5.5 Geology and Soils

This section analyzes the potential geology and soils impacts associated with the proposed Project. Information in this section is based on a Geotechnical Study Report (Geotechnical Report) dated July 13, 2015, by RGH Consultants (RGH) (Appendix H herein). The Geotechnical Report included a Seismic Refraction Survey (Seismic Survey) in support of the geotechnical investigation. The Project description at the time the report was prepared was the development of a winery complex and did not include the hotel and office components proposed in the current Project description. However, geologic and soils conditions have not changed since the report was prepared and the site continues to be undeveloped and covered with grasses, weeds and mature oak trees along the southern and western property lines.

5.5.1 Existing Conditions

1. Geology

Napa County lies within the California Coast Range geomorphic province. This province is a geologically complex and seismically active region characterized by sub-parallel northwest trending faults, mountain ranges and valleys. The oldest bedrock units are the Jurassic-Cretaceous Franciscan Complex and Great Valley sequence sediments originally deposited in a marine environment. Younger rocks such as the Tertiary-age Sonoma Volcanics group, the Plio-Pleistocene-age Clear Lake Volcanics and sedimentary rocks such as the Guinda, Domengine, Petaluma, Wilson Grove, Cache, Huichica and Glen Ellen formations were subsequently deposited throughout the province. Extensive folding and thrust faulting during late Cretaceous through early Tertiary geologic time created complex geologic conditions that underlie the highly varied topography of today. Published geologic maps indicate the property is underlain by Mafic flows and breccias.

2. Surface Conditions

The Project site is undeveloped but has been previously graded. Vegetation on site consists of a growth of grasses, weeds and mature oak trees. At the time the investigation was performed, the site was an unpaved, topographically flat vacant lot. Staking and flagging on the site surface indicates that underground utility lines cross the site at three locations. Natural drainage consists of sheet flow over the ground surface that concentrates in man-made surface drainage elements such as roadside ditches and natural drainage elements such as swales, ravines and creeks.

3. Sub-Surface Conditions

Based on laboratory tests and test pits, RGH determined that the natural surface soils, which vary from a few inches to approximately one foot thick, are sandy clays and clayey sands that are weak to moderately strong and slightly compressible. The site is substantially blanketed with heterogeneous clayey sand fill, ranging from a few inches to about 5 feet, and containing variable amounts of gravel and occasional cobbles and boulders. The fill soils exhibit low to moderate plasticity and low expansion potential.
Bedrock extends from beneath the surface materials to the maximum depths explored (8½ feet). The northeast corner of the site contains bedrock that is extremely hard, resistant Andesite. The remainder of the Project site is generally moderately hard, moderately weathered siltstone, sandstone and conglomerate.

4. **Landslides**

   The Project site is not within a designated landslide area as shown on Exhibit 5.5-1, Generalized Relative Landslide Susceptibility Map below from the City’s General Plan, Chapter 8, Health and Safety.

5. **Soil Erosion**

   Soil erosion is a naturally occurring process that can be worsened by human activities. Susceptibility to soil erosion varies based on geologic materials and slope steepness in the area. Geologic materials that are susceptible to slope failure include sandstones, shales and mudstones. Development, with its grading, construction and land alteration, can cause excessive erosion and sedimentation if not regulated properly. Grading for building pads, roads and landscaping removes natural vegetation that protects topsoil from erosion. The Project site is topographically flat with no likelihood of hillside erosion due to natural elements or construction activities. However, construction activities could result in the loss of topsoil and will require mitigation measures to reduce impacts from surface drainage and erosion.

6. **Groundwater**

   No free groundwater was observed by RGH in the test pits. On hillsides, rainwater typically percolates through the porous surface materials and migrates downslope in the form of seepage at the interface of the surface materials and bedrock, and through fractures in the bedrock. Fluctuations in the seepage rates typically occur due to variations in rainfall intensity, duration and other factors such as periodic irrigation.

7. **Seismic Hazards**

   **Regional Faulting and Seismicity**

   Data estimates the chance of one or more large earthquakes (magnitude 6.7 or greater) in the San Francisco Bay region within the next 30 years to be approximately 63%. Future seismic shaking should be anticipated at the Project site. Exhibit 5.5-2, Generalized Relative Landslide Susceptibility Map shows the areas within the Project vicinity where fault activity occurs.

   **Faulting**

   The Project site is not within a current Alquist-Priolo Earthquake Fault Zone. However, the site is within an area affected by strong seismic activity. Several northwest-trending Earthquake Fault Zones are in close proximity to and within several miles of the site. Table 5.5-1 below identifies the faults and distances from the Project.
Exhibit 5.5-1 Generalized Relative Landslide Susceptibility Map
Chapter 5 – Environmental Setting, Impacts, and Mitigation Measures

5.5 – Geology and Soils

Exhibit 5.5-2 Generalized Relative Landslide Susceptibility Map

Legend:
- California Fault Activity
  - Historically Active
  - Holocene Active
  - Late Quaternary (Potentially Active)
  - Quaternary (Potentially Active)
  - State/County Boundary

Regional Faulting

<table>
<thead>
<tr>
<th>PROJECT NO.</th>
<th>DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>402386001</td>
<td>9/14</td>
</tr>
</tbody>
</table>

Napa & Moore

Figure 3

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Table 5.5-1  **Active Fault Proximity**

<table>
<thead>
<tr>
<th>Fault</th>
<th>Direction</th>
<th>Distance-Miles</th>
</tr>
</thead>
<tbody>
<tr>
<td>San Andreas</td>
<td>SW</td>
<td>32.5</td>
</tr>
<tr>
<td>Healdsburg-Rogers Creek</td>
<td>SW</td>
<td>12.5</td>
</tr>
<tr>
<td>Concord-Green Valley</td>
<td>SE</td>
<td>5</td>
</tr>
<tr>
<td>Cordelia</td>
<td>E</td>
<td>7.5</td>
</tr>
<tr>
<td>West Napa</td>
<td>SW</td>
<td>1.5</td>
</tr>
</tbody>
</table>

Exhibit 5.5-3, Ground Shaking Intensity (West Napa Fault) shows the Project site proximity to areas identified as susceptible to intense ground shaking.

On August 24, 2014, a magnitude 6.0 earthquake (South Napa Earthquake) occurred on the West Napa Fault. The epicenter of the earthquake was approximately 9 miles south of the City and approximately 4 miles from the Project site. Prior to the 2014 South Napa Earthquake, the last major seismic event on the West Napa Fault was a magnitude 5.2 temblor near Yountville in September 2000.

**Liquefaction**

Soil liquefaction results from loss of strength during cyclic loading such as imposed by earthquakes. Liquefaction occurs when water-saturated, cohesionless soil loses its strength and liquefies during intense and prolonged ground shaking. Soils most susceptible to liquefaction are loose to moderately dense, saturated granular soils with poor drainage, such as silty sands or sands and gravels capped by or containing seams of impermeable sediment or non-plastic fine-grained soils. Geologic units generally susceptible to liquefaction include late Quaternary alluvial and fluvial sedimentary deposits and artificial fill.

Effects of liquefaction can range from minor settling of foundations and structures to severe subsidence. According to the City’s General Plan EIR, liquefaction hazards occur generally along the length of Napa Creek, Redwood Creek north to Redwood Road, along Browns Valley Creek west to Thompson Avenue, along the Napa River from Trancas Street south to John F. Kennedy Memorial Park and in the southernmost portion of the City below State Route 29. These areas are known to consist of Holocene Alluvium and Bay Muds that may be subject to liquefaction or subsidence.

**Settlement**

Grading of the Project site will result in removal and re-compaction of underlying unsuitable or unstable soils. Detailed grading plans, as approved by the City, will ensure that appropriate measures are applied to conform with local grading requirements for soil settlement.
Exhibit 5.5-3  Ground Shaking Intensity (West Napa Fault)

Source: Figure 8-1A, Envision Napa 2020, Policy Document, Chapter 8: Health and Safety
5.5.2 **Thresholds of Significance**

The state encourages local agencies to adopt their own thresholds. For purposes of this DEIR, the thresholds of significance for evaluating project impacts are based on suggested criteria from the CEQA Environmental Checklist (Appendix G of the CEQA Guidelines). According to the CEQA Guidelines, the proposed Project would have a potentially significant impact with respect to geology and soils if it would:

a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury or death involving:
   i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist or the area or based on other substantial evidence of a known fault. Refer to Division of Mines and Geology Special Publication 42.
   ii) Strong seismic ground shaking.
   iii) Seismic-related ground failure, including liquefaction.
   iv) Landslides.

b) Result in substantial soil erosion or the loss of topsoil.

c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse.

d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property.

e) Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater.

5.5.3 **Project Impacts Prior to Mitigation**

The Geotechnical Report identified primary geotechnical concerns during design and construction of the Project as follows:

1. The presence of a few inches to approximately 5 feet of heterogeneous fill;
2. The moderately hard to hard, resistant bedrock present below the surface soils and heterogeneous fill; and
3. The strong ground shaking predicted to impact the site during the life of the project.

The report provides recommendations for the following potential issues as analyzed during the site investigation.

1. **Heterogeneous Fill** - Fills of unknown quality and unknown method of placement can settle and/or heave erratically under the load of new fills, structures, slabs and pavements. Where not removed by planned grading, the heterogeneous fill must be excavated and replaced as an engineered fill if it is to be used for structural support.
2. **Foundation, Slab and Pavement Support** - After remedial grading, satisfactory foundation support can be obtained from spread footings bottomed on the engineered fill or bedrock. Interior slab-on-grade floors, exterior slabs and pavements can also be satisfactorily supported on the engineered fill or bedrock.

3. **Soil Quality** - All fill materials used in the building and paved areas must be as described in the report recommendations. The report notes that with the exception of organic matter and rocks or lumps larger than 6 inches in diameter, the excavated material will be suitable for re-use as select fill. The report recommends approval by the geotechnical engineer for use of on-site soils as select fill during grading.

4. **Settlement** - The report estimates that total settlement of heavily loaded column footings will be about one-half inch and settlement of the strip footings will be one-quarter inch provided remedial grading is performed as recommended.

5. **Surface Drainage** - Surface runoff can be concentrated by the planned site grading, landscaping and drainage. The surface runoff can pond against structures and seep into the slab rock. Strict control of surface runoff is necessary to provide long-term satisfactory performance.

6. **Landslides** – No impacts due to landslides were identified in the report and the Project site is not within the City’s General Relative Landslide Susceptibility Map (Exhibit 5.5-1, page 5.5-3).

7. **Soil Erosion** - To prevent impacts due to soil erosion during construction activities, the developer will be required to provide an erosion and sediment control plan (ESCP) per Policy Resolution No. 27 - Standard Mitigation Measures. The ESCP will identify best management practices to be implemented during all phases of construction as approved by the Public Works Director. Section 5.8, Hydrology and Water Quality, includes discussion and mitigation measures that will prevent impacts from storm water and erosion runoff to reduce impacts to water quality.

8. **Groundwater** - No impact to groundwater was identified in the report as none was observed during the drilling of test pits. It is unlikely that the Project will result in an impact to groundwater and no mitigation is recommended.

9. **Seismic Hazards** - The Project site is located in an area that is subject to intense ground shaking due to proximity to faults in the area that range from 1.5 to 32.5 miles in distance from the Project. Policy Resolution No. 27 requires that all construction meet the Uniform Building Code regulations for seismic safety to reduce the potential for building failure and injury due to seismic shaking. While the report notes that risk of fault rupture is low at the Project site, Mitigation requiring adherence to the City’s Policy 27 will ensure that impacts are reduced.

10. **Liquefaction** - While the Project site is not within the identified areas that could be subject to liquefaction or subsidence due to earthquakes, adherence to state and local building codes and regulations will reduce potential impacts. The report notes that no subsurface conditions would suggest the presence of materials that
may be susceptible to seismically induced densification, liquefaction or lurching; however, mitigation requiring adherence to state and local regulations is included herein to reduce potential impacts.

Foulk Civil Engineering, Inc. has provided a letter dated September 15, 2017 detailing the preliminary earthwork calculations for the Project. The letter is included herein as Appendix I. The calculations were based on grading plans provided by Fuscoe Engineering and are summarized as follows.

<table>
<thead>
<tr>
<th>Calculation</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Site Excavation (cut)</td>
<td>31,300 cubic yards</td>
</tr>
<tr>
<td>Total Site Embankment (fill)</td>
<td>1,000 cubic yards</td>
</tr>
<tr>
<td>Total Shrinkage (15%)</td>
<td>150 cubic yards</td>
</tr>
<tr>
<td>Net Export</td>
<td>30,150 cubic yards</td>
</tr>
</tbody>
</table>

The Project will be required to comply with the grading and construction recommendations contained in the Geotechnical Study Report including the following.

### 2013 CBC Seismic Criteria

<table>
<thead>
<tr>
<th>Spectral Response Parameter</th>
<th>Acceleration (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$S_0$ (0.2 second period)</td>
<td>2.001</td>
</tr>
<tr>
<td>$S_1$ (1 second period)</td>
<td>0.714</td>
</tr>
<tr>
<td>$S_{MS}$ (0.2 second period)</td>
<td>2.001</td>
</tr>
<tr>
<td>$S_{M1}$ (1 second period)</td>
<td>0.714</td>
</tr>
<tr>
<td>$S_{DS}$ (0.2 second period)</td>
<td>1.334</td>
</tr>
<tr>
<td>$S_{D1}$ (1 second period)</td>
<td>0.476</td>
</tr>
</tbody>
</table>

### Grading

- **Site Preparation** – Areas to be developed should be cleared of vegetation and debris. Voids created during clearing shall be backfilled with engineered fill as recommended.

- **Stripping** – Areas to be graded should be stripped of the upper few inches of soil containing organic matter. Actual depth should be determined by a representative of the geotechnical engineer in the field at the time of stripping. The strippings should be removed from the site or, if suitable, stockpiled for re-use as topsoil in landscaping.

- **Excavations** – Excavations extending below the proposed finished grade should be backfilled with suitable materials compacted to the requirements given herein. Within building, fill and paved areas, the old fill and natural surface soils should be excavated to within six inches of their entire depth. The excavation of old fills and surface soils should extend at least five feet beyond the outside edge of the exterior footings of the proposed buildings and three feet beyond the edge of exterior slabs and pavements. Temporary construction excavations should conform to the regulations of the State of California, Department of Industrial Relations, Division of Industrial Safety or other stricter governing regulations. The stability of temporary cut slopes, such as those constructed during the installation of underground utilities, should be the responsibility of the contractor. Depending on the time of year when grading is performed, and the surface conditions exposed, temporary
cut slopes may need to be excavated to 1½:1 or flatter. The tops of the temporary cut slopes should be rounded back to 2:1 in weak soil zones.

- **Fill Quality** – All fill materials should be free of perishable matter and rocks or lumps over 6 inches in diameter, meet the criteria set forth herein for select fill and must be approved by the geotechnical engineer prior to use. The suitability of on-site soils for use as select fill should be verified during grading.

- **Select Fill** – Select fill should be free of organic matter, have a low expansion potential, and conform in general to the following requirements.

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Passing (by dry weight)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 inch</td>
<td>100</td>
</tr>
<tr>
<td>4 inch</td>
<td>90-100</td>
</tr>
<tr>
<td>No. 200</td>
<td>10-64</td>
</tr>
</tbody>
</table>

liquid limit - 50% maximum; plasticity index - 24% maximum

In general, imported fill, if needed, should be select. Material not conforming to these requirements may be suitable for use as import fill; however, it shall be the contractor’s responsibility to demonstrate that the proposed material will perform in an equivalent manner. The geotechnical engineer should approve imported materials prior to use as compacted fill. The grading contractor is responsible for submitting, at least 72 hours in advance of its intended use, samples of the proposed import materials for laboratory testing and approval by the soils engineer.

- **Fill Placement** – The surface exposed by stripping and removal of heterogeneous fill and surface soils should be scarified to a depth of at least 6 inches, uniformly moisture-conditioned to at least 2% above optimum and compacted to at least 90% of the maximum dry density of the materials as determined by ASTM Test Method D-1557. Approved fill material should then be spread in thin lifts, uniformly moisture-conditioned to at least 2% above optimum and compacted to at least 90% relative compaction. In areas where a building pad straddles bedrock and fill, the fill beneath the building and for a distance of 5 feet beyond the edges of the footings should be compacted to at least 95% relative compaction. All structural fills, including those placed to establish site surface drainage, should be compacted to at least 90% relative compaction.

- **Permanent Cut and Fill Slopes** – In general, cut and fill slopes should be designed and constructed at slope gradients of 2:1 (horizontal to vertical) or flatter, unless otherwise approved by the geotechnical engineer in specified areas. Where steeper slopes are required, retaining walls should be used.

- **Wet Weather Grading** – Generally, grading is performed more economically during the summer months when on-site soils are usually dry of optimum moisture content. Delays should be anticipated in site grading performed during the rainy season or early spring due to excessive moisture in on-site soils. Special and relatively expensive construction procedures, including dewatering of excavations and importing granular soils, should be anticipated if grading must be completed.
during the winter and early spring or if localized areas of soft saturated soils are found during grading in the summer and fall.

**Foundation Support**

Provided the site grading is performed as recommended herein, the proposed structures can be supported on continuous and isolated spread footings that bottom on select engineered fill or bedrock.

- **Spread Footings** – Spread footings should be at least 18 inches wide and should bottom on select engineered fill or on undisturbed bedrock, as applicable, at least 12 inches below lowest adjacent grade. Additional embedment or width may be needed to satisfy code and/or structural requirements. The bottoms of all footing excavations should be thoroughly cleaned out or wetted and compacted using hand-operated tamping equipment prior to placing steel and concrete. This will remove the soils disturbed during footing excavations, or restore their adequate bearing capacity, and reduce post-construction settlements.

- **Bearing Pressures** – Footings installed in accordance with these recommendations may be designed using allowable bearing pressures of 2,000, 3,000 and 4,000 pounds per square foot (psf), for dead loads, dead plus code live loads, and total loads (including wind and seismic), respectively. For footings bottomed entirely on bedrock, the above pressures can be increased to 3,000, 4,500 and 6,000 psf.

- **Lateral Pressures** – The portion of spread footing foundations extending into undisturbed bedrock or select engineered fill may impose a passive equivalent fluid pressure and a friction factor of 350 pcf and 0.35, respectively, to resist sliding. Passive pressure should be neglected within the upper 6 inches, unless the soils are confined by concrete slabs or pavements.

**Retaining Walls**

Retaining walls constructed at the site must be designed to resist lateral earth pressures plus additional lateral pressures that may be caused by surcharge loads applied at the ground surface behind the walls. Retaining walls free to rotate (yielding greater than 0.1% of the wall height at the top of the backfill) should be designed for active lateral earth pressures. If walls are restrained by rigid elements to prevent rotation, they should be designed for “at rest” lateral earth pressures. In the absence of backdrains, the retaining walls should be designed to resist full hydrostatic pressure. Retaining walls should be designed to resist the following earth equivalent fluid pressures (triangular distribution):

<table>
<thead>
<tr>
<th>Location Condition</th>
<th>Pressure (pcf)</th>
<th>Additional Seismic Pressure (pcf)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active – Level backfill</td>
<td>43</td>
<td>15</td>
</tr>
<tr>
<td>Active - Sloping Backfill 3:1 or Flatter</td>
<td>56</td>
<td>37</td>
</tr>
<tr>
<td>At Rest - Level Backfill</td>
<td>65</td>
<td>38</td>
</tr>
</tbody>
</table>

• If required
These pressures do not consider additional loads resulting from adjacent foundations or other loads. If these additional surcharge loadings are anticipated, additional evaluation should be provided. Where retaining wall backfill is subject to vehicular traffic, the walls should be designed to resist an additional surcharge pressure equivalent to two feet of additional backfill.

Retaining walls will yield slightly during backfilling. Therefore, walls should be backfilled prior to building on, or adjacent to, the walls. Backfill against retaining walls should be compacted to at least 90 and not more than 95% relative compaction. Over-compaction or the use of large compaction equipment should be avoided because increased compactive effort can result in lateral pressures higher than those recommended above.

- **Foundation Support** – Retaining walls should be supported on spread footings designed in accordance with the recommendations presented in this report. Retaining wall foundations should be designed by the project civil or structural engineer to resist the lateral forces set forth in this section.

- **Wall Drainage and Backfill** – Retaining walls should be backdrained. The backdrains should consist of 4-inch diameter, rigid perforated pipe embedded in Class 2 permeable material. The pipe should be PVC Schedule 40 or ABS with SOR 35 or better, and the pipe should be sloped to drain to outlets by gravity. The top of the pipe should be at least 8 inches below lowest adjacent grade. The Class 2 permeable material should extend to within 1½ feet of the surface. The upper 1½ feet should be backfilled with compacted soil to exclude surface water.

**Slab-On-Grade**

Provided grading is performed in accordance with the recommendations presented herein, slabs should be underlain by undisturbed bedrock and/or select engineered fill. Slab-on-grade subgrade should be rolled to produce a dense, uniform surface. The future expansion potential of the subgrade soils should be reduced by thoroughly presoaking the slab subgrade prior to concrete placement. The moisture condition of the subgrade soils should be checked by the geotechnical engineer no more than 24 hours prior to placing the capillary moisture break. The slabs should be underlain with a capillary moisture break consisting of at least 4 inches of clean, free-draining crushed rock or gravel (excluding pea gravel) at least one-quarter inch and no larger than three-quarters inch in size. Interior slabs subject to vehicular traffic may be underlain by Class 2 aggregate base. The use of Class 2 aggregate base should be reviewed on a case by case basis. Class 2 aggregate base can be used for slab rock under exterior slabs. Interior area slabs should be provided with an underdrain system.

Slabs should be designed by the Project civil or structural engineer to support the anticipated loads, reduce cracking and provide protection against the infiltration of moisture vapor. Slabs subjected to heavy concentrated wheel loads, such as forklift or trailer-trucks, should be designed to carry the anticipated wheel loads.
A vapor barrier should be placed under all slabs-on-grade that are likely to receive an impermeable floor finish or be used for any purpose where the passage of water vapor through the floor is undesirable. RGH recommends that a qualified person be consulted to evaluate the general and specific moisture vapor transmission paths and any impact on the proposed construction. This person should provide recommendations for mitigation of the potential adverse impact of moisture vapor transmission on various components of the structure as deemed appropriate.

Utility Trenches

The shoring and safety of trench excavations is solely the responsibility of the contractor. Attention is drawn to the State of California Safety Orders dealing with “Excavations and Trenches.”

Unless otherwise specified by the County of Napa, on-site, inorganic soil may be used as general utility trench backfill. Where utility trenches support pavements, slabs and foundations, trench backfill should consist of aggregate baserock. The baserock should comply with the minimum requirements in Caltrans Standard Specifications, Section 26 for Class 2 Aggregate Base. Trench backfill should be moisture-conditioned as necessary, and placed in horizontal layers not exceeding 8 inches in thickness, before compaction. Each layer should be compacted to at least 90% relative compaction as determined by ASTM Test Method D-1557. The top 6 inches of trench backfill below vehicle pavement subgrades should be moisture conditioned as necessary and compacted to at least 95% relative compaction. Jetting or ponding of trench backfill to aid in achieving the recommended degree of compaction should not be attempted.

Pavements

Based on the study, RGH believes the near-surface soils and heterogeneous fill will have a low supporting capacity, after proper compaction, when used as a pavement subgrade. An R-value of 12 was measured on a bulk sample of near-surface soil. Because of potential variation in the on-site soils, RGH selected an R-value of 10 for use in pavement design calculations. Based on the selected R-Value and our experience with similar projects and soils, it is recommended that the pavement sections listed in the table below be used. The assumed Traffic Indices (TI) are not based on actual truck traffic counts or predictions of counts. Actual truck traffic counts may require revision of these traffic indices. The Project engineer, in consultation with City/County officials, should choose the pertinent (TI) for this Project.

<table>
<thead>
<tr>
<th>TI</th>
<th>Asphalt Concrete (feet)</th>
<th>Class 2 Aggregate Base (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.0</td>
<td>0.35</td>
<td>1.15</td>
</tr>
<tr>
<td>6.0</td>
<td>0.25</td>
<td>1.05</td>
</tr>
<tr>
<td>5.0</td>
<td>0.20</td>
<td>0.85</td>
</tr>
</tbody>
</table>

Pavement thicknesses were computed using Caltrans design procedures and are based on a pavement life of 20 years. These recommendations are intended to provide support for traffic represented by the indicated Traffic Indices. They are not intended
to provide pavement sections for heavy concentrated construction storage or wheel loads such as forklifts, parked truck-trailers and concrete trucks or for post-construction concentrated wheel loads such as self-loading dumpster trucks. In areas where heavy construction storage and wheel loads are anticipated, the pavements should be designed to support these loads. Support could be provided by increasing pavement sections or by providing reinforced concrete slabs. Alternatively, paving can be deferred until heavy construction storage and wheel loads are no longer present. Loading areas for self-loading dumpster trucks should be provided with reinforced concrete slabs at least 6 inches thick, and reinforced with No. 4 bars at 12-inch centers each way. Alternatively, the asphalt concrete section should be increased to at least 8 inches in these areas.

Prior to placement of aggregate base, the upper 6 inches of the pavement subgrade soils should be scarified, uniformly moisture-conditioned to near optimum, and compacted to at least 95% relative compaction to form a firm, non-yielding surface.

Aggregate base materials should be spread in thin layers, uniformly moisture-conditioned, and compacted to at least 95% relative compaction to form a firm, non-yielding surface. The materials and methods used should conform to the requirements of the County of Napa and the current edition of the Caltrans Standard Specifications, except that compaction requirements should be based on ASTM Test Method D-1557. Aggregate used for the base course should comply with the minimum requirements specified in Caltrans Standard Specifications, Section 26 for Class 2 Aggregate Base.

- **Wet Weather Paving** – In general, the pavements should be constructed during the dry season to avoid the saturation of the subgrade and base materials, which often occurs during the wet winter months. If pavements are constructed during the winter, a cost increase relative to drier weather construction should be anticipated. Unstable areas may have to be over-excavated to remove soft soils. The excavations will probably require backfilling with imported crushed (ballast) rock. The geotechnical engineer should be consulted for recommendations at the time of construction.

**Geotechnical Drainage**

Surface water should be diverted away from slopes, foundations and edges of pavements. Surface drainage gradients should slope away from building foundations in accordance with the requirements of the CBC or local governing agency. Roofs should be provided with gutters and the downspouts should empty onto splash blocks that discharge directly onto paved areas or be connected to closed (glued Schedule 40 PVC or ABS with SOR of 35 or better) conduits discharging well away from foundations, onto paved areas or erosion resistant natural drainages or into the site’s surface drainage system. Roof downspouts and surface drains must be maintained entirely separate from the slab underdrains recommended hereinafter.

Water seepage or the spread of extensive root systems into the soil subgrade of footings, slabs or pavements could cause differential movements and consequent
distress in these structural elements. Landscaping should be planned with consideration for these potential problems.

- **Slab Underdrains** – Where interior slab subgrades are less than 6 inches above adjacent exterior grade and where migration of moisture through the slab would be detrimental, slab underdrains should be installed to dispose of surface and/or groundwater that may seep and collect in the slab rock. Slab underdrains should consist of 6-inch wide trenches that extend at least 6 inches below the bottom of the slab rock and slope to drain by gravity. The slab underdrain trenches should be spaced no further than 20 feet, both ways. Additional drain trenches should be installed, as necessary, to drain all isolated under slab areas. Four-inch-diameter perforated pipe (SOR 35 or better) sloped to drain to outlets by gravity should be placed in the bottom of the trenches. Slab underdrain trenches should be backfilled to subgrade level with clean, free draining slab rock. If slab underdrains are not used, it should be anticipated that water will enter the slab rock, permeate through the concrete slab and ruin floor coverings.

**Maintenance**

Periodic land maintenance will be required. Surface and subsurface drainage facilities should be checked frequently, and cleaned and maintained as necessary or at least annually.

5.5.4 **Mitigation Measures**

1. **Standard Mitigation Measures**

   The City's Policy Resolution No. 27 identifies standard mitigation measures applicable to the proposed Project, which are included herein.

<table>
<thead>
<tr>
<th>MM Geo-1</th>
<th>All Project-related grading, trenching, backfilling and compaction operations shall be conducted in accordance with the City of Napa Public Works Department Standard Specifications.</th>
</tr>
</thead>
<tbody>
<tr>
<td>MM Geo-2</td>
<td>All construction activities shall meet the Uniform Building Code regulations for seismic safety (e.g., reinforcing perimeter and/or load bearing walls, bracing parapets).</td>
</tr>
<tr>
<td>MM Geo-3</td>
<td>Developer shall provide an erosion and sediment control plan and a schedule for implementation of approved measures to the Public Works Director for approval prior to the issuance of any grading permits. No grading and excavation shall be performed except in accordance with the approved plan and schedule.</td>
</tr>
<tr>
<td>MM Geo-4</td>
<td>Hydroseeding of all disturbed slopes shall be completed by October 1. Developer shall provide sufficient maintenance and irrigation of the slopes such that growth is established by November 1.</td>
</tr>
</tbody>
</table>
2. **Special Mitigation Measures**

Recommendations have been included in the Geotechnical Report (pages 7-14) and are detailed herein as mitigation.

| MM Geo-5 | Prior to the issuance of building permits and grading permits, the City of Napa shall ensure the grading and building plans demonstrate compliance with the recommendations included in the Geotechnical Study Report by RGH consultants dated July 13, 2015 related to seismic design criteria for structures, grading, foundation support, retaining walls, slab-on-grade, utility trenches, pavements, drainage and maintenance. |
| MM Geo-6 | Prior to issuance of grading permits, the Applicant shall have prepared a haul route plan showing the construction materials haul routes, the number of trips per day, and the location where grading export materials will be taken. |

### 5.5.5 **Level of Significance after Mitigation**

Thresholds of significance identified in the CEQA Guidelines, Appendix G, state the Project would have a significant impact if it would:

a) Expose people or structures to potential substantial adverse effects involving earthquakes, seismic ground shaking, seismic-related ground failure or landslides,

b) Result in substantial soil erosion or loss of topsoil,

c) Be located on a geologic unit that is unstable or becomes unstable due to landslide, lateral spreading, subsidence, liquefaction or collapse,

d) Be located on expansive soil, or

e) Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems.

The Geotechnical Report states that nearly the entire site is blanketed with from a few inches to about 5 feet of heterogeneous fill which is a material with varying density, strength, compressibility and shrink-swell characteristics. Bedrock extends from beneath fill and topsoil to the explored depth of 8½ feet. No groundwater was observed, and no subsurface conditions suggested the presence of materials that may be susceptible to seismically induced densification, liquefaction or lurching. No faults are located on the site; however, future seismic shaking should be anticipated. Strong seismic ground shaking is endemic in southern California and future occupants of the Project components will not be exempt from the risk, if it occurs. Grading and construction activities could result in erosion or the loss of topsoil. The Project has been conditioned to prepare an erosion control plan as detailed in Mitigation Measure MM Geo-3 to prevent impacts from erosion.

Based on the findings, the Geotechnical Report included a number of recommendations which have been included herein as mitigation measures to reduce potential impacts from expansive oils, lateral spreading, subsidence, liquefaction or collapse. In addition, the City's Policy 27 Standard Mitigation, which is included herein, requires compliance with Building Code regulations for seismic safety.
Adherence to the recommendations and mitigation included for Project implementation will ensure that the Project will not expose people or structures to a significant risk of loss, injury or death due to earthquakes or ground-shaking, result in substantial soil erosion or loss of topsoil, be located on a geologic unit that is unstable or be located on expansive soils. The Geotechnical Report contains recommendations that include seismic design criteria, foundation support, drainage and paving details to ensure that risks and exposures are less than significant. There are no septic systems or alternative wastewater disposal systems included in Project design and there will be no impact related to such systems. Mitigation Measure MM Geo-5 requires compliance with all recommendations in the Geotechnical Report to reduce impacts in the area of Geology and Soils to below a level of significance.

5.5.6 **Cumulative Impacts**

The Project, as proposed, will not result in a cumulatively considerable impact when combined with other proposed projects in the vicinity. Soils and geology impacts are site specific and the Project is not in close proximity to the projects identified herein as having the potential for cumulative impacts related to geology and soils. Mitigation has been included in this DEIR to prevent significant impacts due to construction activities and all other potential geologic impacts are reduced through mitigation, recommendations, and best management practices. There will be no significant cumulative impacts due to the implementation of the Project as proposed.

5.5.7 **Unavoidable Adverse Impacts**

Implementation of the recommended mitigation measures specified above will reduce all potentially significant geological impacts to a less than significant level and, therefore, there are no unavoidable adverse impacts associated with development of the Project.