# 5.9 HYDROLOGY AND DRAINAGE

This section analyzes potential impacts to existing drainage patterns and flood control facilities in the project area, as well as potential effects on storm water quality. Mitigation measures are recommended to reduce potential impacts to a less than significant level. Information in this Section is based on the *Hydrology and Water Quality Report* for the Project site prepared by RBF Consulting (dated May 2004). The Report is included in Appendix 15.9, *Hydrology/Water Quality Data*, of this EIR. The assessment and technical analysis in the *Hydrology and Water Quality Report* are in compliance with the local drainage policies and requirements of Madera County, Central Valley Regional Water Quality Control Board (RWQCB), and the California Environmental Quality Act (CEQA) of 1970, as amended. The hydrology analysis and drainage assessments have been prepared at a preliminary engineering level based upon the available details of the proposed project. The final design of the proposed project is subject to the approval of the County Engineer.

## EXISTING CONDITIONS

The purpose of the existing conditions evaluation is to establish a baseline for comparison of the pre-project and the post-project conditions. Baseline conditions investigated include: existing facilities, hydrology, floodplain mapping, and surface water quality. The project area is located within the Miami and Carter Creek watersheds. The Sierra Meadows project comprises only 0.8 square miles or 2.6 percent of the Miami and Carter Creek watersheds. Since the Carter and Miami Creek watersheds are approximately 30 square miles, the proceeding analysis is limited to the local tributary watersheds (approximately 2,305 acres or 3.6 square miles) within the project vicinity. A local analysis, as compared to an analysis of the entire Carter and Miami Creek watersheds, allows impacts regarding hydrology and drainage from the proposed project to be more precisely determined.

### WATERSHED CHARACTERISTICS

The project area is located within the Miami and Carter Creek watersheds. As stated above, since the Miami and Carter Creek watersheds combined are approximately 30 square miles, this analysis focuses upon the local tributary watershed characteristics, which consists of approximately 2,305 acres. The historic drainage patterns for the local tributary watersheds follow the natural topography. The project area generally drains from north to south and a small portion from northeast to southeast. Exhibit 5.9-1, *Existing Condition Hydrology Map*, illustrates the drainage patterns of the local tributary watersheds. Although there are no storm drains on the project site, there are many small cross culverts along Opah Drive, Wallu Lane and the Sierra Meadows Golf Course that convey the flows from onsite facilities or regional creeks. The pipes range in size from 18- to 30-inch corrugated metal pipe. Additionally, the local project vicinity includes a large culvert crossing at Miami and Carter Creek and several bridge crossings within the golf course.

The maximum elevation differential of the local tributary watersheds is approximately 1,100 feet (from elevation 3,200 feet at the north point of the study area to an elevation of 2,100 feet at the southern end of the project site). Slopes within the project area range from approximately one (1) to thirty (30) percent.

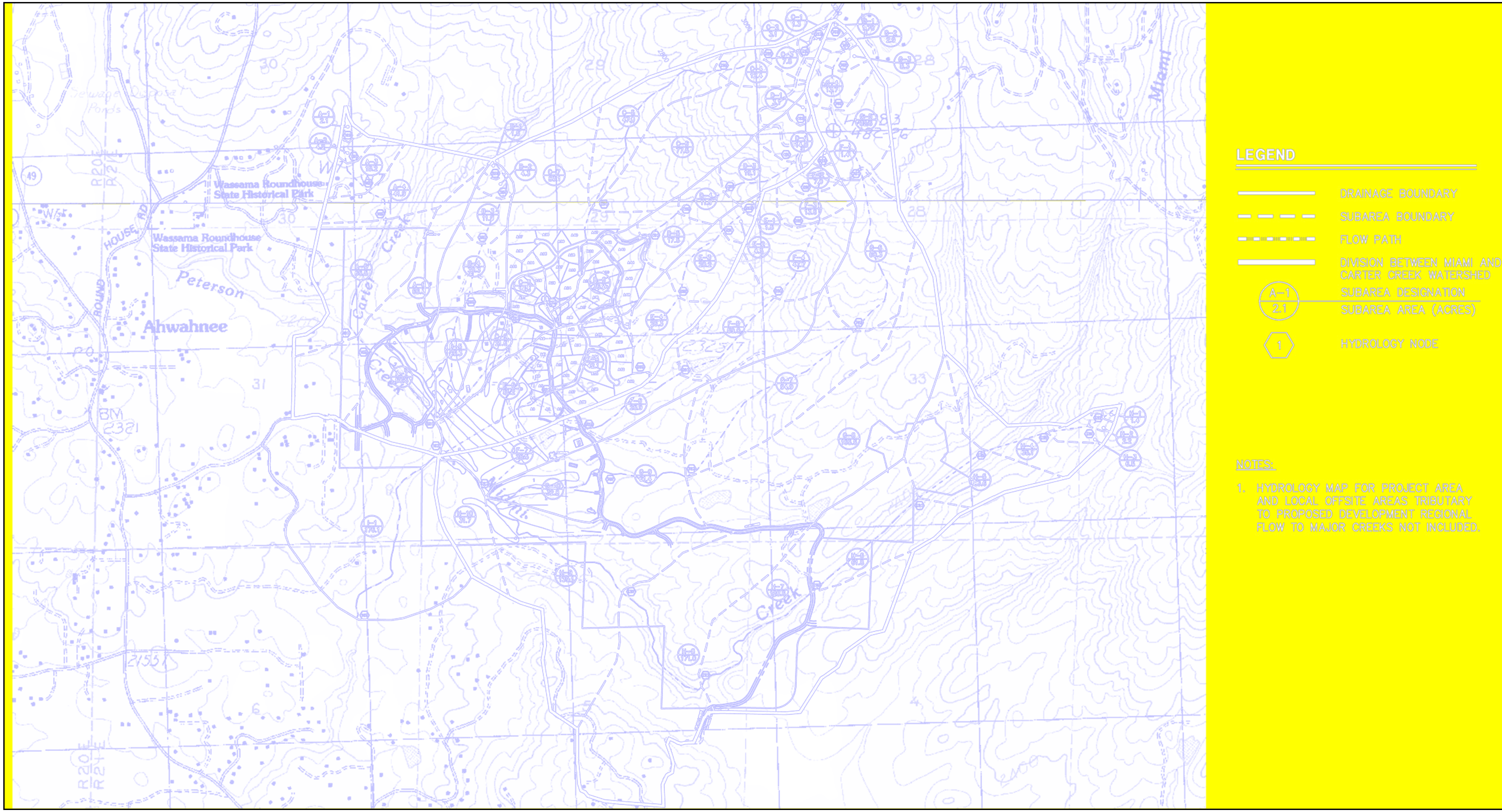
The local tributary watersheds that consist of portions of the Miami and Carter Creek watersheds have been divided into nine watersheds (A-I) to conduct a local hydrology and drainage analysis. The existing Ahwahnee Estates development is located in Watersheds C, D and E. A small portion of Watersheds A, B, D, E, F, G and H contain portion of the Sierra Meadows Golf Course. The majority of the Project site is natural open space with Miami Creek flowing along the southern boundary and Carter Creek flowing along the western boundary of the project site. Table 5.9.1, *Existing Condition Watershed Areas*, summarizes the watershed acreages and corresponding tributary creeks.

**Table 5.9-1**
**Existing Condition Watershed Areas**

| Tributary Creek | Watershed | Area (acres) |
|---|---|---|
| Carter Creek | A | 245.7 |
| | B | 73.3 |
| | C | 269.3 |
| | D | 101.9 |
| | E | 152.2 |
| Miami Creek | F | 183.1 |
| | G | 471.1 |
| | H | 632.4 |
| Confluence of Two Creeks | I | 176.1 |
| Total Acres | | 2,305.1 |

Each of the nine watershed areas has been divided into smaller sub-watersheds. Exhibit 5.9-1 illustrates the location and acreage of each sub-watershed. RBF Consulting examined the existing terrain and topographic conditions of each sub-watershed through site visits and information provided by Nolte Associates, *Madera Area Soil Survey* and Unites United States Geological Survey (USGS) topography. Hydrologic properties such as slope, length, soil type, vegetation and land use were characterized for each sub-watershed. The soils map from the *Madera Area Soil Survey* indicates that the study area consists of soil type Ahwahnee and Auberry series soil. This translates to hydrological soil type “C.” Table 5.9-2, *Local Existing Sub-Watershed Characteristics*, contains a summary of the existing sub-watershed characteristics.

Percentage pervious factors for the project area range from approximately zero (0) percent for paved surfaces, 100 percent for natural cover, 98 percent for golf courses, 75 percent to 80 percent for single-family housing and 10 percent for commercial development.




Source: RBF Consulting, May 2004.

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# Existing Condition Hydrology Map

Exhibit 5.9-1

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**Table 5.9-2**
**Local Existing Sub-Watershed Characteristics**

| Sub-Area ID | Length (ft) | Slope (ft/ft) | Soil type | Land Use (Acres) | | | | | Total Area (Acres) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 0-1 DU | Commercial | Golf Course | Open Space | Ponds | |
| A1 | 300 | 0.05 | C | | | | 2.1 | | 2.1 |
| A2 | 400 | 0.0375 | C | | | | 4.2 | | 4.2 |
| A3 | 620 | 0.0806 | C | | | | 15.2 | | 15.2 |
| A4 | 615 | 0.1951 | C | | | | 41.9 | | 41.9 |
| A5 | 2,100 | 0.0238 | C | | | | 65.5 | | 65.5 |
| A6 | 350 | 0.0286 | C | | | | 66.3 | | 66.3 |
| A7 | 2,140 | 0.0117 | C | | | | 50.5 | | 50.5 |
| B1 | 230 | 0.2174 | C | | | | 1.5 | | 1.5 |
| B2 | 440 | 0.0909 | C | | | | 4.3 | | 4.3 |
| B3 | 835 | 0.0958 | C | | | | 11.9 | | 11.9 |
| B4 | 1,170 | 0.0769 | C | | | | 30.3 | | 30.3 |
| B5 | 1,730 | 0.0549 | C | | | 10.6 | 14.7 | | 25.3 |
| C1 | 300 | 0.0667 | C | | | | 1.3 | | 1.3 |
| C2 | 360 | 0.0556 | C | | | | 3.1 | | 3.1 |
| C3 | 590 | 0.1017 | C | | | | 7.8 | | 7.8 |
| C4 | 780 | 0.2308 | C | | | | 12.4 | | 12.4 |
| C5 | 3,425 | 0.1752 | C | | | | 47.9 | | 47.9 |
| C6 | | | C | | | | 77.5 | | 77.5 |
| C7 | 2,130 | 0.0376 | C | 2.5 | | | 56.5 | 1.7 | 83.1 |
| C8 | 820 | 0.0488 | C | 14.6 | | | | | 14.6 |
| C9 | 2,320 | 0.0323 | C | | | 21.6 | | | 21.6 |
| D1 | 300 | 0.1167 | C | | | | 3.1 | | 3.1 |
| D2 | 660 | 0.1364 | C | | | | 14 | | 14 |
| D3 | 1,250 | 0.224 | C | | | | 19.1 | | 19.1 |
| D4 | 840 | 0.2024 | C | | | | 11.9 | | 11.9 |
| D5 | 630 | 0.2222 | C | | | | 17.5 | | 17.5 |
| D6 | 3,540 | 0.0452 | C | 28.0 | | | 7.3 | 1.1 | 36.3 |
| E1 | 300 | 0.2667 | C | | | | 1.5 | | 1.5 |
| E2 | 500 | 0.28 | C | | | | 4.5 | | 4.5 |
| E3 | 1,450 | 0.1793 | C | | | | 20.2 | | 20.2 |
| E4 | 1,100 | 0.0636 | C | | | | 26.3 | | 26.3 |
| E5 | 1,740 | 0.0517 | C | 51.2 | | | | | 51.2 |
| E6 | 2,150 | 0.0581 | C | 14.1 | | 31.0 | 3.4 | | 48.5 |

**Table 5.9-2 [Continued]**
**Local Existing Sub-Watershed Characteristics**

| Sub-Area ID | Length (ft) | Slope (ft/ft) | Soil type | Land Use (Acres) | | | | | Total Area (Acres) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 0-1 DU | Commercial | Golf Course | Open Space | Ponds | |
| F1 | 300 | 0.1 | C | | | | 1.4 | | 1.4 |
| F2 | 430 | 0.186 | C | | | | 7 | | 7 |
| F3 | 470 | 0.2979 | C | | | | 13.6 | | 13.6 |
| F4 | 1,480 | | C | | | | 47.7 | | 47.7 |
| F5 | 2,055 | 0.0608 | C | | | | 57.2 | 1.8 | 59 |
| F6 | 1,915 | 0.0627 | C | | | | 25.9 | | 25.9 |
| F7 | 2,240 | 0.0246 | C | | 2.6 | 17.4 | 6.0 | 2.6 | 28.5 |
| G1 | 300 | 0.1333 | C | | | | 1.7 | | 1.7 |
| G2 | 275 | 0.1818 | C | | | | 2.9 | | 2.9 |
| G3 | 335 | 0.0597 | C | | | | 5.3 | | 5.3 |
| G4 | 670 | 0.0746 | C | | | | 13.7 | | 13.7 |
| G5 | 1,290 | 0.062 | C | | | | 32.6 | | 32.6 |
| G6 | 3,860 | 0.0959 | C | | | | 60.3 | | 60.3 |
| G7 | 3,760 | 0.0931 | C | | | | 94.9 | | 94.9 |
| G8 | | | C | | | | 162.2 | 3.3 | 165.5 |
| G9 | 1,505 | 0.0399 | C | | | | 61.4 | | 61.4 |
| G10 | 2,090 | 0.0191 | C | | 0.7 | 21.6 | 10.5 | | 32.8 |
| H1 | 330 | 0.1818 | C | | | | 1.4 | | 1.4 |
| H2 | 285 | 0.2105 | C | | | | 2.2 | | 2.2 |
| H3 | 685 | 0.1752 | C | | | | 6.5 | | 6.5 |
| H4 | 1,200 | 0.1833 | C | | | | 35.5 | | 35.5 |
| H5 | 1,315 | 0.0152 | C | | | | 56.6 | | 56.6 |
| H6 | 2,340 | 0.0128 | C | | | | 61.8 | | 61.8 |
| H7 | 2,750 | 0.0545 | C | | | | 126.6 | | 126.6 |
| H8 | 2,280 | 0.0088 | C | | | | 171 | | 171 |
| H9 | 3,070 | 0.0065 | C | | | 15.3 | 123.8 | | 139.1 |
| H10 | 1,090 | 0.0275 | C | | | 4.1 | 27.6 | | 31.7 |
| I-1 | 3,345 | 0.0045 | C | | | | 176.1 | | 176.1 |
| | | | | | | | Total | Acres | 2,305.1 |

## HYDROLOGY

A local hydrology analysis was conducted to provide the basis for the existing condition hydrology for the Sierra Meadows project site. Hydrologic calculations were used to evaluate surface water runoff associated with 10-year and 100-year design storm frequencies only for local drainage areas and not the entire Carter Creek and Miami Creek watersheds, for reasons stated above.

Several references were used to determine the hydrologic parameters for the project site. Soil types were determined using the *Madera Area Soil Survey*. Synthesized rainfall data was obtained from the Department of Water Resources (refer to Appendix A of the *Hydrology and Water Quality Report*).

Hydrologic calculations to evaluate surface runoff associated with 10-year and 100-year design storm frequencies from the local drainage areas were performed using the Rational Method, described below. The time of concentration was determined using the TR-55 formula for overland flow and the Manning's equation for natural valley routing. TR-55 is a computerized watershed model that is used to determine peak discharge or peak flow hydrograph for a drainage design, developed by the Soil Conservation Service (SCS). Manning's Equation is utilized to determine the travel time for the component flow segments of street flow, pipe flow and open channel flow. The sub-watershed boundaries were delineated utilizing topographic mapping (provided by Nolte Associates) and a site visit to determine the existing drainage patterns. Exhibit 5.9-1 illustrates the hydrology map for the existing project area conditions.

### Rational Method

Hydrologic calculations were performed to determine the 10-year and 100-year peak flow rates using the Rational Method. The Rational Method is an empirical computation procedure used for developing a peak runoff rate (discharge) for storms of a specific recurrence interval. The design discharges were computed by generating a hydrologic "link-node" model, which divides the study area into drainage subareas. These subareas are tributary to a concentration point or hydrologic "node" point determined by the existing terrain and street layout. The assumptions/ guidelines applied for use of the Rational Method are included in Appendix 15.9, *Hydrology/Water Quality Data*.

### Surface Water Hydrology

Exhibit 5.9-1 illustrates the project site's existing hydrological conditions that were determined utilizing the Rational Method. Approximately 3.5 percent of the local watersheds drain to Miami Creek and 1.5 percent of the local watersheds drain to Carter Creek. The existing surface water hydrology conditions are summarized in Table 5.9-3, *Local Existing Condition Surface Water Hydrology Summary*. Detailed spreadsheets for the existing condition analyses are included in Appendix A of the *Hydrology and Water Quality Report* (refer to Appendix 15.9, *Hydrology/Water Quality Data*). Table 5.9-3 identifies the 10- and 100-year flowrates in cubic feet per second (cfs) for the Carter Creek and Miami Creek watersheds, as well as the confluence of the Miami Creek and Carter Creek watersheds. The 10- and 100-year flowrates for the Carter Creek watershed are 368 cfs and 632 cfs, respectively. The 10- and 100-year flowrates for the Miami Creek watershed are 409 cfs and 792 cfs, respectively. The 10- and 100-year flowrates at the confluence of the Miami Creek and Carter Creek watersheds are 735 cfs and 1,355 cfs, respectively.

**Table 5.9-3**
**Local Existing Condition Surface Water Hydrology Summary**

| Description | Effective Total Area (acres) | 10-year Flowrate (cfs)* | 100-year Flowrate (cfs) |
|---|---|---|---|
| Carter Creek Watershed | 842 | 368 | 632 |
| Miami Creek Watershed | 1,053 | 409 | 792 |
| Confluence of Miami Creek and Carter Creek | 2,072 | 735 | 1,355 |

Notes:
- Flowrates presented are for local tributary drainage only. The flowrates are lower than the actual flowrates in Carter and Miami Creeks.
- * cfs = cubic feet per second

## FLOODPLAIN MAPPING

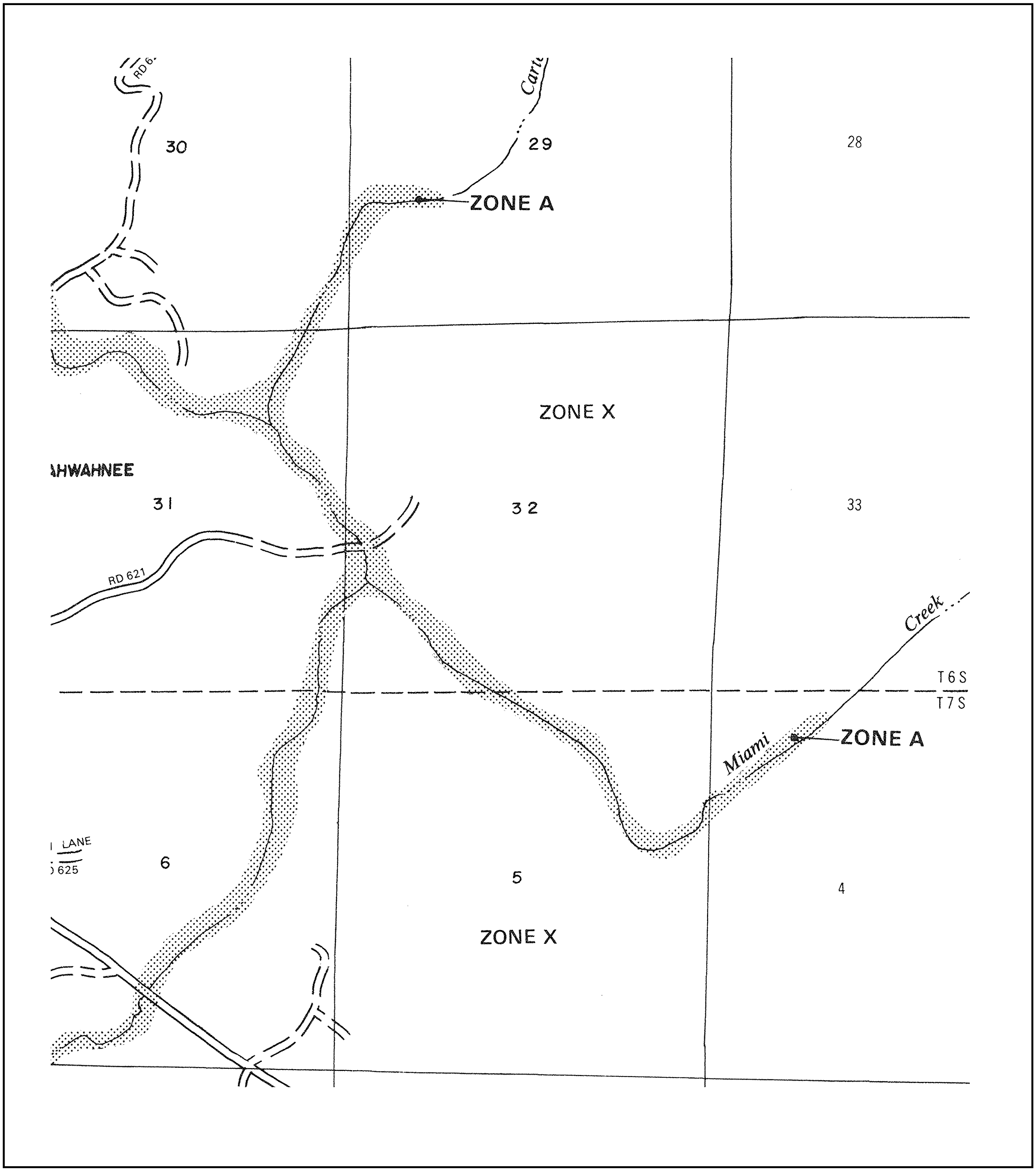
Madera County is a participant in the National Flood Insurance Program (NFIP). Communities participating in the NFIP must adopt and enforce minimum floodplain management standards, including identification of flood hazards and flooding risks. Participation in the NFIP allows communities to purchase low cost insurance protection against losses from flooding. The published Flood Insurance Rate Map (FIRMs) for the project site is included on Community Panel No. 0601700225B. The current Flood Insurance Rate Map (FIRM) shows a portion of the site is contained within a Zone "A" flood plain along Carter and Miami Creeks (refer to Exhibit 5.9-2, *Flood Insurance Rate Map*). The Zone "A" flood insurance rate zone designation corresponds to an area that is subject to 100-year flooding, where no flood elevations and flood hazards have been determined. The FIRM also illustrates that the project area is located within Zone "X," which corresponds to an area of minimal to moderate flood hazard.

## STORM WATER QUALITY

This section discusses typical pollutants found in storm water runoff and discusses the types of contaminants that may be found in existing storm water runoff.

### Non-Point Source Pollutants

A net effect of development can be to increase pollutant export over naturally occurring conditions. The impact of the higher export can be on the adjacent streams and also on the downstream receiving waters. However, an important consideration in evaluating storm water quality from the project is to assess if it impairs the beneficial use to the receiving waters. Receiving waters can assimilate a limited quantity of various constituent elements, however there are thresholds beyond which the measured amount becomes a pollutant and results in an undesirable impact. Background of these standard water quality categories provides an understanding of typical impacts.




Source: Federal Emergency Management Agency, Effective Date - August 4, 1987.

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SIERRA MEADOWS ESTATES SUBDIVISION

# Flood Insurance Rate Map

**Exhibit 5.9-2**

Sediment - Sediment is made up of tiny soil particles that are washed or blown into surface waters. It is the major pollutant by volume in surface water. Suspended soil particles can cause the water to look cloudy or turbid. The fine sediment particles also act as a vehicle to transport other pollutants including nutrients, trace metals, and hydrocarbons. Construction sites are the largest source of sediment for areas under development. Another major source of sediment is stream bank erosion, which may be accelerated by increases in peak rates and volumes of runoff due to an increase in impervious areas.

Nutrients - Nutrients are a major concern for surface water quality, especially phosphorous and nitrogen, can cause algal blooms and excessive vegetative growth. Of the two, phosphorus is usually the limiting nutrient that controls the growth of algae in lakes. The orthophosphorous form of phosphorus is readily available for plant growth. The ammonium form of nitrogen can also have severe effects on surface water quality. The ammonium is converted to nitrate and nitrite forms of nitrogen in a process called nitrification. This process consumes large amounts of oxygen, which can impair the dissolved oxygen levels in water. The nitrate form of nitrogen is very soluble and is found naturally at low levels in water. When nitrogen fertilizer is applied to lawns or other areas in excess of plant needs, nitrates can leach below the root zone, eventually reaching ground water. Orthophosphate from auto emissions also contributes phosphorus in areas with heavy automobile traffic. As a general rule of thumb, nutrient export is greatest from development sites with the most impervious areas. Other problems resulting from excess nutrients are 1) surface algal scums, 2) water discolorations, 3) odors, 4) toxic releases, and 5) overgrowth of plants. Common measures for nutrients are total nitrogen, organic nitrogen, total Kjeldahl nitrogen (TKN), nitrate, ammonia, total phosphate, and total organic carbon (TOC).

Trace Metals - Trace metals are primarily a concern because of their toxic effects on aquatic life and their potential to contaminate drinking water supplies. The most common trace metals found in runoff are lead, zinc, and copper. Fallout from automobile emissions is also a major source of lead in urban areas. A large fraction of the trace metals in urban runoff are attached to sediment and this effectively reduces the level, which is immediately available for biological uptake and subsequent bioaccumulation. Metals associated with the sediment settle out rapidly and accumulate in the soils. Shorter duration storms have limited exposure, which could be toxic to the aquatic environment. The toxicity of trace metals in runoff varies with the hardness of the receiving water. As total hardness of the water increases, the threshold concentration levels for adverse effects increases.

Oxygen-Demanding Substances - Aquatic life is dependent on the dissolved oxygen (DO) in the water and when organic matter is consumed by microorganisms then DO is consumed in the process. A rainfall event can deposit large quantities of oxygen demanding substance in lakes and streams. The biochemical oxygen demand of typical urban runoff is on the same order of magnitude as the effluent from an effective secondary wastewater treatment plant. A problem from low DO results when the rate of oxygen-demanding material exceeds the rate of replenishment. Oxygen demand is estimated by direct measure of DO and indirect measures such as biochemical oxygen demand (BOD), chemical oxygen demand (COD), oils and greases, and total organic carbon (TOC).

Bacteria - Bacteria levels in undiluted runoff exceed public health standards for water contact recreation almost without exception. Studies have found that total coliform counts exceeded EPA water quality criteria at almost every site and almost every time it rained. The coliform bacteria that are detected may not be a health risk in themselves, but are often associated with human pathogens.

Oil and Grease - Oil and grease contain a wide variety of hydrocarbons some of which could be toxic to aquatic life in low concentrations. These materials initially float on water and create the familiar rainbow-colored film. Hydrocarbons have a strong affinity for sediment and quickly become absorbed to it. The major sources of hydrocarbons are through leakage of crankcase oil and other lubricating agents from automobiles. Hydrocarbon levels are highest in the runoff from parking lots, roads, and service stations. Residential land uses generate less hydrocarbons export, although illegal disposal of waste oil into storm waters can be a local problem.

Other Toxic Chemicals - Priority pollutants are generally related to hazardous wastes or toxic chemicals and can be sometimes detected in storm water. Priority pollutant scans have been conducted in previous studies, which evaluated the presence of over 120 toxic chemicals and compounds. The scans rarely revealed toxins that exceeded the current safety criteria. The runoff scans were primarily conducted in small residential areas not expected to have many sources of toxic pollutants (with the possible exception of illegally disposed or applied household hazardous wastes). Measures of priority pollutants in storm water include: 1) phthalate (plasticizer compound); 2) phenols and creosols (wood preservatives); 3) pesticides and herbicides; 4) oils and greases; and 5) metals.

### Physical Characteristics Of Surface Water Quality

Standard parameters, which can assess the quality of storm water, provide a method of measuring impairment. A background of these typical characteristics assists in understanding water quality requirements. The quantity of a material in the environment and its characteristics determine the degree of availability as a pollutant in surface runoff. In an urban environment, the quantity of certain pollutants in the environment is a function of the intensity of the land use. For instance, a high density of automobile traffic makes a number of potential pollutants (such as lead and hydrocarbons) more available. The availability of a material, such as a fertilizer, is a function of the quantity and the manner in which it is applied. Applying fertilizer in quantities that exceed plant needs leaves the excess nutrients available for loss to surface or ground water.

The physical properties and chemical constituents of water traditionally have served as the primary means for monitoring and evaluating water quality. Evaluating the condition of water through a water quality standard refers to its physical, chemical, or biological characteristics. Water quality parameters for storm water comprise a long list and are classified in many ways. In many cases, the concentration of pollutant is needed to assess a water quality problem, instead of the annual pollutant loads. Some of the physical, chemical or biological characteristics that evaluate the quality of the surface runoff are outline below:

Dissolved Oxygen - Dissolved oxygen in the water has a pronounced effect on the aquatic organisms and the chemical reactions that occur. It is one of the most important biological water quality characteristics in the aquatic environment. The dissolved oxygen concentration of a water body is determined by the solubility of oxygen, which is inversely related to water temperature, pressure, and biological activity. Dissolved oxygen is a transient property that can fluctuate rapidly in time and space. Dissolved oxygen represents the status of the water system at a particular point and time of sampling. The decomposition of organic debris in water is a slow process and the resulting changes in oxygen status respond slowly too. The oxygen demand is an indication of the pollutant load and includes measurements of biochemical oxygen demand or chemical oxygen demand.

Biochemical Oxygen Demand (BOD) - The biochemical oxygen demand (BOD) is an index of the oxygen-demanding properties of the biodegradable material in the water. Samples are taken from the field and incubated in the laboratory at 20°C, after which the residual dissolved oxygen is measured. The BOD value commonly referenced is the standard 5-day values. These values are useful in assessing stream pollution loads and for comparison purposes.

Chemical Oxygen Demand - The chemical oxygen demand (COD) is a measure of the pollutant loading in terms of complete chemical oxidation using strong oxidizing agents. It can be determined quickly because it does not rely on bacteriological actions as with BOD. COD does not necessarily provide a good index of oxygen demanding properties in natural waters.

Total Dissolved Solids (TDS) - TDS concentration is determined by evaporation of a filtered sample to obtain residue whose weight is divided by the sample volume. The TDS of natural waters varies widely. There are several reasons why TDS is an important indicator of water quality. Dissolved solids affect the ionic bonding strength related to other pollutants such as metals in the water. TDS are also a major determinant of aquatic habitat. TDS affects saturation concentration of dissolved oxygen and influences the ability of a water body to assimilate wastes. Eutrophication rates depend on total dissolved solids.

pH - The pH of water is the negative log, base 10, of the hydrogen ion (H+) activity. A pH of 7 is neutral; a pH greater than 7 indicates alkaline water; a pH less than 7 represents acidic water. In natural water, carbon dioxide reactions are some of the most important in establishing pH. The pH at any one time is an indication of the balance of chemical equilibrium in water and affects the availability of certain chemicals or nutrients in water for uptake by plants. The pH of water directly affects fish and other aquatic life and generally toxic limits are pH values less than 4.8 and greater than 9.2.

Alkalinity - Alkalinity is the opposite of acidity, representing the capacity of water to neutralize acid. Alkalinity is also linked to pH and is caused by the presence of carbonate, bicarbonate, and hydroxide, which are formed when carbon dioxide is dissolved. A high alkalinity is associated with a high pH and excessive solids. Most streams have alkalinities less than 200 mg/l and ranges of alkalinity of 100-200mg/l seem to support well-diversified aquatic life.

Specific Conductance - The specific conductivity of water, or its ability to conduct an electric current, is related to the total dissolved ionic solids. Long term monitoring a project waters can develop a relationship between specific conductivity and TDS. Its measurement is quick and inexpensive and can be used to approximate TDS. Specific conductivities in excess of 2000 µohms/cm indicate a TDS level too high for most freshwater fish.

Turbidity - The clarity of water is an important indicator of water quality that relates to the alkalinity of photosynthetic light to penetrate. Turbidity is an indicator of the property of water that causes light to become scattered or absorbed. Suspended clays and other organic particles cause turbidity. It can be used as an indicator of certain water quality constituents such as predicting the sediment concentrations.

Nitrogen (N) - Sources of nitrogen in storm water are from the additions of organic matter to water bodies or chemical additions. Ammonia and nitrate are important nutrients for the growth of algae and other plants. Excessive nitrogen can lead to eutrophication since nitrification consumes dissolved oxygen in the water. Nitrogen occurs in many forms. Organic Nitrogen breaks down into ammonia, which eventually becomes oxidized to nitrate-nitrogen, a form available for plants. High concentrations of nitrate-nitrogen (N/N) in water can stimulate growth of algae and other aquatic plants, but if phosphorus (P) is present, only about 0.30 mg/l of nitrate-nitrogen is needed for algal blooms. Some fish life can be affected when nitrate-nitrogen exceeds 4.2 mg/l. There are a number of ways to measure the various forms of aquatic nitrogen. Typical measurements of nitrogen include Kjeldahl nitrogen (organic nitrogen plus ammonia); ammonia; nitrite plus nitrate; nitrite; and nitrogen in plants. The principal water quality criteria for nitrogen focus on nitrate and ammonia.

Phosphorus (P) - Phosphorus is an important component of organic matter. In many water bodies, phosphorus is the limiting nutrient that prevents additional biological activity from occurring. The origin of this constituent in storm water discharge is generally from fertilizers and other industrial products. Orthophosphate is soluble and is considered to be the only biologically available form of phosphorus. Since phosphorus strongly associates with solid particles and is a significant part of organic material, sediments influence concentration in water and are an important component of the phosphorus cycle in streams. The primary methods of measurement include detecting orthophosphate and total phosphorus.

**Storm Water Quality**

The project site lacks any measured data on storm water runoff quality. In the absence of site-specific data, expected storm water quality can be qualitatively discussed by relating typical pollutants to specific land uses.

Currently, the project vicinity includes a golf course, residential development, roads and open space. The expected existing pollutants in the existing condition storm water runoff from the developed areas of the Ahwahnee Country Club Estates and the golf course include trash, nutrients, bacteria, pesticides and herbicides, oil and grease, and household hazardous wastes. The natural open space areas are likely to produce suspended solids.

Currently, the site contains retention ponds on the golf course, which would potentially decrease the amount of pollutants in storm water runoff. These retention ponds are being used for golf course irrigation. It is likely that portions of potential pollutants are removed through the use of natural conveyance, rather than a storm drain system. Conveying flows overland through vegetation affords some infiltration and biofiltration of runoff and thus, potential pollutant removal. However, conveying flows overland tends to create erosion problems and increases suspended solids in the runoff. Since the majority of the site drains onto the golf course the existing runoff may contain additional pollutants from fertilizer, pesticides and herbicides.

# IMPACTS

## SIGNIFICANCE CRITERIA

Appendix G of the California Environmental Quality Act (CEQA) Guidelines contains the Initial Study Environmental Checklist, which includes questions relating to hydrology, drainage and water quality. The issues presented in the Initial Study Checklist have been utilized as thresholds of significance in this Section. Accordingly, a project may create a significant environmental impact if it causes one or more of the following to occur:

- Violation of any water quality standards or waste discharge requirements (refer to Impact Statements 5.9-4 and 5.9-5);

- Substantial depletion of groundwater supplies or substantial interference with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted) (Refer to Section 5.8, *Geology and Soils* and Section 5.10, *Public Services and Utilities*);

- Substantial alteration of the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or offsite (refer to Impact Statements 5.9-1 and 5.9-2);

- Substantial alteration of the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or offsite (refer to Impact Statements 5.9-1 to 5.9-3);

- Creation or contribution of runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provision of substantial additional sources of polluted runoff (refer to Impact Statements 5.9-1 and 5.9-2);

- Otherwise substantial degradation of water quality (refer to Impact Statements 5.9-4 and 5.9-5);

- Housing placement within a 100-year flood hazard area as mapped on a Federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map (refer to Impact Statement 5.9-3);

- Placement within a 100-year flood hazard area structures which would impede or redirect flood flows (refer to Impact Statement 5.9-3); and/or

- Exposure of people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam (refer to Impact Statement 5.9-3).

The following sections discuss applicable laws and regulations that will be used to determine the level of significance of each impact area.

Hydrology and Surface Water Drainage. Federal, State and local drainage laws and regulations govern the evaluation of impacts to surface water drainage. For this evaluation, impacts to surface water drainage would be considered potentially significant if the project alters the drainage patterns of the site, which would result in substantial erosion, siltation, or increase runoff that would result in increased flooding. An increase in the amount of runoff could be considered a potentially significant impact if it impacts local roadways and/or downstream drainage facilities.

The proposed project would also include a 210-acre foot water storage reservoir. A dam is within County jurisdiction if its embankment height is at or under 25 feet and the storage capacity behind the dam is less than 50 acre-feet or if the storage capacity is less than 15 acre-feet regardless of embankment height. Otherwise, if the dam and/or reservoir capacity exceeds these limits, the water reservoir facility/dam falls under California Department of Water Resources, Division of Safety of Dams (DSOD) jurisdiction and needs to be designed per DSOD standards. Since the proposed reservoir would store approximately 210-acre feet of water, it falls under the jurisdiction of the DSOD.

Floodplain. As a participate in the National Flood Insurance Program (NFIP) communities must adopt and enforce minimum floodplain management standards, including identification of flood hazards and flooding risks as defined by the Federal Emergency Management Agency (FEMA). Since Madera County is a participant of NFIP, any changes to existing FEMA mapped floodplains must conform to FEMA standards.

Stormwater Quality. Storm water quality is measured for both construction and post-construction conditions.

Construction. The Construction General Permit authorizes the discharge of stormwater to surface waters for construction activities that result in the disturbance of one or more acres of land. It prohibits the discharge of materials other than storm water and authorized non-storm water discharges, which contains hazardous substances. The General Permit requires the development and implementation of a Storm Water Pollution Prevention Plan (SWPPP). Best Management Practices (BMPs) required for the SWPPP primarily emphasize source control BMPs, such as erosion control and pollution prevention methods.

Post-Construction. The evaluation of impacts to storm water quality is of growing concern throughout the country. The project site is located in an area that does not currently have a Municipal National Pollution Discharge Elimination System (NPDES) Permit. The Municipal Permit would regulate post-construction water quality requirements. However, per conversation with Madera County Flood Control staff, the site should reduce the discharge of pollutants to a less then significant level through the implementation of the post-construction water quality measures. Madera County recommends that all applicable guidelines implemented by Caltrans, as deemed appropriate by the County, be developed to address post-construction water quality management. In addition to the post-construction water quality requirements, the site will require coverage under the Construction NPDES Permit CAS000002 for the discharge of stormwater runoff associated with construction activities on site.

Madera County Flood Control Recommendations. The following are recommended guidelines to reduce the storm water discharge pollutants to a less then significant level in the post-construction stage. Even though the project area does not have a municipal NPDES permit it is good practice to:

- Effectively prohibit non-storm water discharges, and
- Reduce the discharge of pollutants from storm water conveyance system to the Maximum Extent Practicable.

For this evaluation, impacts to storm water quality would be considered significant if the project did not attempt to address storm water pollution to the maximum extent practicable. Currently, there are no definitive water quality standards that require storm water quality leaving a project site to meet standards for individual pollutants. For purposes of this EIR analysis, impacts to storm water quality would be considered less than significant if they meet all of the following guidelines:

- Conserve natural areas by using cluster development, limiting clearing and grading of native vegetation, maximize trees and other vegetation, promote natural vegetation, and preserve riparian area and wetlands.
- Minimize storm water pollutants of concern by incorporating BMPs or combinations of BMPs best suited to maximize the reduction of pollutant loadings in runoff to the maximum extent practicable.
- Protect slopes and channels to decrease the potential of slopes and channels from eroding and impacting storm water runoff.
- Properly design outdoor material storage areas.
- Properly design trash storage areas.
- Provide proof of ongoing BMP maintenance.
- Properly design vehicle/equipment wash areas.

As stated in the Existing Conditions section above, the assessment of impacts is based upon a local hydrology analysis, rather than the entire Carter and Miami Creek Watersheds. Since these two watersheds are approximately 30 square miles combined, a local analysis provides a more precise assessment of local drainage impacts as a result of implementing the proposed project.

Potential impacts associated with drainage and water quality are categorized below according to topic. Mitigation measures at the end of this Section directly correspond to the impact statements below.

## DRAINAGE

5.9-1 *The proposed project would alter drainage patterns, which could result in increased erosion potential and runoff. Drainage and erosion impacts are concluded as less than significant with compliance of all applicable Madera County and FEMA design requirements.*

Implementation of the proposed project would involve the development of 315 single-family residential lots and necessary infrastructure to support the development. Numerous roads would be built to support the development. As part of the development, Opah Drive would be extended to Pine River Road, a county road that terminates just west of the proposed project. Water would be diverted from Miami Creek into a 210-acre-foot reservoir for onsite water supply.

This analysis assumes that there will be no storm drain system on the project site to convey flows. However, it is assumed that there would be cross culverts to direct flow across streets and around homes.

Table 5.9-4, *Local Existing Versus Proposed Watershed Conditions*, provides an area summary for the proposed conditions drainage areas and compares it to existing conditions. Additionally, similar to the Existing Conditions section, above, hydrologic properties such as slope, length, soil type, vegetation and land use were characterized for each sub-watershed under the proposed project conditions (refer to Table 5.9-5, *Proposed Local Project Sub-Watershed Characteristics*).

**Table 5.9-4**
**Local Existing Versus Proposed Watershed Conditions**

| Tributary Creeks | Watershed | Existing Condition (acres) | Proposed Condition (acres) | Difference (acres) |
|---|---|---|---|---|
| Carter Creek | A | 245.7 | 230.1 | 15.6 |
| | B | 73.3 | 90.4 | -17.1 |
| | C | 269.3 | 272.3 | -3.0 |
| | D | 101.9 | 101.9 | 0.0 |
| | E | 152.2 | 134.1 | 18.1 |
| Miami Creel | F | 183.1 | 185.4 | -2.3 |
| | G | 471.1 | 472.9 | -1.8 |
| | H | 632.4 | 600.3 | 32.1 |
| Confluence of two Creeks | I | 176.1 | 217.7 | -41.6 |
| Total | | 2,305.1 | 2,305.1 | 0.0 |

**Table 5.9-5**
**Proposed Local Project Sub-Watershed Characteristics**

| Sub-Area ID | Length (ft) | Slope (ft/ft) | Soil Type | Land Use (Acres) | | | | | | Total Area (Acres) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 0-1 DU | 0-5 DU | Service Commercial | Golf Course | Open Space | Ponds | |
| A1 | 300 | 0.05 | C | | | | | 2.1 | | 2.1 |
| A2 | 400 | 0.038 | C | | | | | 4.2 | | 4.2 |
| A3 | 540 | 0.093 | C | | | | | 15.2 | | 15.2 |
| A4 | 790 | 0.139 | C | | | | | 24.3 | | 24.3 |
| A5 | | | C | | | | | 25.4 | | 25.4 |
| A6 | 2,370 | 0.034 | C | 53.0 | | | | | | 53.0 |
| A7 | | | C | | | | | 24.9 | | 24.9 |
| A8 | 1,620 | 0.006 | C | | 13.0 | | 10.7 | | | 23.7 |
| A9 | 620 | 0.016 | C | 57.3 | | | | | | 57.3 |
| B1 | 230 | 0.217 | C | | | | | 1.5 | | 1.5 |
| B2 | 440 | 0.091 | C | | | | | 4.3 | | 4.3 |
| B3 | 800 | 0.1 | C | | | | | 15.2 | | 15.2 |
| B4 | 1,140 | 0.088 | C | | | | | 36.7 | | 36.7 |
| B5 | 1,550 | 0.042 | C | | 14.8 | 3.7 | | | | 18.5 |
| B6 | 680 | 0.037 | C | | | | 14.2 | | | 14.2 |
| C1 | 300 | 0.067 | C | | | | | 1.3 | | 1.3 |
| C2 | 360 | 0.056 | C | | | | | 3.1 | | 3.1 |
| C3 | 590 | 0.102 | C | | | | | 7.8 | | 7.8 |
| C4 | 780 | 0.231 | C | | | | | 12.4 | | 12.4 |
| C5 | 3,425 | 0.175 | C | | | | | 47.9 | | 47.9 |
| C6 | | | C | | | | | 77.5 | | 77.5 |
| C7 | 2,130 | 0.038 | C | 24.9 | | | | 57.3 | 0.8 | 83.1 |
| C8 | 1,870 | 0.091 | C | 23.5 | | | 15.7 | 0 | | 39.2 |
| D1 | 300 | 0.117 | C | | | | | 3.1 | | 3.1 |
| D2 | 660 | 0.136 | C | | | | | 14 | | 14 |
| D3 | 1,250 | 0.224 | C | | | | | 19.1 | | 19.1 |
| D4 | 840 | 0.202 | C | | | | | 11.9 | | 11.9 |
| D5 | 630 | 0.222 | C | | | | | 17.5 | | 17.5 |
| D6 | 3,540 | 0.023 | C | 36.3 | | | | | | 36.3 |
| E1 | 300 | 0.267 | C | | | | | 1.5 | | 1.5 |
| E2 | 500 | 0.28 | C | | | | | 4.5 | | 4.5 |
| E3 | 1,450 | 0.179 | C | | | | | 20.2 | | 20.2 |
| E4 | 1,100 | 0.064 | C | | | | | 26.5 | | 26.5 |
| E5 | 1,740 | 0.052 | C | 42.2 | | | | | | 42.2 |
| E6 | 2,170 | 0.06 | C | | 11.8 | | 27.4 | | | 39.2 |

## Table 5.9-5 [Continued]
## Proposed Local Project Sub-Watershed Characteristics

| Sub-Area ID | Length (ft) | Slope (ft/ft) | Soil Type | Land Use (Acres) | | | | | | Total Area (Acres) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 0-1 DU | 0-5 DU | Service Commercial | Golf Course | Open Space | Ponds | |
| F1 | 300 | 0.1 | C | | | | | 1.4 | | 1.4 |
| F2 | 430 | 0.186 | C | | | | | 7.0 | | 7 |
| F3 | 470 | 0.298 | C | | | | | 13.6 | | 13.6 |
| F4 | 1,480 | 0.243 | C | | | | | 47.7 | | 47.7 |
| F5 | 2,055 | 0.061 | C | | | | | 57.2 | 1.8 | 59 |
| F6 | 1,915 | 0.063 | C | | | | | 25.9 | | 25.9 |
| F7 | 2,240 | 0.033 | C | 13.86 | | | | 16.9 | | 30.8 |
| G1 | 300 | 0.133 | C | | | | | 1.7 | | 1.7 |
| G2 | 275 | 0.182 | C | | | | | 2.9 | | 2.9 |
| G3 | 325 | 0.062 | C | | | | | 5.3 | | 5.3 |
| G4 | 670 | 0.075 | C | | | | | 13.7 | | 13.7 |
| G5 | 1,290 | 0.062 | C | | | | | 32.6 | | 32.6 |
| G6 | 3,860 | 0.096 | C | | | | | 60.3 | | 60.3 |
| G7 | 3,760 | 0.093 | C | | | | | 94.9 | | 94.9 |
| G8 | | | C | | | | | 150.6 | 16.7 | 167.3 |
| G9 | 1,505 | 0.04 | C | | | | | 61.4 | | 61.4 |
| G10 | 2,090 | 0.029 | C | | 8.5 | | 24.3 | | | 32.8 |
| H1 | 330 | 0.182 | C | | | | | 1.4 | | 1.4 |
| H2 | 285 | 0.211 | C | | | | | 2.2 | | 2.2 |
| H3 | 685 | 0.175 | C | | | | | 6.5 | | 6.5 |
| H4 | 1,200 | 0.183 | C | | | | | 31.7 | | 31.7 |
| H5 | 2,155 | 0.014 | C | 18.1 | | | | 42.3 | | 60.4 |
| H6 | 1,500 | 0.017 | C | 51.0 | | | | 9.0 | | 60 |
| H7 | 960 | 0.177 | C | 48.7 | | | | 48.7 | | 97.4 |
| H8 | | | C | 32.5 | | | | 39.7 | | 72.2 |
| H9 | 990 | 0.009 | C | 13.8 | | | | 78.5 | | 92.3 |
| H10 | 1,260 | 0.014 | C | 42.8 | | | | 12.1 | | 54.9 |
| H11 | 2,640 | 0.003 | C | | 20.6 | | 15.8 | 84.9 | | 121.3 |
| I-1 | 3,350 | 0.003 | C | | 163.3 | | | 54.4 | | 217.7 |
| | | | | | | | | Total | Acres | 2305.1 |

As shown in Table 5.9-4, with implementation of the proposed project, the watershed delineation changes slightly from the existing condition, due to grading, and increases of impervious areas (roads and lots). Similar to existing conditions, percentage pervious factors for the project area under the proposed conditions would range from approximately zero (0) percent for paved surfaces, 100 percent for natural cover, 98 percent for golf courses, 75 percent to 80 percent for single-family housing and 10 percent for commercial development. However, the proposed project would alter drainage patterns due to onsite grading and increases in the amount of impervious area. This could result in increased local erosion and runoff and is considered a potentially significant impact.

With the construction of 315 homes on the project site, drainage boundaries would be altered due to grading. This would increase the overall imperviousness of the watershed from three (3) percent pervious in the existing condition to 8.5 percent in the developed condition. As shown in Table 5.9-4, under the proposed condition, Watersheds B, C, F, G and I would increase the total area draining to each watershed. In contrast, Watersheds A, E and H would decrease the total area draining to each watershed. Watershed D does not change between existing and proposed condition. Existing drainage courses would also be slightly altered through grading. The addition of homes and roads would require a drainage system to reduce flooding and erosion impacts. Concentrate flows entering the creeks at various discharge locations may cause an increase to potential local erosion.

Potential erosion impacts would be reduced to less than significant levels by designing drainage conveyance systems, such as open ditches and connections to existing creeks, per standard engineering practices and compliance with Madera County design standards. Potential drainage impacts would be reduced to less than significant levels by providing protection to minimize erosion by designing cross culverts based upon Madera County design requirements and designing creek crossings based upon FEMA requirements. Thus, no mitigation measures are necessary beyond compliance with all applicable Madera County and FEMA design requirements to reduce potentially significant drainage and erosion impacts to less than significant levels.

## HYDROLOGY

5.9-2 *The proposed project would alter hydrology due to onsite grading and increases in impervious area drainage patterns, which could result in on- or off-site flooding, or exceed the capacity of planned drainage systems. Impacts are concluded as less than significant with compliance of all applicable Madera County and FEMA design requirements.*

Project hydrology (based on assumed flow paths, provided grading plan, lot location and existing cross culvert locations) was prepared to determine the local impacts that the proposed project would have on runoff. Hydrologic calculations to evaluate surface runoff associated with 10-year and 100-year design storm frequencies from the local drainage areas were performed using the Rational Method (refer to "Rational Method" discussion, above).

At the time of this analysis, the grading plan did not include grading for the entire project site. Thus, the hydrology analysis is based on certain assumptions regarding drainage patterns and drainage facility locations based in standard engineering practice and professional expertise. The proposed project contains one 210 acre-foot reservoir for drinking and irrigation water storage. For this hydrology analysis, it was assumed that the reservoir would be at capacity; therefore no attenuation of flood flows is considered.

The sub-watershed boundaries were delineated utilizing topographic mapping (provided by Nolte Associates), onsite grading provided by Nolte Associates and a site visit to determine the existing drainage patterns. Exhibit 5.9-3, *Proposed Conditions Hydrology Map*, illustrates the locations of each sub-watershed and the drainage patterns for the proposed project area conditions. In the proposed condition, the proposed lots and open ditches would flow directly towards Miami and Carter Creeks through cross culverts and overland flow.

The results of the proposed condition hydrologic analysis are summarized in Table 5.9-6, *Proposed Local Condition Hydrology Summary*. Appendix B of the *Hydrology and Water Quality Report* includes the results from the 10-year and 100-year flows.

**Table 5.9-6**
**Proposed Local Project Sub-Watershed Characteristics**

| Description | Effective Total Area (acres) | 1-Year Flowrate (cfs) | 100-Year Flowrate (cfs) |
|---|---|---|---|
| Carter Creek | 829 | 461 | 667 |
| Miami Creek | 1,259 | 443 | 848 |
| Confluence of Miami and Carter Creeks | 2,305 | 939 | 1,590 |
| Note: Flowrates presented are for local tributary drainage only. The flowrates are lower than the actual flowrates in Carter and Miami Creeks. | | | |

Development of the proposed project would alter hydrology due to onsite grading and increases in impervious area. Based on engineering assumptions, as discussed above, the proposed flow path is assumed to travel through streets and between lots in an overland flow pattern or through cross culverts at road crossings. The change in the proposed hydrology conditions could result in existing crossings being undersized due to the increased flows on-site. Table 5.9-7, *Existing Versus Proposed Conditions Local Flowrates*, compares the overall flowrate from the local site tributary area in Carter Creek, Miami Creek, and at a downstream point in Miami Creek after the confluence with Carter Creek. Drainage patterns were assumed for the hydrologic analysis based on information collected at a site visit, current proposed site grading and lot layout.

**Table 5.9-7**
**Existing Versus Proposed Conditions Local Flowrates**

| Tributary Creek | 10-year Flowrate (cfs)* | | 100-year Flowrate (cfs) | |
|---|---|---|---|---|
| | Existing Condition | Proposed Condition | Existing Condition | Proposed Condition |
| Carter Creek | 368 | 461 | 632 | 667 |
| Miami Creek | 409 | 443 | 792 | 848 |
| Confluence of Two Creeks | 735 | 939 | 1,355 | 1,590 |

Notes:
- Flowrates presented are for local tributary drainage only. The flowrates are lower than the actual flowrates in Carter and Miami Creeks.
- * cfs = cubic feet per second

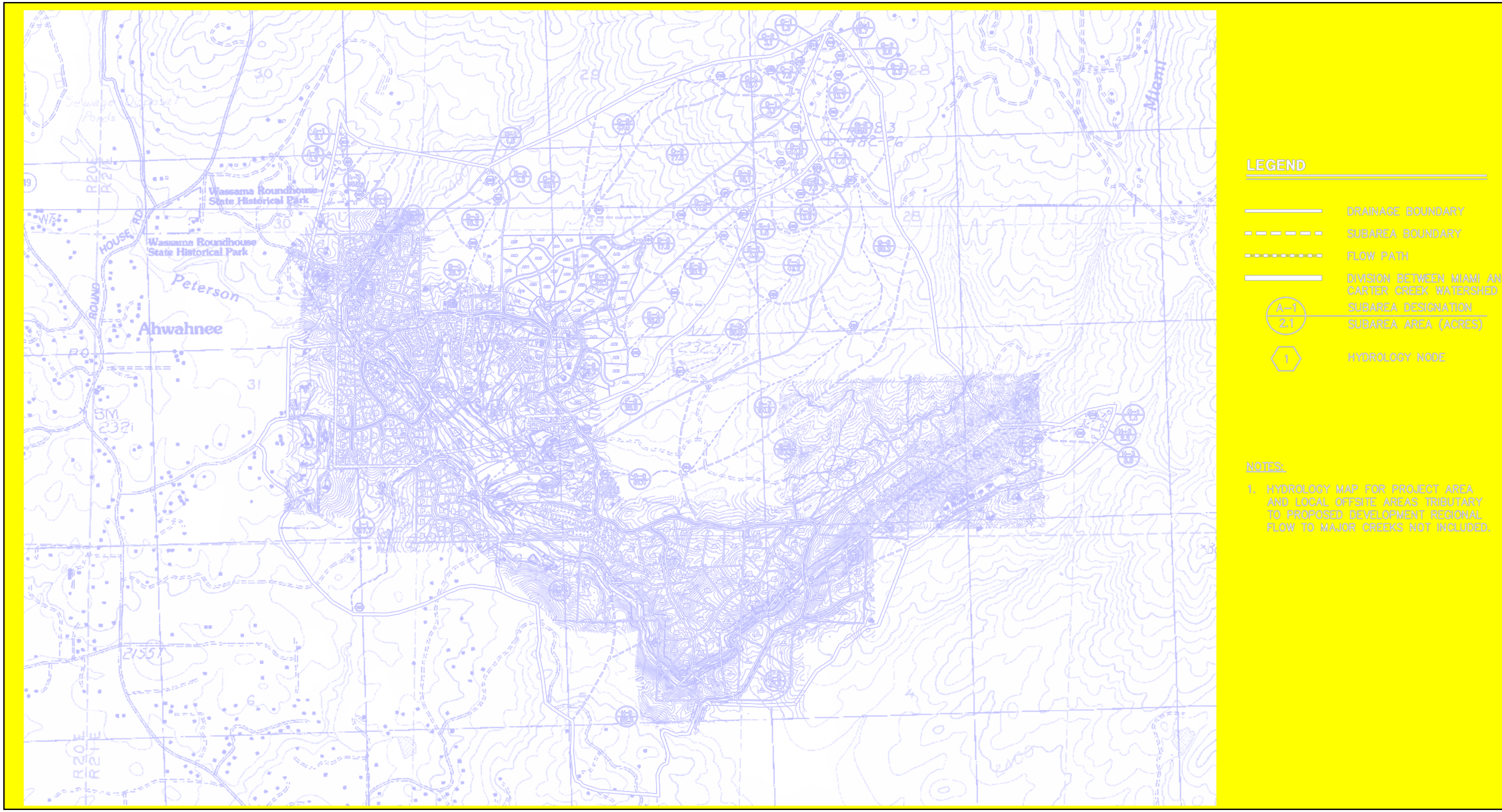
As shown in Table 5.9-6, the overall increase in flows entering Carter Creek is 35 cfs and 56 cfs for Miami Creek during the 100-year storm event, which would increase the local flow from the site entering each creek by approximately 5.5 percent. After the confluence of Carter and Miami Creeks, the overall increase in flows would be 235 cfs in the 100-year, which would increase the local flows from the site entering the creeks by approximately 17 percent. However, the increase of 17 percent is only for the local area, which is 2.6 percent of the total Miami and Carter Creek Watersheds. Thus, due to the increase in runoff from the site, the existing facilities may be undersized to accommodate the increase in flowrates.

Potential impacts to planned drainage systems or as a result of flooding from increased flowrates would be reduced to less than significant levels by designing culverts per Madera County design standards and creek crossings to FEMA design standards. No mitigation measures are necessary beyond compliance with all applicable Madera County and FEMA design requirements to reduce potentially significant impacts to planned drainage systems or as a result of flooding from increased flowrates to less than significant levels.

## FLOODING

5.9-3 *The proposed project would place housing in an area that is subject to flooding. Impacts are concluded as less than significant with compliance of all applicable Madera County, DSOD and FEMA design requirements and implementation of the recommended mitigation measures.*

As stated in the Existing Conditions section, the published Flood Insurance Rate Map (FIRMs) for the project site is included on Community Panel No. 0601700225B. The current Flood Insurance Rate Map (FIRM) shows the site is contained within a Zone "A" floodplain created by Carter and Miami Creeks. The Zone A refers to a 100-year floodplain, which flood elevations and flood hazard factors have not been determined. Because detailed hydraulic analyses are not performed for such areas, no Base Flood Elevations or depths are shown within this zone. The FIRM also illustrates that the project area is located within Zone X, which corresponds to an area of minimal to moderate flood hazard.




Source: RBF Consulting, May 2004.

Not to Scale

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ENVIRONMENTAL IMPACT REPORT
SIERRA MEADOWS ESTATES SUBDIVISION

# Proposed Conditions Hydrology Map

**Exhibit 5.9-3**

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Portions of the Sierra Meadows site are located in a Zone "A" floodplain along Miami and Carter Creeks, which is considered a 100-year floodplain. The construction of four proposed culverts/bridges within Carter and Miami Creeks could impact the 100-year floodplain. Additionally, the construction of the residential lots near Miami Creek could impact the 100-year floodplain. The residential lots adjacent to Miami and Carter Creeks have the potential to be impacted by the 100-year flows in the creeks.

However, culverts and bridges within Miami and Carter Creeks would be designed and constructed to convey the 100-year flow, pursuant to all applicable Madera County and/or FEMA requirements. Additionally, the recommended mitigation includes that the Project Applicant obtain a Conditional Letter of Map Revision and Letter of Map Revision from FEMA for construction activities within the mapped floodplain. Implementation of the recommended mitigation measures would ensure that potentially significant flooding impacts are reduced to less than significant levels.

The project also includes a dam being constructed as part of a 210-acre-foot water storage reservoir. Since this dam would have an approximately 40-foot embankment and would store approximately 210 acre-feet of water, the dam would fall under California Department of Water Resources, Division of Safety of Dams (DSOD) jurisdiction. Per natural drainage courses shown on the proposed conditions hydrology map (refer to Exhibit 5.9-3), it appears that if the dam fails, the flow from the dam may inundate the lots adjacent to the southeast portion of the existing golf course. This may cause damage to structures within the flow path. However, designing the dam to conform to all applicable safety and design standards of Madera County and the DSOD would reduce potential flooding risks to less than significant levels. No mitigation measures are necessary beyond compliance with all applicable DSOD design requirements to reduce potentially significant impacts as a result of flooding from the water reservoir to less than significant levels.

Also, the project site is not located in an area that would be impacted by a tsunami. The project site is surrounded by developed land uses, however, upstream of the site the area is undeveloped and there is a potential for mudflows onto the site. However, the impacts from mudflows are considered to be less than significant given the varying topography and heavily vegetated nature of the surrounding area.

In conclusion, compliance with all applicable Madera County, FEMA and DSOD design standards and implementation of the recommended mitigation measures would reduce potentially significant flooding impacts to less than significant levels.

## WATER QUALITY – CONSTRUCTION

5.9-4 *Grading, excavation and construction activities associated with the proposed project could impact water quality due to sheet erosion of exposed soils and subsequent deposition of particles and pollutants in drainage areas. Impacts would be reduced to a less than significant level through regulatory compliance and with implementation of the recommended mitigation measures.*

Construction controls are separated from the rest of the water quality management because the measures are temporary and specific to the type of construction. Construction activities, including earth moving, would create potentially significant impacts to storm water quality. Construction of the proposed project has the potential to produce typical pollutants such as nutrients, heavy metals, pesticides and herbicides, toxic chemicals related to construction and cleaning, waste materials including wash water, paints, wood, paper, concrete, food containers, and sanitary wastes, fuel, and lubricants. Thus, increased pollutant loading could occur immediately offsite as a result of construction activities.

Since the proposed project would disturb one (1) or more acres of soil, it is required to obtain coverage under the General Permit for Discharges of Storm Water Associated with Construction Activity (Construction General Permit, Permit Order 99-08-DWQ). Construction activity subject to this permit includes clearing, grading and disturbances to the ground such as stockpiling, or excavation, but does not include regular maintenance activities performed to restore the original line, grade, or capacity of the facility.

The Construction General Permit requires the development and implementation of a Storm Water Pollution Prevention Plan (SWPPP). The SWPPP must list Best Management Practices (BMPs) the discharger will use to protect storm water runoff and the placement of those BMPs. The *Hydrology and Water Quality Report* recommends numerous erosion control BMPs that would avoid or mitigate runoff pollutants at the project construction site to the "maximum extent practicable." The recommended BMPs include the following:

- *Employee and Subcontractor Training* – Have a training session for employees and subcontractors to understand the need for implementation and usage of BMPs.

From the California *Storm Water Best Management Practice Handbook - Construction Activity*:

- *EC 2 Preservation of Existing Vegetation* – Minimize the removal of existing trees and shrubs because they serve as erosion control.

- *EC 3 Hydraulic Mulching* – Provides suitable soil disturbed areas requiring temporary protection by applying a mixture of wood fiber and stabilizing emulsion until permanent stabilization is established.

- *EC 4 Hydroseeding* – Provides suitable soil disturbed areas requiring temporary protection by applying a mixture of wood fiber, seed, fertilizer, and stabilizing emulsion until permanent stabilization is established.

- *EC 5 Soil Binders* – Applying soil stabilizers to exposed soil surfaces to prevent water induced erosion and wind erosion.

- *EC 7 Geotextiles and Mats* – Natural or synthetics material can be used for soil stability.

- *EC 9 Earth Dikes and Drainage Swales* – Construct earth dikes of compacted soil to divert runoff or channel water to a desired location. Use temporary drains and swales to divert off-site runoff around the construction site and stabilized areas and direct it into sediment basins or traps.

- *SE 1 Silt Fence* – Composed of filter fabric, which have been entrenched, attached to support poles and sometimes backed by wire fence support. Silt fences promote sedimentation behind the fence of sediment-laden water.

- *SE 3 Sediment Trap* – A sediment trap is a small, excavated or bermed area where runoff for small drainage areas can pass through allowing sediment to settle out.

- *SE 5 Fiber Rolls* – Placed at the toe and face of the slopes to intercept runoff, reduce its flow velocity, release the runoff as sheet flow and provide sediment removal.

- *SE 6 Gravel Bag Berms* – Placed on level contours to pond sheet flow, allow sediment to settle and release runoff slowly as sheet flow to prevent erosion.

- *SE 7 Street Sweeping and Vacuuming* – Used to remove sediment from streets and roadways.

- *SE 8 Sand Bag Barriers* – By stacking sand bags on a level contour, creates a barrier to detain sediment-laden water. The barrier would promote sedimentation.

- *SE 9 Straw Bale Barrier* – Place straw bales end to end in a level contour in a shallow trench and stake them in place. The bales would detain runoff and promote sedimentation.

- *NS 2 Dewatering Operations* – This operation requires the use of sediment controls to prevent or reduce the discharge of pollutant to storm water from dewatering operations.

- *NS 3 Paving and Grinding Operations* – Prevent or reduce the runoff of pollutant from paving operations by proper storage of materials, protecting storm drain facilities during construction and training employees.

- N*S 8 Vehicle and Equipment Cleaning* – Use off-site facilities, or wash in designated areas to reduce pollutant discharge into the storm drain facilities.

- *NS 9 Vehicle and Equipment Fueling* – Use off-site facilities, or designated areas with enclosing or coverings to reduce pollutant discharge into the storm drain facilities.

- *NS 10 Vehicle and Equipment Maintenance* – Use off-site facilities, or designated areas with enclosing or coverings to reduce pollutant discharge into the storm drain facilities. In addition run a "dry site" to prevent pollution discharge into storm drains.

- *WE 1 Wind Erosion Control* – Applying water or other dust palliatives to prevent or alleviate dust nuisance.

- *TC 1 Stabilized Construction Entrance* – Stabilize the entrance pad to construction area to reduce amount of sediment tracked off site.

- *TC-2 Construction Road Stabilization* – All on-site vehicle transport routes should be stabilized immediately after grading and frequently maintained to prevent erosion and control dust.

- *WM 5 Solid Waste Management* - This BMP describes the requirements to properly design and maintain trash storage areas. The primary design feature requires the storage of trash in covered areas

- *WM 6 Hazardous Waste Management* - This BMP describes the requirements to properly design and maintain waste areas.

- *WM 7 Concrete Waste Management* – Prevent and reduce pollutant discharge to storm water from concrete waste by performing on and off-site washouts in designated areas and training employees and consultants.

- *WM 9 Sanitary Septic Water Management* – Provide convenient, well-maintained facilities, and arrange regular service and disposal of sanitary waste.

It is noted that the BMPs identified above serve as recommended BMPs to be included in the SWPPP for the proposed project. However, the SWPP may or may not include the BMPs identified above, depending on the practicality and/or feasibility of implementing site-specific BMPs.

In summary, construction activities associated with the proposed project could result in potentially significant short-term water quality impacts. However, compliance with the Construction General Permit, including implementation of BMPs identified in a SWPPP, would reduce impacts to water quality to a less than significant level. Implementation of the recommended mitigation measures would reduce short-term water quality impacts to less than significant levels.

## WATER QUALITY – LONG-TERM

5.9-5 *Project development may result in long-term impacts to the quality of storm water and urban runoff, subsequently impacting water quality. Impacts would be reduced to less than significant levels with compliance to State and Madera County Development Code requirements and implementation of the recommended mitigation measure.*

The proposed project has the potential to impact water quality due to the development of the proposed residential uses and associated infrastructure. The development of the proposed project would increase the amount of impervious area; thus, potentially increasing runoff associated with residential and transportation uses. The project would be expected to increase pollutant loadings, including hydrocarbons, fertilizers, pesticides, oils and grease, and household hazardous wastes which could impact water storm water quality. The proposed drainage structures, including cross culverts and open channels, would increase pollutant loading immediately offsite. It is possible to grade the site so that the flows are directed to the existing ponds located within the golf course. Conveying flows overland through vegetation would afford some infiltration and biofiltration of runoff and thus, potential pollutant removal. However, additional water quality measures would be needed to reduce the pollutants from the entire project area.

Madera County recommends that all applicable guidelines implemented by Caltrans, as deemed appropriate by the County, be developed to address post-construction water quality management. Thus, in order to reduce potential long-term water quality impacts to the maximum extent practicable, it would be necessary to implement the applicable Caltrans guidelines to identify non-structural/source and structural BMPs. The *Hydrology and Water Quality Report* recommends numerous BMPs that would avoid or mitigate runoff pollutants as a result of development on the project site to the "maximum extent practicable." The recommended BMPs include the following:

<u>Non-Structural/Source Control BMPs</u>

- *Education for Property Owners, Tenants and Occupations* – The Property Owners Association (POA) is required to provide awareness educational material, including information provided by Madera County and Regional Water Quality Control Board. The materials would include a description of chemicals that should be limited to the property and proper disposal, including prohibition of hosing waste directly to gutters, catch basins, storm drains or the lake.

- *Common Area Litter Control* – POAs are required to implement trash management and litter control procedures to minimize pollution to drainage waters.

<u>Structural/Treatment BMPs</u>

- *Control of Impervious Runoff* – Surface runoff shall be directed to landscape areas or pervious areas.

- *Storm Water Pollutants of Concern* – Minimize pollution by using vegetated swales, vegetated strips, oil/water separators, and cross culvert screens. In addition, direct rooftop runoff to pervious areas such as yards, open channels or vegetative area.

- *Common Area Runoff-Minimizing Landscape Design* – Group plants with similar water requirements in order to reduce excess irrigation runoff and promote surface filtration.

- *Slopes and Channels* – Protect slopes and channels by installing energy dissipaters, such as rip rap, at the outlet of a new culvert, use velocity rings to reduce the velocity of the water.

- *Debris Posts* – Are necessary to prevent large floatable debris from entering the storm drains. They are place upstream of the cross culverts.

- *Inlet Trash Racks* – Where appropriate to reduce intake and transport through the storm drain system of large floatable debris, trash racks shall be provided where drainage from open areas entering storm drain or cross culverts.

- *Parking Areas* – Reduce the oil and hydrocarbon runoff from parking area by treating to remove oil and hydrocarbons. Also maintain and operate treatment systems to reduce oil and sludge in the storm drain.

From the *California Storm Water Best Management Practice Handbook - Municipal*:

- *TC 10 Infiltration Trenches* – Are long, narrow, rock-filled trenches with no outlet that receive stormwater. They perform well in removing fine sediment and associated pollutants. A typical infiltration trench is essentially an excavated trench, which is lined with filter fabric and backfilled with stones. Depth of the infiltration trench ranges from 3 to 8 feet and functions best in areas with permeable soils, and water table and bedrock depth situated well below the bottom of the trench. Trenches should not be used to trap coarse sediments, because large sediment will likely clog the trench. Grass buffers can be installed to capture sediment before it enters the trench to minimize clogging.

- *TC 30 Vegetative Swales* – Open shallow channels with vegetation covering the site slopes and bottom that collect and slowly covey runoff flow. Treat runoff from filtration by vegetation. In order for the vegetation swales to be effective in the removal of potential pollutants, the swales must be treated as water quality features and must be maintained differently than grass areas. Specifically, pesticides, herbicide, and fertilizers, which may be used on the grass areas, must not be used in the vegetation swales.

- *TC 31 Buffer Swales* – Grassed strips that treat by sheet flow. They remove sediment and other pollutants to settle and by providing some infiltration into the soil.

It is noted that the BMPs identified above serve as recommended BMPs to be included in the post-construction management of water quality for the proposed project. However, the post-construction water quality management may or may not include the BMPs identified above, depending on the practicality and/or feasibility of implementing site-specific BMPs.

In summary, the proposed project would be required to prepare and implement all applicable guidelines implemented by Caltrans, as deemed appropriate by the County, which would include post-construction BMPs to reduce pollutant loadings.

Implementation of the recommended mitigation measures would reduce long-term water quality impacts to less than significant levels.

### CUMULATIVE IMPACTS

5.9-6 *The proposed project along with other future development may result in increased hydrology and drainage impacts in the area. Analysis has concluded that impacts are less than significant.*

As stated in Section 4.0, *Basis For Cumulative Analysis*, cumulative development would occur in conjunction with growth anticipated in the Madera County General Plan and Ahwahnee/Nipinnawasee Area Plan. Cumulative development would contribute to higher runoff volumes and water quality effects. However, as stated in the Madera County General Plan EIR, with full implementation of the Madera County General Plan Polices and programs, cumulative impacts would be less than significant. Additionally, potential hydrology and drainage impacts associated with future development would be evaluated on a site specific, project-by-project basis, pursuant to CEQA, to ensure that potentially significant impacts are reduced to less than significant levels. In consideration of these requirements, along with proposed project mitigation that reduces potentially significant hydrology and drainage impacts to less than significant levels, the project's contribution to significant cumulative effects is concluded to be a less than significant impact.

## MITIGATION MEASURES

This section directly corresponds to the identified Impact Statements in the impacts subsection.

### DRAINAGE

5.9-1 No mitigation measures are recommended.

### HYDROLOGY

5.9-2 No mitigation measures are recommended.

### FLOODING

5.9-3 The Project Applicant shall obtain a conditional Letter of Map Revision and Letter of Map Revision from FEMA for the proposed construction with the mapped floodplain.

### WATER QUALITY - CONSTRUCTION

5.9-4a The Project Applicant shall prepare and submit a Notice of Intent to comply with the Construction General Permit to the California State Water Resources Board.

5.9-4b The Project Applicant shall prepare a Storm Water Pollution Prevention Plan (SWPPP) per requirements of the Construction General NPDES Permit.

### WATER QUALITY – LONG-TERM

5.9-5 The Project Applicant shall prepare and implement all applicable Caltrans guidelines, as deemed appropriate by the County, to address post-construction water quality management.

### CUMULATIVE IMPACTS

5.9-6 No mitigation measures are recommended.

## LEVEL OF SIGNIFICANCE AFTER MITIGATION

No unavoidable significant impacts related to hydrology and water quality have been identified following implementation of the recommended mitigation measures and/or through regulatory compliance.