Project No.
9567.000.001

February 2, 2017

Ms. Carey Algaze
Pacifica Companies
1775 Hancock Street, Suite 200
San Diego, CA 92110

Subject: Haystack Pacifica
215 Weller Street
Petaluma, California

GROUND IMPROVEMENT - DRILLED DISPLACEMENT PRESSURE GROUTED COLUMNS

References:
1. ENGEO, Updated Geotechnical Engineering Recommendations, Haystack Property, Petaluma, California, March 24, 2014, Project No. 9567.000.001
2. ENGEO; Geotechnical Engineering Consultation, Haystack Property, 215 Weller Street, Petaluma, California; August 3, 2012; Project No. 9567.000.000
3. BDE; Architectural Plan, Haystack Petaluma, California, Sheets 1 through 5; September 6, 2016.

Dear Ms. Algaze:

This letter provides our preliminary recommendations for ground improvement using drilled displacement pressure grouted columns (DDC) for support of the planned structures at the Haystack project in Petaluma, California. The current development concept includes two, four-story townhome structures with interior two-story parking garage. The ground improvement technique is selected based on discussions with the project team regarding construction logistics and structural loads.

The site is underlain by local deposits of soft compressible soils and potentially liquefiable sands within the upper 15 to 25 feet below the existing ground surface. Ground improvement prior to construction of the structures is recommended to mitigate soil conditions for support of structures on shallow foundations. We understand that ZFA, the project Structural Engineer, estimate loads to range between 150 to 300 kips on columns for the interior garage, and 90 kips for columns and 4.4 kips per lineal foot for perimeter strip footings for the four-story townhome structures. The current land use plan shows buildings to encompass majority of the project site out to the project boundary.

DRILLED DISPLACEMENT PRESSURE GROUT COLUMN (DDC)

DDC involves advancing drilled shaft to displace the soil around the shaft as it extends to the competent material below the soft and loose soil. The open shaft created is backfilled with pressure grout to form a sand-cement column; typically, the column have diameters of approximately 16 to 18 inches. The effects of displacement and backfilling of grout under pressure will densify or stiffens the soil within the area of influence around the column. DDC columns may be reinforced with a single bar of reinforcing steel (rebar) to increase shearing and tension resistance.

DDC ground improvement results in limited vibration and noise. We understand that it is contemplated that DDC will be installed at locations of shallow foundation elements. Areas outside of the treatment zone (i.e interior slabs, landscaping, planters) will not be supported by DDC, and thus these improvements will remain susceptible to compressible soil and seismic induced settlement. Therefore, interior slabs should be designed to span across the footings bearing on DDC. Under slab utilities will have to be suspend beneath the foundation and slabs with hangars to minimize differential settlement impacts. Design of DDC should be provided by a design-build specialty contractor experienced with this type of ground improvement after foundation plans become available. Prior to production installation of the DDC, a load test program is recommended to be performed to provide actual field capacity and determine if the ground improvement column design needs to be modified based on the site specific data.

ENGEO should review DDC ground improvement design to confirm conformance with the project requirements. Also, ENGEO should provide construction quality assurance during construction and provide observation during construction to determine the work was performed in conformance with the project specifications.

If you have any questions or comments regarding this letter, we will be glad to discuss them with you.

Sincerely,

ENGEO Incorporated

Leroy Chan, GE

Theodore P. Bayham, GE, CEG

lc/tpb/bvv