

The previously designated "900-Foot Aquifer" or "Deep Aquifer," from which most of the pumping to support Fort Ord development is taken, is now understood to include at least two distinct aquifers:

> Taken together, the overall conclusion that can be derived from the collected data and the preliminary analysis is that the deep aquifers from which MCWD extracts its water supply is actually two separate aquifer systems. Existing geologic and water chemistry data suggest that MCWD Well Nos. 10 and 11 produce primarily from the Paso Robles Formation, whereas MCWD Well No. 12 produces from the Purisima Formation.[8]

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[6] MCWRA, State of the Salinas Valley Groundwater Basin.

[7] SVGBGSA, Draft 180/400-Foot Aquifer Subbasin GSP, October 1, 2019, p. 5-40.

[8] WRIME, Deep Aquifer Investigative Study, May 2013, p. 2-31; see also WRIME, p. 3-13; MCWD, 2015 UWMP, pp. 35, 37; MCWRA, Recommendations to Address the Expansion of Seawater Intrusion in the Salinas Valley Groundwater Basin, Oct. 2017, pp. 45-46, available at https://www.co.monterey.ca.us/home/showdocument?id=57394.

Accordingly the deeper aquifer system underlying the upper aquifers (the 180-Foot and 400-Foot aquifers) is now sometimes referred to as the Deep Aquifers.[9]

2. Increased pumping for new development in the Ord community would aggravate seawater intrusion in the upper aquifers and further deplete the Deep Aquifers.

The proposal to add up to 86 units of additional housing to the Ord Community is based on the premise that MCWD would supply water to support that housing. According to the Negative Declaration, the revised Program 1A of the Housing element calls for 16 units of moderate and above-moderate income housing and 70 units of low and very-low income housing in Fort Ord "where water is available for development."[10]

Assuming that the moderate and above-moderate housing units are single family units, and that the low and very-low income units are multi-family units, the units would require 0.33 afy and 0.25 afy per housing unit respectively.[11] Based on these demand factors, the 86 units of housing would require an additional 23 afy of water supply from MCWD. Residential development on a per-acre basis is significantly more water-intensive than commercial or industrial development.

As noted, MCWD's groundwater pumping to service Fort Ord and Marina comes from its wells in the Deep Aquifer and the 400-Foot Aquifer.[12] Wells 10, 11, 12, and 34 draw from the Deep Aquifers. Wells 29, 30, 31, and "WG" (the Watkins Gate well, aka well 35) draw from the upper aquifers. In 2018, MCWD pumped 2,508 af from the Deep Aquifer wells and 895 af from the upper aquifer wells.[13] Thus, about 74% of MCWD pumping comes from the Deep Aquifers and about 26% comes from the upper aquifers.

The impact of groundwater pumping on the aquifers includes cumulative effects from past, present and foreseeable future pumping. MCWRA has documented that Deep Aquifer

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[9] MCWRA, Recommendations to Address the Expansion of Seawater Intrusion in the Salinas Valley Groundwater Basin, Oct. 2017, pp. 45-46.

[10] DRO Negative Declaration, Appendix A, Attachment, revised Chapter 7.0, available at https://www.delreyoaks.org/sites/default/files/fileattachments/city_hall/page/2692/city_of_del_rey_oaks_housing_element_10_23_2019.pdf.

[11] MCWD, 2015 UWMP, p. 18.

[12] MCWD, 2015 UWMP, pp. 9 [Figure 2.2], 45.

[13] MCWD, 2018 Well Production Summary.

pumping by all users, including MCWD, was 8,901 afy in 2016.[14] As discussed below, this pumping directly depletes the Deep Aquifers because there is no known recharge source other than leakage from the upper aquifers. Cumulative pumping from the Pressure Subarea, primarily from the 400-Foot Aquifer and 180-Foot Aquifer, averages 110,000 afy, which results in an ongoing annual overdraft of 2,000 afy.[15] Cumulative pumping is projected to increase. MCWD projects that its water demand for Marina and Fort Ord will increase from 4,174 afy in 2015 to 12,197 afy in 2035.[16] As discussed below, despite the 2018 moratorium on new wells in the Deep Aquifers, it is foreseeable that increased Deep Aquifer pumping will occur from wells that have been permitted prior to 2018 and from future "replacement wells" that may be permitted under the moratorium ordinance. Any increases in groundwater pumping must be assessed with reference to its contribution to this cumulative groundwater pumping to the Deep Aquifers and to the upper aquifers of the Pressure Subarea.

In summary, the conclusions in my October 8, 2016 memorandum and in my February 15, 2018 letter regarding proposals to increase groundwater pumping to support Ord Community development remain valid.[17] First, seawater intrusion into the 180-Foot and 400-Foot aquifers continues in the Pressure Subarea due to overdraft conditions, despite the groundwater management projects that are intended to halt it. Additional pumping of either the 180-Foot Aquifer or the 400-Foot Aquifer will directly induce additional seawater intrusion.

Second, additional pumping of the Deep Aquifers will deplete them and contribute to seawater intrusion of the 180-Foot and 400-Foot aquifers. This is because the Deep Aquifers have no known source of recharge other than induced leakage from the upper aquifers, and that leakage induces seawater intrusion into the upper aquifers. The leakage from the upper aquifers also threatens to salinate the Deep Aquifers themselves.

Consistent with the conclusions in my earlier letters, the incremental water demand for 86 units of additional housing would contribute considerably to the cumulative seawater intrusion of the upper aquifers and the depletion of the Deep Aquifers. The discussion

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[14] MCWRA, Recommendations to Address the Expansion of Seawater Intrusion in the Salinas Valley Groundwater Basin, Oct. 2017, p. 52.

[15] MCWRA, State of the Salinas Valley Groundwater Basin, p. ES-11.

[16] MCWD, 2015 UWMP, p. 22.

[17] Timothy K. Parker, Technical Memorandum to John H. Farrow, October 8, 2016; Timothy K. Parker, letter to John H. Farrow, February 15, 2018.

below summarizes these conclusions and notes additional information that has become available since my previous letters.

a. Additional pumping from the Deep Aquifers would further deplete the Deep Aquifers and induce additional seawater intrusion.

According to MCWD's 2015 Urban Water Management Plan, "[o]ther than MCWD, only a small number of wells tap the deep aquifer . . .."[18] MCWD's 2015 UWMP claims that as of 2015 "MCWD is currently the only significant user of the Deep Aquifer . . .."[19] However, contrary to MCWD's UWMP, there are in fact other users of the Deep Aquifers and there has been a substantial increase in pumping from the Deep Aquifers as new wells have been installed to replace the seawater intruded wells in the upper aquifers.[20] Since 1995, new wells in the Deep Aquifer have been drilled at the rate of more than one per year, and there are now more than 40 wells in the Deep Aquifers.[21] Deep Aquifer extractions increased from 2,151 afy in 1999 to 8,901 afy in 2016.[22]

Well drilling in the Deep Aquifers continues. For example, MCWD brought a lawsuit against the County of Monterey in March 2018 challenging the September 2017 drilling permit for a Deep Aquifer well with the capacity to pump another 4,000 afy.[23] And although the County enacted a moratorium on new wells in the Deep Aquifers in May 2018, that moratorium exempts both municipal supply wells and so-called "replacement wells," i.e., wells drilled to replace the water supply previously obtained from wells in the upper aquifers that have failed due to seawater intrusion.[24]

The Deep Aquifers are not a sustainable water source. MCWD acknowledges that the Deep Aquifer water "is not of recent origin" and that carbon dating reveals it to be "between 22,000 and 31,000 years old."[25] In fact, the only known source of recharge to the Deep

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[18] MCWD, 2015 UWMP, p. 31.

[19] Ibid.

[20] MCWRA, Recommendations to Address the Expansion of Seawater Intrusion in the Salinas Valley Groundwater Basin, Oct. 2017, p. 48.

[21] Ibid.

[22] Id., p. 52.

[23] MCWD v. County of Monterey (Bill Armstrong et al., Real Parties in Interest), Petition for Writ of Mandate and Complaint for Injunctive Relief, March 5, 2018, paragraph 2.

[24] Monterey County Urgency Ordinance # 5302, available at https://www.co.monterey.ca.us/government/departments-a-h/health/environmental-health/wells/interim-urgency-ordinance-5302.

[25] MCWD, 2015 UWMP, p. 37.

Aquifers is "leakage from the overlying aquifer system, i.e. the Pressure 180-Foot Aquifer and Pressure 400-Foot Aquifer."[26]

The leakage from the upper aquifers caused by increased pumping from the Deep Aquifers induces seawater intrusion in the upper aquifers. The MCWD UWMP acknowledges this impact:

> Another concern is that the Deep Aquifer may be connected to, and affect seawater intrusion in, the upper aquifers. Preliminary findings regarding the Deep Aquifer in the Ord Community area indicate that there is some vertical connectivity between the Deep Aquifer and the overlying aquifers. According to the Deep Aquifer Investigative Study, WRIME, May 2003, increased pumping of the Deep Aquifer would be expected to increase the rate of seawater intrusion in the middle and upper aquifers, but to a lesser extent than if the increased pumping occurred in the middle or upper aquifers. In that report, WRIME modeled the effect of increasing groundwater pumping from the Deep Aquifer by two to five times the baseline rate of 4,800 afy. The model predicted that, in the absence of other actions to control seawater intrusion, the landward flow of groundwater would increase as a result.[27]

The 2003 WRIME study cited by MCWD concluded that increasing the baseline rate of extraction would induce seawater intrusion. The 2003 WRIME study concluded that annual MCWD production from Deep Aquifer wells had averaged about 2,000 afy since 1990.[28] The WRIME analysis of the effects of increased pumping over baseline conditions assumed that baseline pumping was 2,400 afy.[29, 30]

Using the Salinas Valley Integrated Groundwater and Surface water Model (SVGISM) modified to reflect the best understanding of the structure of the Deep Aquifers, WRIME evaluated the effects of increased pumping of the Deep Aquifers on the 180-Foot Aquifer,

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[26] MCWRA, Recommendations to Address the Expansion of Seawater Intrusion in the Salinas Valley Groundwater Basin, Oct. 2017, p. 52.

[27] MCWD, 2015 UWMP, p. 50.

[28] WRIME, Deep Aquifer Investigative Study, May 2013, pp. 2-14, 2-15.

[29] Id., pp. 3-60, 4-1; 4-11.

[30] MCWD's 2015 UWMP misstates the baseline conditions in the WRIME analysis as follows: "In that report, WRIME modeled the effect of increasing groundwater pumping from the Deep Aquifer by two to five times the baseline rate of 4,800 afy." (MCWD, 2015 UWMP, p. 50.) As noted, the baseline rate in the WRIME study was 2,400 afy.

the 400-Foot Aquifer, the upper aquifer of the Deep Aquifers, and the lower aquifer of the Deep Aquifers, which WRIME termed Aquifers 1, 2, 3, and 4.

WRIME concluded that increasing Deep Aquifer pumping from 2,400 afy to 8,000 afy (the Alternative 2 analysis) would reduce groundwater levels at coastal monitoring locations in all four aquifers by 4 to 7 feet and would induce additional seawater intrusion (coastal groundwater flows).[31] WRIME found that increasing Deep Aquifer pumping from 2,400 to 8,000 afy would induce additional vertical flows between the aquifers, including an additional flow of 4,152 afy from the 400-Foot Aquifer to the upper Deep Aquifer.[32]

As noted, the level of Deep Aquifer pumping at 8,901 afy, now exceeds the 8,000 afy level modeled by WRIME.[33] Thus, the available analysis indicates that the current level of Deep Aquifer pumping is contributing to seawater intrusion. Any further increase in Deep Aquifer Pumping will further induce seawater intrusion.

Because the Deep Aquifer is not known to be a sustainable aquifer with ongoing natural recharge, the Monterey County Water Resources Agency imposed a moratorium in 2018 on new wells in the Deep Aquifer pending a study to determine whether the Deep Aquifer has any sustainable yield.[34] Although the moratorium exempts municipal supply wells and certain "replacement wells," such wells have the same effect on aquifer depletion and seawater intrusion as other wells.

In sum, the available evidence indicates that use of the Deep Aquifers amounts to mining an ancient and non-sustainable resource, which will deplete that resource. Furthermore, increased pumping from the Deep Aquifers will also induce further seawater intrusion in the upper aquifers and will increase the risk that the Deep Aquifers will themselves become saline due to induced vertical leakage from the upper aquifers. Under the circumstances, the Del Rey Oaks Housing Element Negative Declaration should acknowledge that additional pumping from the Deep Aquifers to support 86 residential units would make a considerable contribution to the ongoing significant cumulative impacts from Deep Aquifer pumping.

b. Additional pumping from the upper aquifers would threaten existing MCWD wells, add to overdraft conditions, and induce additional seawater intrusion.

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[31] WRIME, Deep Aquifer Investigative Study, May 2013, p. 4-11, Tables 4.2 and 4.3.

[32] Id., Table 4.4 [Alternative 2, change in flow from Aquifer 2 to Aquifer 3].

[33] MCWRA, Recommendations to Address the Expansion of Seawater Intrusion in the Salinas Valley Groundwater Basin, Oct. 2017, p. 52.

[34] Monterey County Urgency Ordinance # 5302.

As noted, about 24% of current MCWD pumping for Marina and Fort Ord comes from the aquifers above the Deep Aquifers. Any additional pumping for new development from these upper aquifers is problematic.

First, additional pumping to support Fort Ord development may not remain viable. MCWD's continued pumping from the 400-Foot Aquifer on Fort Ord is threatened by the rapid advance of seawater intrusion. MCWD and the Army have frequently had to replace wells in the 180-Foot and 400-Foot aquifers that have become unusably saline since 1960, drilling new wells farther inland or to the Deep Aquifers as the seawater intrusion front advances.[35] MCWRA's most recent mapping of the seawater intrusion front in 400-Foot Aquifer shows rapid advance of that front along Reservation Road in the vicinity of MCWD's only remaining upper aquifer wells, wells number 29, 30, 31 and 35.[36] There is no assurance that MCWD's remaining wells in the 400-Foot Aquifer will remain viable in the face of this rapid seawater intrusion.

Furthermore, any additional pumping from the upper aquifers will add to the existing overdraft conditions in the Pressure Subarea. MCWRA reports that overdraft in the Pressure Subarea has averaged 2,000 afy from 1944 to 2013.[37] This cumulative overdraft condition results in declining groundwater levels, which in turn cause seawater intrusion. Groundwater levels in the Pressure Subarea 400-Foot Aquifer continue to decline, especially along the coast.[38]

Coastal pumping, such as MCWD's pumping for Fort Ord and Marina, induces seawater intrusion more than the same amount of pumping from further inland. Thus, to halt the advance of seawater intrusion, the most recent hydrological studies have recommended that pumping be reduced in the coastal aquifers or that pumping be shifted further away from the coast.[39]

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[35] MCWD, 2015 UWMP, p. 45.

[36] Compare MCWD, 2015 UWMP, p. 9, Figure 2.2 [well maps] to MCWRA, Historic Seawater Intrusion Map, Pressure 400-Foot Aquifer, June 7, 2017 [seawater intrusion front], available at http://www.co.monterey.ca.us/home/showdocument?id=19378.

[37] MCWRA, State of the Salinas River Groundwater Basin, 2017, p. ES-11.

[38] MCWRA, presentation of Groundwater Level Contours And Seawater Intrusion Maps, July 13, 2017, available at http://www.co.monterey.ca.us/home/showdocument?id=31294.

[39] MCWRA, State of the Salinas River Groundwater Basin, 2017, pg. ES-16; Geoscience, Protective Elevations to Control Seawater Intrusion in the Salinas Valley, Nov. 19, 2013, pp. 1, 11, available at https://www.co.monterey.ca.us/home/showdocument?id=19014.

In sum, any additional pumping from MCWD's wells in the upper aquifers will exacerbate the existing overdraft, falling coastal groundwater levels, and seawater intrusion.

Finally, I understand that MCWRA agreed in 1993 that the Army could pump 6,600 afy to support Fort Ord use pending a new 6,600 afy potable water supply for Fort Ord. I understand that this 6,600 afy allocation has been sub-allocated to Fort Ord land use jurisdictions and to individual development projects, but that no new potable water supply for Fort Ord has been implemented. As I explained in my earlier letters, the real-world physical impacts to the aquifers is occurring, and will be aggravated by increased pumping, regardless of the availability of any portion of the 6,600 afy allocation. The right to pump groundwater is a distinct issue from the impacts from that pumping.