August 2, 2018

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30 PERCENT DEWATERING DESIGN SUBMITTAL, MARYMOOR LMC, REDMOND, WASHINGTON

Dear Bryan,

This letter presents our 30 percent dewatering design submittal for the proposed Marymoor LMC development in Redmond, Washington. This submittal provides a brief review of the site conditions and dewatering requirements for the site.

The Marymoor LMC will be a mixed use building located at the intersection of NE 70th Street and 176th Avenue NE in eastern Redmond, Washington. The site is a triangular-shaped. The proposed building footprint (July 26, 2018) places the building immediately adjacent to the East Lake Sammamish Trail on the east, and leaves some space between the building and adjacent streets bordering the rest of the building.

The top of slab elevation for the building will be 37.61 feet. Five elevator pits will be constructed with a top of slab elevation of 32.17 feet, we understand that there will be a 5-foot thick base slab for each of these elevator pits with a base of excavation elevation of about 27 feet. The base of the crane pad is anticipated to be no deeper than the elevator pit excavations. Since these are the deepest excavations proposed for the project, elevation 27 feet will be the target elevation for the work.

The geotechnical information for the project is provided in a March 2018 report by PanGeo, Inc. titled: Preliminary Geotechnical Report, Marymoor LMC, 17611 Northeast 70th Street, Redmond, Washington. This report provides the results of 5 explorations on the site, groundwater level data, and other geotechnical considerations for the project.

The aquifer that lies beneath the City of Redmond is one of the more pervious sand and gravel deposits in Washington State. The aquifer lies throughout the commercial portion of the city and we have provided a number of dewatering designs throughout this area. Aquifer transmissivity is the primary variable used in dewatering designs; this is a function of aquifer permeability, or hydraulic conductivity, and aquifer thickness. The boring logs did not penetrate to a significant depth of this aquifer, but based on other projects in the vicinity it is assumed to be 70 feet deep. Based on experience with projects to the north and west we use a range in aquifer transmissivity of 20 to 30 square feet per minute.

Groundwater levels at the site are a function of the levels in Lake Sammamish to the south of the site, the Sammamish River to the south and west of the site, and Bear and Evans Creeks to the north. Levels

in these water bodies are a function of precipitation. PanGeo obtained groundwater data collected by the City of Redmond since 2009 and determined that groundwater may fluctuate over 8 feet from a low of 29.7 to a high of 37.6 feet. The maximum and minimum levels, and timing of the fluctuations will vary seasonally according to precipitation patterns. During the summer months the aquifer will discharge to the surface water bodies downstream of the site, during the winter the surface water bodies may drain to the aquifer; however, Bear Creek may be perched in the vicinity of the site. At this stage of the design process it is helpful to know the dewatering requirements for the seasonal winter levels, which will be the most challenging for groundwater control; as such, we use a design groundwater elevation of 36 feet, which is about the highest elevation measured at MW334.

The design calculations were performed by analytical modeling based on the Theis and Jacob solutions and the principle of superposition. Even though much of the main slab will be above the water table for much of not all of the year, the elevator pit slabs will be below the water table all of the year. Though dewatering can be performed for the individual elevator pit excavations, this would place wells inside the excavation and would interfere with construction activities. Experience in Redmond, and in high transmissivity aquifers shows that the location of the wells is not as important as the volume of water removed, as such, wells placed outside the excavation will provide a nearly identically shaped drawdown curve with the same total yield. As a result, wells were located outside the excavation. Since the building abuts to the East Lake Sammamish River Trail on the east side of the site and will not allow placement of wells outside the excavation, well spacings were reduced on the remaining three sides to provide sufficient total system yield to dewater the excavation.

Figure 1 shows the locations of the wells, Figure 2 shows the results of the calculation. As shown, the calculations indicate that 14 dewatering wells would be necessary with total system yields between 3,500 and 4,700 gpm in the first month of dewatering, rates may decline up to 20 percent thereafter.

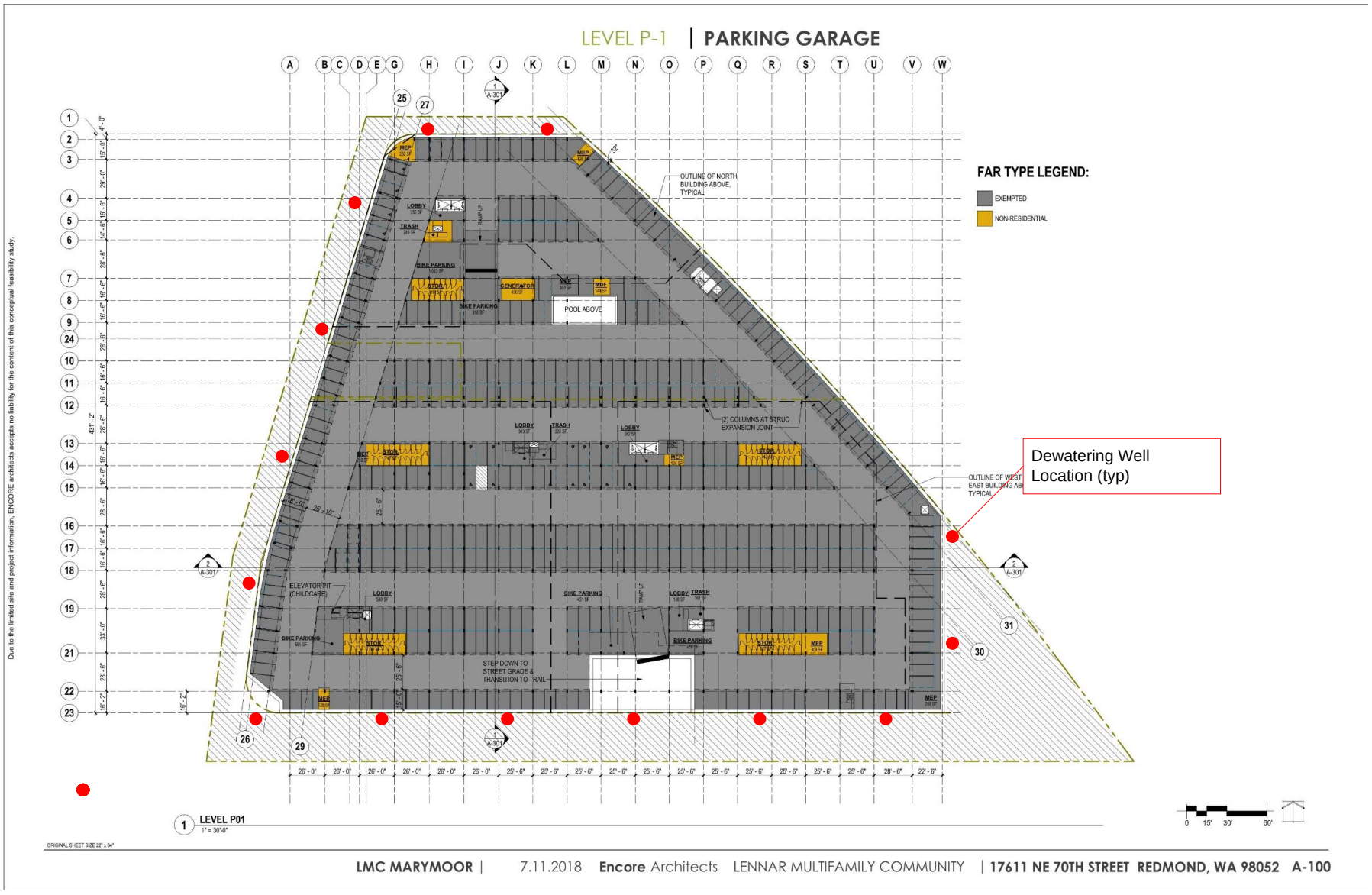
The City of Redmond requires estimation of the amount of drawdown that may occur at their water supply wells; Figure 3 shows that less than 1 foot of groundwater drawdown may occur at the City Wells 1 and 2, and about 2 feet of drawdown at Well 5 in the winter months. Note that the calculation for drawdown during the seasonal low summer months will be less; as such, it does not appear that operation of this system will impact the City's wells.

The dewatering wells would consist of 12-inch casings installed in a 30-inch dimeter boring drilled using bucket auger methods. The wells would be outfitted with submersible pumps likely of about 15 horse power. The discharge from the wells would be connected to a central header which would discharge to a nearby storm sewer. The location of a storm sewer for the discharge has not been identified at this time but will need to be for future submittals.

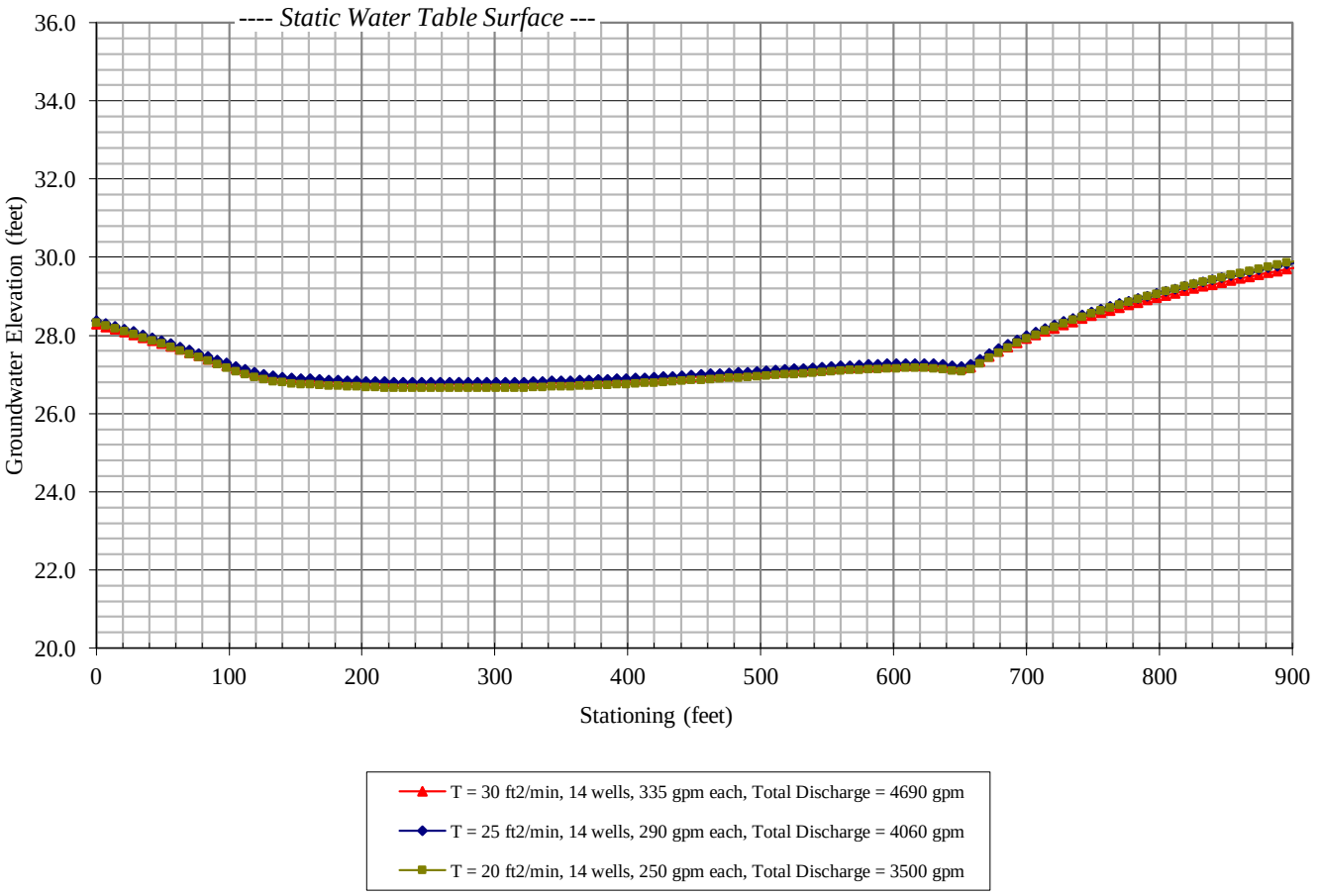
Thank you for the opportunity to be of service. Please call us at (360) 631-5600 should you have any questions or comments.

Sincerely,

Scott F. Bender L.H.G., C.G.W.P.



BENDER CONSULTING, LLC Applied Groundwater Solutions	Dewatering Design Recommendations Marymoor LMC Encore Architects, PLLC	Schematic Dewatering Well Locations	Project Number 1838-01 Figure 1



BENDER CONSULTING, LLC
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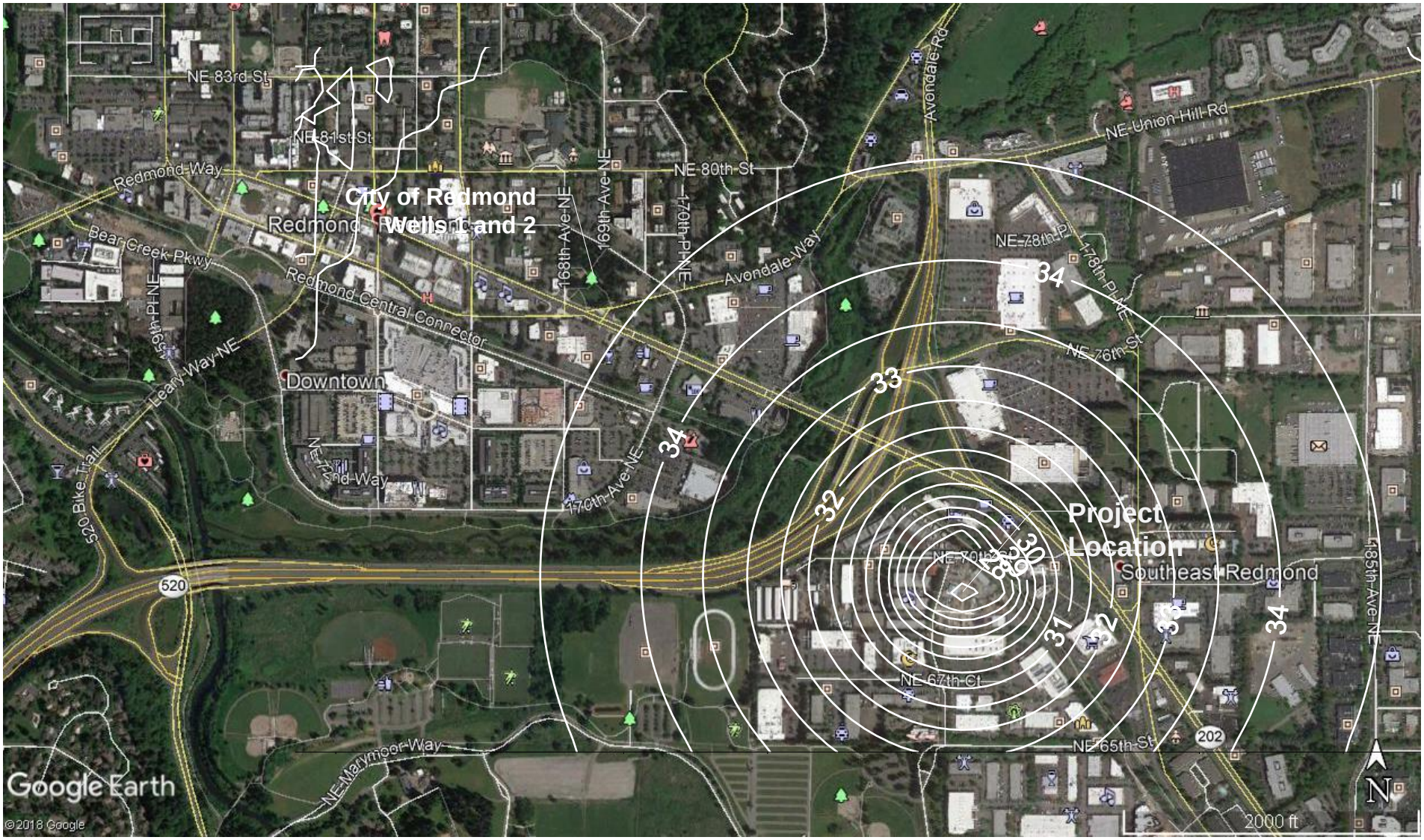
Dewatering Design Recommendations
Marymoor LMC
Encore Architects, PLLC

Calculated Dewatering Groundwater Elevation Profile across Center of the Excavation

Project Number
1838-01

Figure 2



BENDER CONSULTING, LLC *Applied Groundwater Solutions*	Dewatering Design Recommendations Marymoor LMC Encore Architects, PLLC	Calculated Dewatering Groundwater Contours (static elevation 36 feet)	Project Number 1838-01 Figure 3