Figure 3.7-8
HEC-1 Peak Runoff Flow Analysis

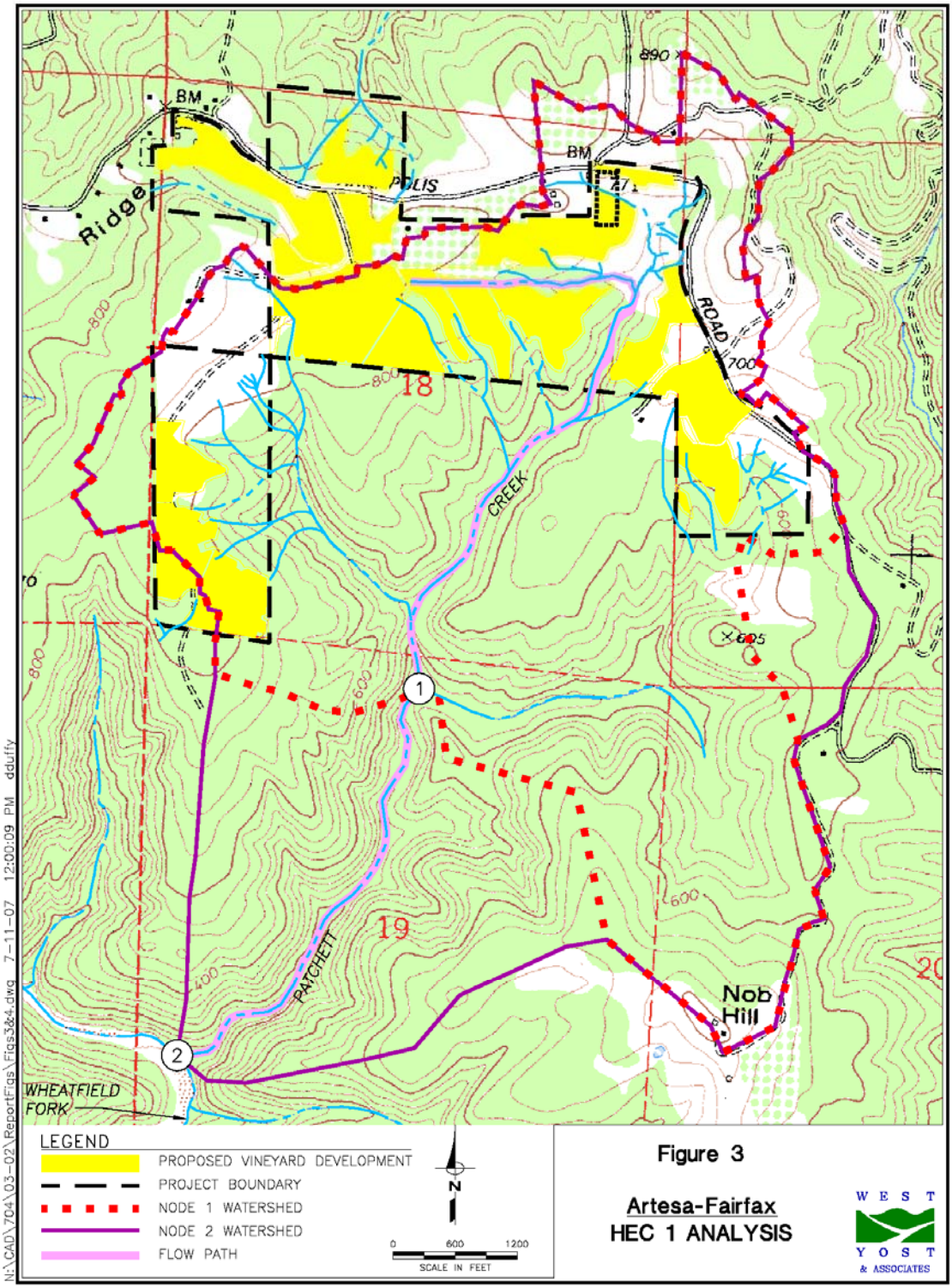


Table 3.7-4
Estimated Peak Flows for Node 1 on Patchett Creek

Return Period	Flow Under Existing Conditions, cubic feet per second (cfs)	USGS NFFv3.2 Mean (Mean + 95% Confidence Interval) (cfs)
2-yr	585	170 (282)
10-yr	1,230	352 (563)
100-yr	2,126	615 (1,021)

Source: West Yost & Associates, July 15, 2008.

Table 3.7-5
Estimated Peak Flows for Node 2 on Patchett Creek

Return Period	Flow Under Existing Conditions, cubic feet per second (cfs)	USGS NFFv3.2 Mean (Mean + 95% Confidence Interval) (cfs)
2-yr	675	224 (372)
10-yr	1,541	460 (736)
100-yr	2,652	801 (1,330)

Source: West Yost & Associates, July 15, 2008.

Table 3.7-6
Existing 2-year Recurrence Interval Peak Flows

Drainage Node	Total Area (ac.)	Woodland (ac.)	Grassland & Cultivated (ac.)	Existing Peak Flows (cfs)
N01	23.0	22.1	0.8	12.3
N07	41.9	41.9	0	22.1
N17	12.6	12.6	0	6.6
N20	40.8	19.6	21.2	25.2
N26	5.8	5.8	0	3.1
N30	22.3	10.7	11.6	13.8
N31	38.8	36.1	2.7	21.0
N33	10.5	10.5	0	5.5
N35	3.5	3.5	0	1.8
N37	8.0	8.0	0	4.2
N40	6.9	6.9	0	3.6
N45	27.8	27.8	0	14.7
N50	111.2	58.4	52.8	68.0
N20 + N50	151.9	77.9	74.0	93.2
N56	27.2	22.7	4.5	15.2
N60	12.1	11.9	0.3	6.5
N61	20.8	6.1	14.7	13.6
N62	9.5	9.5	0	5.0
N63	6.6	2.5	4.1	4.2
Total	**429.2**	**316.5**	**112.7**	**246.5**

Source: O'Connor Environmental Hydrologic Effects Analysis, May 2008.

Assessment of Drainage and Channel Sensitivity to Potential Peak Flow Increases

O'Connor Environmental conducted a detailed survey of the project site in January 2002 and January 2007 following periods of high rainfall and runoff in order to identify all potentially significant surface drainage features intersecting the proposed project boundaries. All drainage features intersecting the perimeter of the project area were surveyed in the field. Surveys recorded a broad range of systematic observations of the existing drainage feature from the approximate location of the proposed sedimentation basins, as identified on maps provided by Erickson Engineering, Inc., to a point at least 300 feet downslope.

Geomorphic observations focused on functional characteristics of headwater channels related to:

1. Active erosion processes;
2. Resistance to erosion, including
    - Valley-scale effects of plant roots and stems along the drainage axis, and
    - Discrete elements of channel morphology (e.g. logs); and
3. Effects of roads and skid trails on hydrologic processes.

The specific field observations pertaining to these functional characteristics are summarized below.

Evidence of active erosion was typically observed in the form of discrete features characterized by relatively fresh, unvegetated soil surfaces lying in or adjacent to a channel as described in Table 3.7-7. Erosion scarps indicating past erosion with substantial potential for renewed erosion were also noted. The survey team recorded the presence of an individual erosion feature the first time it was encountered. The relative abundance of these features was noted and at the end of the survey a ranking of the top 3 features present was given. In some cases only one or two features were present and only the top two or one feature was ranked. Hence these data identify the range and relative intensity of active erosion processes present. Erosion features would not typically be found in swales where no channel was present.

Table 3.7-7
Erosion Features

Erosion Feature	Description
Stream banks	Stream banks actively eroded as indicated by fresh, unstable soil surfaces, undercut banks and/or bank collapse.
Stream bed	Stream bed actively eroded as indicated by exposed fine roots and/or fresh exposures of underlying substrate.
Rill or gully	Erosion scars, typically located on planar or divergent topography and frequently associated with roads or landslides.
Knick point	Actively eroding or relatively stable, near-vertical drop in the channel greater than 0.5 ft. Face of step in channel bed composed of soil or colluvium.
Erosion of road cut or fill slope	Actively eroding cut or fill slope of a road or skid trail.
Landslide	Channel appears to be cutting through landslide deposits or scarp, or other evidence of landslide.

Source: O'Connor Environmental Hydrologic Analysis, May 2008.

Observations pertaining to factors that contribute to resistance to erosion by concentrated flow in drainage features included characterization of vegetation type in the axis of the drainage feature and individual elements of flow resistance found in channels. Vegetation observed along the axis of each drainage feature was classified into three groups: grass, shrubs and trees. At the end of each survey the survey team estimated the percentage of the length along the drainage feature axis occupied by vegetation in each class.

Individual elements of flow resistance found in the axis of drainage features that were observed in surveys are summarized in Table 3.7-8. Elements of flow resistance are expected to armor the drainage feature and make it less prone to erosion by surface flow in swales. In channels, resistance elements are expected to provide local checks on stream flow, reducing stream velocity and promoting local deposition of sediment. The survey team recorded the presence of an individual erosion feature the first time the element was encountered. Features were noted only once, even if there were multiple occurrences of a particular feature. Hence these data identify the range of types of resistance elements present.

Table 3.7-8 Resistance Elements	
Resistance Element	**Description**
Stumps	Tree stump located within the drainage feature axis.
Bedrock	Bedrock identified within channel axis.
Boulders/cobbles	Boulders or cobbles identified as channel substrate.
Large Woody Debris	Large woody debris located along the drainage feature axis.
Source: O'Connor Environmental Hydrologic Effects Analysis, May 2008.	

The effect of roads and skid trails on hydrologic processes pertains to existing features in the project area developed primarily for past timber management. This set of observations (See Table 3.7-9) characterizes the degree to which past road construction affected drainage features and runoff or stream flow processes. The survey team recorded the presence of a road feature the first time it was encountered. Features were noted only once, even if there were multiple occurrences of a particular feature. These data identify the range of types of road features present.

Table 3.7-9 Effects of Roads	
Effects of Roads and Skid Trails on Hydrology	**Description**
Minor-only at crossing, local effect	Road crosses drainage feature. No diversion of flow along road. Local erosion of road prism may be present.
Substantial-flow diversion of natural flow path	Water from drainage feature is diverted onto road and away from natural drainage path.
Road concentrates additional flow into drainage feature. Interception of water table in cut slopes	Road concentrates additional flow into drainage feature.
Interception of water table in cut slopes	Seep or spring observed in cut slope. Very moist soil or flowing water present.
Source: O'Connor Environmental Hydrologic Analysis, May 2008.	

Indicators of erosion potential are considered as a means to assess relative erosion potential and sensitivity to potential peak flow increase. The primary water quality concern in the Gualala River watershed is sediment, in particular fine sediment that can be carried in suspension over long distances to stream reaches supporting fish habitat. Peak flow increase and associated fluvial erosion that could potentially result from timberland conversion is the mechanism considered in this EIR. The extent and degree of channel development can be used as indicators of erosion potential in headwater drainages.

A headwater drainage characterized as a swale, and lacking a defined channel, is considered to have higher sensitivity to concentrated peak flow increases (e.g. vineyard runoff collected in a drainage system and discharged at a point into a headwater drainage). Drainages containing higher proportions of existing channel are considered less sensitive to such flow increases; an existing channel would already have been subject to fluvial erosion and would have developed some degree of stability compared to what may be expected in a swale exposed to concentrated flow.

Furthermore, the degree of stability and erosion potential of a channel or swale would be indicated by the channel substrate. Channels with boulders or bedrock forming the channel bed are stable with low potential for increased erosion in response to increased flow. Channels with beds comprised of fluvial sediment have been previously eroded to some degree such that finer sediment (e.g. clay and silt) has been winnowed out of the bed material and coarser sediment (e.g. sand and gravel) remains on the bed. The coarser bed material left on the bed resists erosion up to a peak flow threshold, hence the bed is relatively resistant to erosion for a range of lower magnitude flows. Channels or swales with organic litter, such as debris from trees, leaves and duff, have a substantial layer of material protecting underlying soil from erosion. Finally, bare soil is vulnerable to erosion, and could be expected to have a higher erosion rate in response to peak flow increase.

Another indicator of a channel's relative sensitivity to peak flow increase in terms of potential increased fluvial erosion is channel cross sectional area. Channel cross sectional area is proportional to flow magnitude. Wider and deeper channels would be expected to be less susceptible to erosion caused by an increase in flow than a narrower channel; the proportion of flow increase would be less in the larger channel than in the smaller channel.

Erosion potential could be expected to be proportional to slope, but this is frequently not the case in the project area. Swales and channels with steeper slopes are potentially more susceptible to erosion; however, few swales and channels observed in the field have relatively steep slopes. This is largely because areas proposed for vineyard development are located on gentle to moderate slopes lying upslope from steeper terrain. Where the steeper terrain develops, there is typically sufficient drainage area and slope to support an energetic stream channel that has cut down to relatively stable substrate, frequently the underlying Franciscan bedrock.

It should be noted that both the West Yost and O'Connor assessments focused on peak flow increases in the small drainages that feed Patchett Creek. An evaluation of peak flows on tributaries to Grasshopper Creek or Little Creek were not developed because impacts to these watersheds associated with the proposed project would be significantly less than the impacts anticipated on Patchett Creek.

Summer Flows

West Yost notes that late summer and early fall stream flows are dominated by groundwater recharge, with some runoff occurring during occasional rainfall events. Based on a review of available information, salmonid populations are believed to be present in the lower reaches of Patchett Creek during the summer and late fall months, starting approximately 4,800 feet downstream of the project area (the location of Node 1 discussed above). Therefore, West Yost evaluated the potential impacts of the proposed project to flows in this downstream reach of Patchett Creek. As with the peak runoff analysis above, tributaries to Grasshopper and Little Creeks were not evaluated.

West Yost relied in part on studies conducted in Mendocino County at Jackson State Forest's Caspar Creek Experimental Watersheds in order to evaluate potential effects of the proposed

project to summer flows. The USDA Forest Service Redwood Sciences Laboratory, in conjunction with CDF, has conducted extensive research on watershed-scale hydrologic processes at Jackson State Forest. The Caspar Creek Experimental Watersheds were established in 1962 as a cooperative effort between the USDA Forest Service Pacific Southwest Research Station and CDF to research the effects of forest management on streamflow, sedimentation, and erosion in the rainfall-dominated, forested watersheds of north coastal California. Currently, 21 stream sites are gauged in the North Fork (484 ha) and South Fork (424 ha) of Caspar Creek. The project has evolved from a simple paired watershed study into one of the most comprehensive and detailed investigations of its kind. From 1971 to 1973, 50 percent of the timber volume in the South Fork was selectively cut and tractor yarded, and from 1989 to 1991, 48 percent of the North Fork basin was clearcut and cable yarded. Three unlogged tributaries serve as controls.

At Caspar Creek, annual runoff increased an average of 15% (ranging from 6 to 29%) for monitoring periods of about 10 years following harvest. The above levels of flow increase were observed in the North Fork and South Fork of Caspar Creek in successive watershed experiments on fish-bearing perennial streams with drainage areas greater than 1,000 ac. Minimum mean daily summer flows increased an average of 148% following clearcut harvesting of about 50% of the watershed of North Fork Caspar Creek (Keppeler1998). The smallest annual increase was 75% and the largest was 287% over the period 1990-1997. Increased minimum flows in the dry season at Caspar Creek resulted in “increased habitat volumes, and…lengthened the flowing channel network along logged reaches” (Keppeler, 1998, p. 43).

A summary of the Caspar Creek study information is presented in the O’Connor report. As stated in that report, the Caspar Creek research suggests that annual water yield and summer stream flows can be expected to increase due to the following factors:

- Reduced evapotranspiration that occurs when forest canopy (trees) are replaced vineyard crops;
- Use of stored winter runoff flows to meet vineyard evapotranspiration demands in lieu of stored groundwater (that is used to maintain existing vegetation).

WYA reviewed the Caspar Creek study reports and agrees with these conclusions presented in the O’Connor report.

It should be noted that the extrapolation of results from the Caspar Creek study to analyzing potential impacts of timberland conversion projects involves some uncertainty. The North Fork Phase of the Caspar Creek project focused on monitoring the impacts of clearcuts in a second growth coast redwood/Douglas-fir forest; it is reasonable to assume that conversion areas would be hydrologically similar to clearcut areas initially, and with respect to the gross effects of such projects on primary hydrologic processes (evapotranspiration). Beyond the initial time period, probably a period of a few years, the extrapolation is less reliable, and there is a lower confidence in results. The proposed monitoring program has been proposed, in part, to account for this uncertainty.

Late Summer Rainfall Capture

There has been some suggestion by project critics that impacts to summer flows would occur due to the development of the sump and reservoir, which would capture all runoff flows from approximately 36 acres of the project area (total capture area of 41.5 acres including the reservoir). The proposed operation of the sump and reservoir is to collect and store runoff in the reservoir during the winter months. During the spring and summer months it is anticipated that any runoff that occurred would not be pumped to the reservoir. The only runoff that would be captured during the summer is that falling on the 5-acre reservoir. Furthermore, as discussed above, the change in land use would result in an increase in runoff as compared to existing conditions. Therefore, any runoff captured by the reservoir would be mostly offset by increased runoff resulting from development of the proposed vineyard. In addition, at low flow conditions, a portion of the flow in Patchett Creek would also originate from groundwater seeps and interflow.

Late summer and early fall runoff flows are expected to increase as a result of the proposed project. Information collected from similar watershed areas indicate that logging practices within coastal hillslope areas can lead to an increase in groundwater recharge due to decreased evapotranspiration. Therefore, the overall impact to downstream summer flows is probably small but is uncertain. Please refer to Chapter 3.4, Biological Resources, for an in depth discussion of potential impacts to salmonids resulting from the changes to the onsite hydrologic conditions associated with the proposed project.

Flood Hazard

The project site is located approximately one-half mile southeast of Annapolis atop Beatty Ridge, a broad, flat ridge. According to the project THP, major high flow events occurred in the Gualala Basin in 1955, 1964, 1974, 1986, 1993, 1995, and 1997. Recent high flow events are believed to have had no significant adverse impact on the current watercourse conditions, and have in fact been beneficial, contributing to the recovery of habitat by flushing stored sediment through the system.

West Yost notes that site elevation and terrain make it unlikely that flooding would be an issue on the site. The review of the relevant FEMA Flood Insurance Rate Maps (FIRMs) conducted by West Yost confirms that the vineyard development area has not been identified as an area susceptible to flooding from local creeks. Additionally, due to the rural nature of areas downstream of the project site, significant downstream flooding effects to people or structures would not be anticipated from the proposed project.

Other Studies for Watersheds within the Region

As discussed in depth in the O'Connor Environmental Hydrologic Analysis, the proximity and general similarity of the Caspar Creek watershed to the project site near Annapolis indicates that the experimental results at Caspar Creek would be generally applicable at the project site. The Caspar Creek watershed, located in Mendocino County a few miles from the coast about halfway between the communities of Ft. Bragg and Mendocino, has similar climate, soil and

geologic conditions compared to the site near Annapolis. In addition, the similarities in watershed size allow qualitative extrapolation of experimental results to the project site.

Watershed experiments regarding the effects of harvesting redwood forests on streamflow and water quality have been conducted in the region for over 30 years at Caspar Creek. Watershed studies in the Pacific Northwest, indicate that increases in storm runoff during the first few rainstorms of the season may be large, however, "[t]hese first rains and consequent streamflow in the fall are usually small and geomorphically inconsequential in the Pacific Northwest" (Ziemer 1998). These early winter increases in storm runoff have been attributed to reduced evapotranspiration from forest vegetation during the growing season, resulting in increased soil moisture. In other words, following harvest, forest vegetation draws less water from the soil via its root system and more of the rain water that enters the soil during the wet season remains in the soil or moves by gravity into surface or sub-surface channels, or percolates to groundwater aquifers.

Interception and evaporation of rainfall by forest canopy is a significant hydrologic process in forest ecosystems. Studies have found that interception losses in temperate forests average approximately 20 percent. Studies in Caspar Creek found that about 25 percent of annual rainfall was intercepted by forest canopy in experimental plots located in 100 year-old stand of redwood and Douglas-fir at Caspar Creek. Approximately a tenth of the intercepted rainfall reached the forest floor via stemflow, hence about 22 percent of the annual rainfall is evaporated. In larger storms (about 3 inches rainfall), interception losses were approximately 21 percent, somewhat less than the annual average. Interception losses are equivalent to approximately 8 to 9 inches of additional precipitation that would reach the soil surface annually. This is particularly relevant to the analysis of likely effects of the conversion project because these changes in interception and evaporation during the winter are believed to be the primary mechanism responsible for hypothesized peak flow increases under project conditions.

At Caspar Creek, annual runoff increased an average of 15 percent (ranging from 6 to 29 percent) for monitoring periods of about 10 years following harvest. Minimum mean daily summer flows increased an average of 148 percent following clearcut harvesting of about 50 percent of the watershed of North Fork Caspar Creek. Increased minimum flows in the dry season at Caspar Creek resulted in "increased habitat volumes, and…lengthened the flowing channel network along logged reaches" (Keppeler, 1998, p. 43; as quoted in the O'Connor Environmental Hydrologic Effects Analysis).

The Caspar Creek experiments also found increases in peak storm runoff following clear cut harvest of 50 percent of the North Fork watershed. For storms with a recurrence interval of about 2 years, which generate peak runoff greater than about 0.11 cfs per acre of watershed area, there was a mean peak flow increase of 27 percent in the five clearcut tributaries. For the entire North Fork watershed (1,170 ac), the instantaneous peak flow increase for a 2-yr recurrence interval was 9 percent for an area that was 50 percent harvested.

Increases in total storm runoff were similar to those for peak runoff. Under the wettest antecedent conditions, total storm runoff volume increased 27 percent for clearcuts and 16 percent for partially harvested watersheds. Percentage increases were higher when antecedent

wetness was lower. Annual storm runoff volume for all storms increased 60 percent in clearcut watersheds and 23 percent in partially harvested watersheds. Statistical analyses of the runoff data that were designed to determine factors that significantly affect runoff rates found that only logged area and antecedent wetness were important.

Global Climate Change

As recognized by the passage of the Assembly Bill 32, the California Climate Solutions Act of 2006, global climate change is a growing concern both in California and around the world. Scientists have determined with a high degree of certainty that the observable warming of the global climate is influenced by the emission of greenhouse gases (GHG), particularly carbon dioxide.

Climate Change has the potential to alter the existing hydrological environment in a number of ways. Increased temperatures have the potential to increase evapotranspiration, alter rainfall patterns, as wells as alter the habitat for existing native habitats leading to changes in ground cover and forestation. Currently, Climate Change models are primarily focused on global changes, and potential changes to specific locations are speculative. California is primarily concerned with the potential for reductions in snowfall (with the moisture coming down as winter rain), which would lead to flooding and water shortages; and rising sea levels. As the project site is fed by rainwater, the increase in rains, and corresponding decrease in snowfall, would not be expected to adversely impact available water supply for the proposed project.

Regulatory Context

Existing policies, laws, and regulations that would apply to the proposed project are summarized below.

Federal

Federal Emergency Management Agency (FEMA)

The Federal Emergency Management Agency (FEMA) operates the National Flood Insurance Program, which issues maps of Special Flood Hazard Areas (SFHA), based on water surface elevations of the one-percent (100-year) flood event. For any project that would result in a change to the designated 100-year floodplain, a Conditional Letter of Map Revision (CLOMR) is required to be issued by FEMA prior to the initiation of any construction activities. FEMA would issue CLOMRs to modify the elevations and/or boundaries of the Special Flood Hazard Areas (based on the 100-year flood event). FEMA requires assurance by the participating community that minimum floodplain management requirements are complied with, including minimum floor elevations above the “base flood,” existing lands and structures or proposed structures are “reasonably safe from flooding,” and that all supporting analysis and documentation used to make that determination is on file and available upon request. The supporting hydraulic analysis and documentation includes new topographic data and certification by a registered professional engineer or licensed land surveyor.

The floodplain areas are identified on the FIRMs published by FEMA.

Federal Clean Water Act

Construction Site Runoff Management

As authorized by the Clean Water Act (CWA), the National Pollutant Discharge Elimination System (NPDES) permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States. The proposed project would occupy approximately 190 acres in the South Fork Gualala River watershed.

Impaired Watersheds

Section 303(d) of the CWA calls for the designation of "impaired waterbodies" to be applied to any watershed exceeding specified thresholds for various pollutants or water temperatures. The South Fork of the Gualala River currently falls under the Section 303(d) designation of impairment for sediment.

State

California Department of Forestry and Fire Protection

The California Department of Forestry and Fire Protection (CDF) enforces the regulations that address timber harvesting on privately owned lands in California. These regulations are found in the Z'Berg-Nejedly Forest Practice Act of 1973, which relates to the use, restoration, and protection of forest resources providing timber products, recreational lands, wildlife habitat, watershed protection, and fisheries maintenance, among other uses. Additional rules enacted by the State Board of Forestry and Fire Protection are also enforced to protect these resources.

CDF ensures that private landowners abide by these laws when harvesting trees. Although specific exemptions occur in some cases, compliance with the Forest Practice Act and Board rules apply to all commercial harvesting operations for landowners of small parcels, to ranchers owning hundreds of acres, and large timber companies with thousands of acres.

Under the Forest Practice Act, Timber Harvesting Plans (THPs) are submitted to CDF for commercial timber harvesting on all non-federal timberlands. The plans are reviewed for compliance with the Forest Practice Act and rules adopted by the State Board of Forestry and Fire Protection as well as other state and federal laws that protect watersheds and wildlife. CDF foresters also do on-site inspections of proposed logging sites. THPs must be prepared by Registered Professional Foresters, and harvesting operations must be carried out by Licensed Timber Operators (LTOs) certified by the Department. CDF annually reviews approximately 400 THPs and performs 7,500 inspections.

In March of 2002, the Board of Forestry and Fire Protection adopted a set of changes to the Forest Practice Rules designed to protect anadromous fish. The adopted changes pertain to the amendments of Forest Practice Rules in Title 14 CCR affecting timber harvesting throughout

the state. Among many other sources of information considered by the Board of Forestry and Fire Protection in preparing the proposal for rule changes in 2002, a comprehensive review of the California Forest Practice Rules (FPRs), with regard to their adequacy for the protection of salmonid species, was prepared for the Board (Report of the Scientific Review Panel [SRP report], 1999). Following an extensive review of the regulations, the SRP report concluded that "the FPRs, including their implementation (the 'THP process') do not ensure protection of anadromous salmonid populations" (Report of the Scientific Review Panel, 1999). Although this report was specific to the North Coast region, the Board believes that many of the recommendations made in the report can be effectively applied throughout the state to ensure the protection of the beneficial uses of water, including fisheries and other aquatic habitat, while avoiding significant economic impacts. An analysis of the rule changes can be found at http://www.bof.fire.ca. gov/pdfs/TIISOR2003.pdf.

A summary of the changes follows:

Intent

- Defines "watersheds with threatened or impaired values" and recognizes that they exist and need special prescriptions for timber harvesting activities.
- Specifies that the intent of timber operations in and around those Watercourse and Lake Protection Zones (WLPZ) within watersheds with threatened or impaired values is to ensure beneficial uses of water and that riparian zones be fully protected from site-specific and cumulative impacts of timber operations.
- Beneficial uses of water and the functions of riparian zones shall be :
  1. Maintained if in good condition;
  2. Protected where threatened; and
  3. Restored where impaired.

Protection

- Protection must also be provided for riparian functions.
- The watercourse and lake protection measures set forth in the Rules are minimum protection measures; additional protection or restoration must be provided where water-related values are threatened or impaired.

Watersheds with Threatened or Impaired Values

- Every timber operation shall meet the following goals:
  1. Not result in any measurable sediment load increase.
  2. Not result in any measurable decrease in stability of watercourse channel or bank.
  3. Not result in any measurable blockage of aquatic migratory routes.
  4. Protect and maintain stream flows during low water periods.
  5. Protect and restore trees for large woody debris recruitment.
  6. Protect shade canopy for stream temperature control.
- 150-foot minimum WLPZ for all Class I streams with 85% overstory shade canopy retained. Overstory shade shall be 85% for the first 75 feet and 65% for the next 75 feet.

- No salvage logging is allowed in a WLPZ without an approved Habitat Conservation Plan (HCP), Sustained Yield Plan (SYP) or approved plan.
- Large woody debris (LWD) standards are prescribed for Class I watercourses.
- No-cut buffers within Class I watercourses out to the transition line.
- Pre-THP adverse cumulative watershed effects shall be considered.
- Watercourse Transition Line is 2 times the bankful depth for confined channels. For unconfined channels, the watercourse transition line is the line defined by the landward margin of the most active portion of the channel zone area readily identified in the field by riverine hardwood and conifer trees at least 25 yrs in age.
- During the winter period no skid trails, landings or roads shall be constructed or used on slopes over 40%.
- RPFs shall identify all active erosion sites and address remediation in the plan.
- Site preparation shall be designed to prevent movement of soil into a watercourse.
- Logging road crossings of Class I watercourses must not disrupt normal hydrologic and biologic processes and must have a stable bed.

Roads and Landings

- New road construction shall be designed to minimize the adverse effects of long-term site occupancy of the transportation system.
- New and reconstructed logging roads shall be no wider than needed for the widest equipment to be used and single lane with adequate turnouts for safety.
- Specific provisions of construction shall be identified for roads on slopes greater than 50 percent or must be properly engineered when using cuts and fills.
- All Class I constructed or reconstructed watercourse crossings must allow for passage of 100 yr flood flows, sediment and debris, as well as passage of all life stages of fish.

It should be noted that many of these rule changes pertain to Class I, year-round fish-bearing watercourses, which do not exist on the project site.

<u>State Water Resources Control Board</u>

The State Water Resources Control Board (SWRCB) and the local Regional Water Quality Control Boards (RWQCBs) are responsible for ensuring implementation and compliance with the provisions of the federal CWA and California's Porter-Cologne Water Quality Control Act (Cal. Water Code §§13000-14920). Pursuant to Section 401 of the Clean Water Act and USEPA 404(b)(1) Guidelines, an applicant for a federal permit to conduct any activity which may result in discharge into navigable waters must provide a certification from the applicable Regional Water Quality Control Board (RWQCB) that such discharge would comply with the state water quality standards (Cal. Code Regs. tit. 23, §§3830 et seq.).

Under the Porter-Cologne Act, the RWQCB is authorized to regulate the discharge of waste that could affect the quality of the state's waters. "Waste" is broadly defined by the Porter-Cologne Act to include "sewage and any and all other waste substances, liquid, solid, gaseous, or radioactive, associated with human habitation, or of human or animal origin, or from any producing, manufacturing, or processing operation of whatever nature […]" (Cal. Water Code §13050). Concentrated silt or sediment associated with human habitation and harmful to the

aquatic environment is "waste" under this section. In addition, the California Attorney General has interpreted this definition to include extraction of sand, gravel or other minerals from a streambed, because it may cause an increase in turbidity and silt in the waters of the stream downstream from the operations. Therefore, even if a project does not require a federal permit (e.g., a Nationwide Permit for the USACE), the project may require review and approval of the RWQCB. The RWQCB has a policy of no-net-loss of wetlands in effect and typically requires mitigation for all impacts to wetlands before it will issue a water quality certification or waiver thereof.

The project site is situated within the jurisdiction of the North Coast Regional Water Quality Control Board (NCRWQCB). The NCRWQCB has the authority to implement water quality protection standards through the issuance of permits for discharges to waters at locations within its jurisdiction. Water quality objectives for the Gualala River and its tributaries are specified in the Basin Plan prepared by the NCRWQCB in compliance with the federal CWA and the Porter-Cologne Act. The Basin Plan establishes water quality objectives and implementation programs to meet stated objectives, and to protect the beneficial uses of water in the Gualala River Basin and other watersheds under NCRWQCB jurisdiction. Because the project site is located within the NCRWQCB's jurisdiction, all discharges to surface water or groundwater are subject to the Basin Plan requirements.

The runoff capture system supplying the proposed reservoir would capture only overland sheet flow (or "diffused surface flows"), and would not draw water from any channel on the project site. Under the California Water Code, the collection of sheet flow or diffused surface flow does not require an appropriative permit from the State Water Resources Control Board. Because the proposed reservoir would be located off-channel and would be used for agricultural purposes, the reservoir would be exempt from regulation and permitting pursuant to California Water Code §6004(a). However, the applicant would still be required to obtain an official exemption from the State Division of Dam Safety.

Pursuant to the California Forest Practices Act and the applicable Management Agency Agreement(s) and Memoranda of Understanding between the North Coast Regional Water Quality Control Board ("Regional Water Board") and the California Department of Forestry, the Regional Water Board will review the THP to determine whether the proposed timber operations will result in a discharge into any watercourse that has been classified as impaired due to sediment pursuant to subsection (d) of Section 303 of the Federal Water Pollution Control Act. The Gualala River is the only watercourse downstream from the Project area that is classified as impaired due to sediment. If the Regional Water Board determines, based on substantial evidence, that the THP will result in a sediment discharge to the Gualala River, the Regional Water Board must then determine whether the discharge will cause or contribute to a violation of the Water Quality Control Plan for the North Coast Region.

Division of Dam Safety

The State Department of Water Resources' (DWR) Division of Dam Safety is responsible for reviewing plans and specifications for the construction of new dams or for the enlargement, alteration, repair, or removal of existing dams, under application, and must grant written

approval before the owner can proceed with construction. Professional engineers and geologists from the Division evaluate each project, investigate proposed sites, and check available construction materials. For dams that are exempt from SWRCB permitting and dam safety requirements, such as the proposed Fairfax Conversion Project reservoir, the Division of Dam Safety must still issue an official exemption.

California Department of Fish and Game

The California Department of Fish and Game (CDFG) exercises jurisdiction over wetland and riparian resources associated with rivers, streams, and lakes under California Fish and Game Code §1600-1607. CDFG has the authority to regulate work that will substantially divert, obstruct, or change the natural flow of a river, stream, or lake; substantially change the bed, channel, or bank of a river, stream, or lake; or use material from a streambed.

CDFG jurisdiction generally extends to the "hinge points" on the top-of-bank of opposing channel banks and/or the full lateral extent of riparian vegetation beyond the top-of-bank. Definitions used in the identification of CDFG jurisdiction are contained in various documents including the Fish and Game Code, Title 14 of the California Code of Regulations (Hernandez 1999), and *A Field Guide to Lake and Streambed Alteration Agreements, Sections 1600-1607, California Fish and Game Code* (1994a). The areas generally include rivers, streams, creeks, or lakes. In addition, canals, aqueducts, irrigation ditches, and other means of water conveyance can also be considered streams if they support aquatic life, riparian vegetation, or stream-dependent terrestrial wildlife.

The bed and banks of the Class II and III waterways, including any aquatic habitat within the Ordinary High Water Mark (OHWM), and any riparian woodland extending beyond their banks are potentially subject to the regulatory jurisdiction of the California Department of Fish and Game under Sections 1602. A Streambed Alteration Agreement would be required prior to any work within the bed and banks, and associated riparian woodland of any on-site Class II waterways, and may be required for work within the bed and bank of any Class III waterways determined to be subject to Section 1602 (See Chapter 3.4, Biological Resources, of this Draft EIR for additional discussion).

Local

Sonoma County General Plan Goals and Policies

The 1989 Sonoma County General Plan is applicable to the proposed project. The General Plan sets forth various goals, policies, and programs that would apply to projects in the County of Sonoma. The following hydrology and water quality related goals, objectives, and policies are applicable to the proposed project.

Goal RC-3 Conserve, enhance, and manage water resources, protect their quality, and assure an adequate long term supply of water for domestic, fishing, industrial and agricultural use.

Objective RC-3.1	Preserve watersheds and groundwater recharge areas by avoiding the placement of potential pollution sources in areas with high percolation rates.
Objective RC-3.2	Provide development standards in recharge areas to maintain groundwater supplies.
Objective RC-3.3	Preserve and enhance the quality of surface and groundwater resources.
Objective RC-3.4	Insure that land uses in rural areas be consistent with the availability of groundwater resources.
Policy RC-3a	Grading, filling and construction should not substantially reduce or divert any stream flow that would affect groundwater recharge.
Policy RC-3b	Require groundwater monitoring programs for all large scale commercial and industrial uses using wells.
Policy RC-3c	Continue to encourage research on and monitoring of local groundwater, watersheds, streams, and aquifer recharge areas in order to determine their water supply value.
Policy RC-3h	Require proof of adequate groundwater in Class III and IV water areas. Require test wells or the establishment of community water systems in Class IV water areas. Test wells may be required in Class III areas. Deny discretionary applications unless a geologic report establishes that groundwater supplies are adequate and will not be adversely impacted by the cumulative amount of additional development.

Sonoma County Water Agency

The SCWA's mission is to effectively manage the County's water resources for the benefit of people and the environment, through resource and environmental stewardship, technical innovation, and responsible fiscal management. The SCWA is responsible for administration of water supply, flood control, wastewater treatment, fisheries protection and restoration, and water-based recreation in Sonoma County.

Sonoma County Drainage and Stormwater Management Ordinance

Chapter 11 of the Sonoma County Code regulates all acts that obstruct or diminish free flow of floodwaters in channels or waterways within the County (Ordinance No. 4803 § 1 and 1994: Ord. No. 1108 § 15). A permit for any of the following acts is required:

(a) Impair or impede or obstruct the natural flow of storm waters or other water running in a defined channel, natural or man-made, or cause or permit the obstruction of any such channel.
(b) Deposit any material in such channel.
(c) Alter the surface of land so as to reduce the capacity of such channel.
(d) Construct, alter or repair any storm water drainage structure, facility or channel without first obtaining a permit therefore, as provided by this article.
(e) Commit any act, within any easement dedicated for drainage purposes that will impair the use of such easement for such purpose.
(f) Place any material along the sides of any defined channel or so close to the side of such channel as to cause such material to be carried away by flood waters passing through such channel.
(g) Construct any structure within 100 feet of the top of any embankment, natural or man-made which defines a channel, except structures constructed on a lot in a subdivision where the flood hazard has been found to be remote in the review by the county water agency.

All drainage structures and facilities shall be designed and constructed according to the Sonoma County Water Agency's flood control design criteria (Ord. No. 4981 § 5, 1996.). Section 11-25 protects and enhances the water quality of Sonoma County's watercourses pursuant to and consistent with the Federal Clean Water Act and amendments, and assures compliance with the conditions set forth by the National Pollution Discharge Elimination System (NPDES) as requirements of stormwater discharge permits. The release of non-stormwater discharges to the County's stormwater system is prohibited without an NPDES permit.

Sonoma County Vineyard Erosion and Sediment Control Ordinance (VESCO)

VESCO restricts planting of vineyards on slopes in excess of 50 percent. In addition, the Ordinance requires the creation and submittal of an erosion and sediment control plan prior to undertaking any vineyard work. The Ordinance includes specific requirements for vineyard plantings, sediment and erosion control plans, and restricts the dates on which initial vineyard planting may be undertaken to between April 1st and November 15th.

Impacts and Mitigation Measures

The impacts to hydrology and water quality regarding the proposed project are analyzed and assessed in this section.

Standards of Significance

A hydrology or water quality impact would be significant if the proposed project were to:

- Violate any water quality standards or waste discharge requirements;
- Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (i.e., 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);
- Substantially alter 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 off site;
- Substantially alter 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 off site;
- Create or contribute runoff water that would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff;
- Otherwise substantially degrade water quality;
- Place housing within a 100-year floodplain, as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map;
- Place within a 100-year floodplain structures which would impede or redirect flood flows; or
- Expose 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.

Method of Analysis

<u>Water Quality Methodology</u>

Erosion and Sedimentation

The O'Connor assessment evaluates potential increases in erosion and sediment yield associated with development of proposed vineyards on the project site. The potential significance of impacts is greatest in downstream areas of Patchett Creek that are thought to be accessible to anadromous salmonids, primarily steelhead. Evaluation of potential erosion and sedimentation effects of the project on Patchett Creek and on the Wheatfield Fork Gualala River can be accomplished by developing a sediment source analysis (the erosion components of watershed sediment budget) for the Patchett Creek watershed.

The sediment source analysis was developed using techniques commonly employed in development of sediment budget for mountainous, forested areas. O'Connor Environmental used existing studies of the Gualala River watershed and field observations to develop a quantitative sediment source analysis specifically for Patchett Creek. Erosion rate estimates

for the proposed project area, including proposed vineyard fields, were determined from application of a new USDA soil erosion model. This modeling effort utilized substantial geographic information developed for the analysis of project effects on peak runoff.

Gualala River Watershed TMDL for Sediment

O'Connor Environmental reviewed the USEPA total maximum daily load (TMDL) assessment for sediment which was completed for the Gualala River watershed in late 2002. The TMDL assessment was based on the North Coast Regional Water Quality Control Board (Regional Board) *Gualala River Watershed Technical Support Document for Sediment* (TSD). Recommendations in these two documents were incorporated into the Hydrologic Analysis and the Erosion Analysis for the proposed project.

Soil Loss Estimates

Soil loss calculations were developed by O'Connor Environmental using the Revised Universal Soil Loss Equation - 2 (RUSLE2) for the following conditions:

- Existing conditions;
- Post-project conditions without sediment basins; and
- Post-project conditions with sediment basins.

The RUSLE2 method is the latest refinement of the USLE method, which tended to overestimate erosion rates in upland settings such as the project area. The approach of determining soil loss is intended to obtain a comparison of pre- and post-project soil loss rates. The major input parameters for estimated soil loss using RUSLE2 are as follows:

- Land Use Templates;
- Annual Precipitation and Soils;
- Soil Gradient and Slope Length; and
- Soil Erosion Rates and Sediment Yield.

The RUSLE2 model was used to develop quantitative estimates of erosion rates by surface processes for the proposed vineyards, existing vineyards on adjacent properties, and existing grasslands. Erosion rates from existing forests in the project area are also estimated. These quantitative erosion rates were used in the sediment source analysis for the Patchett Creek watershed to evaluate potential changes in water quality resulting from the project.

Non-forested portions of the watershed with grassland cover at the former Sonoma County landfill site (adjacent to the refuse transfer station) were assumed to be non-contributing with respect to any potential grassland erosion owing to runoff control measures in place on that site. Some erosion probably occurs on the landfill site that contributes suspended sediment to the Patchett Creek watershed; the assumption that off-site delivery does not occur is conservative because the assumption tends to magnify the estimated contribution of the project watershed sediment load relative to existing conditions. Similarly, the negligible estimated

surface erosion rates for forested areas are conservative in that they reduce the estimated background erosion rate, thereby increasing the relative magnitude of potential project effects.

Land Use Templates

The RUSLE2 database contains land use templates for Crop Management Zones (CMZ) distributed across the United States. A land use template is a compilation of management operations, vegetation and organic residue defined over specific periods of the calendar year. Sonoma County is located in CMZ 45. Within the templates are specific management options, and opportunities for customization. A custom template was created for forest and vineyard uses, as discussed in the Erosion Analysis contained in Appendix M of the DEIR.

Annual Precipitation and Soils

A mean annual rainfall of 58 inches was used for all model estimates. The value is based on interpretation of National Oceanic and Atmospheric Administration (NOAA) maps. Both Goldridge Fine Sandy Loam and Hugo Very Gravelly Loam characteristics are contained in the RUSLE2 database and were modeled.

Slope Gradient and Slope Length

RUSLE2 allows model estimates to distinguish between vine rows oriented parallel to the slope and perpendicular to the slope. O'Connor Environmental developed slope lengths based on the Erosion Control Plan prepared by Erickson Engineering.

The slopes were calculated by Erickson using 100-foot transects perpendicular to the contour within approximately 100-foot grid cells. This methodology resulted in a representative slope over about 0.70-acre on average, and an average slope of 11.7 percent for the entire site. This slope determination methodology is acceptable per the Sonoma County Vineyard Erosion and Sediment Control Ordinance; however, other techniques may yield different results.

The methodology used to develop the average site slope does not describe maximum or minimum slopes because of the averaging nature of the procedure. However, Erickson estimates that the minimum slope ranges from zero to three percent and the maximum slope ranges from 35 to 40 percent based on previous experience and knowledge of the site. Maximum slopes are located in small isolated areas, generally due to rock outcrops and topography irregularities. Areas with slopes exceeding 50 percent do not exist on the project site.

As defined by the Sonoma County Vineyard Erosion and Sediment Control Ordinance the proposed project is a Level II Planting. This is because the average slope is between 10 and 15 percent, and the dominant soil series on the project site (Goldridge soils) are highly erodible.

Soil Erosion Rates and Sediment Yield

Slope data was analyzed in conjunction with soil type, vegetative cover, and watershed to which drainage and eroded soil would be delivered. Table 3.7-8 contains the erosion rates for

soils and vegetation of various lengths and slopes. It should be noted that slopes of 25 percent and 35 percent with a slope length of 200 feet would not occur in the proposed vineyard, but provide an upper boundary for the estimated erosion rates. Estimated erosion rates provided in Table 3.7-10 were applied to acreages (See Tables 4 and 5 of the O'Connor Environmental Erosion Analysis contained in Appendix M of this DEIR) to determine estimated annual sediment yield from the project area.

Table 3.7-10
Estimated Annual Erosion Rates for Soils and Land Uses (t/ac/yr)

Template Scenario		Mean Slope					
Vine rows and alley management, soil type and planting orientation	**Slope Length (ft)**	**4%**	**8%**	**12%**	**16%**	**25%**	**35%**
Goldridge Fine Sandy Loam – rows perpendicular to flow	60	0.077	0.110	0.160	0.220	-	-
Goldridge Fine Sandy Loam – rows perpendicular to flow	200	0.082	-	-	-	-	-
Goldridge Fine Sandy Loam – rows parallel with flow	60	0.140	0.170	0.250	0.330	-	-
Goldridge Fine Sandy Loam – rows parallel with flow	200	0.150	0.230	0.350	0.480	0.620	0.850
Hugo Very Gravelly Loam – rows perpendicular to flow	60	0.110	0.170	0.250	0.330	-	-
Hugo Very Gravelly Loam – rows perpendicular to flow	200	0.120	-	-	-	-	-
Hugo Very Gravelly Loam – rows parallel with flow	60	0.110	0.170	0.250	0.330	-	-
Forested (woodland) cover	**Slope length (ft)**	**5%**	**15%**	**25%**	**35%**		
Goldridge Fine Sandy Loam (GdE) – forested	200	0.0003	0.0007	0.0010	0.0013		
Goldridge Fine Sandy Loam (GdE) – forested	500	0.0003	0.0007	0.0011	0.0014		
Hugo Very Gravelly Loam (HkF) – forested	200	0.0004	0.0010	0.0016	0.0020		
Hugo Very Gravelly Loam (HkF) – forested	500	0.0005	0.0011	0.0016	0.0021		
Grassland (pasture) cover	**Slope length (ft)**	**5%**	**15%**	**25%**	**35%**		
Goldridge Fine Sandy Loam (GdE), grassland	100	0.26	0.83	1.5	2.0		
Goldridge Fine Sandy Loam (GdE), grassland	300	0.30	1.1	2.0	2.9		

Source: O'Connor Environmental, Erosion Analysis, May 2008.

Patchett Creek Watershed Peak Flow Estimates

West Yost estimated peak runoff flows under existing and post-project conditions for the Patchett Creek watershed using the SCS Curve Number Method and HEC-1 modeling. As stated previously, it should be noted that this approach was selected to facilitate development of a quantitative estimate of project effects on peak runoff. Other methods for predicting peak flow (e.g. US Geological Survey NFFv3.2 program, or unit area runoff estimates from gage data), for the area of interest produce substantially lower estimates of peak flow as shown in Tables 3.7-4 and 3.7-5. Such methods, however, are empirically based and cannot be used to estimate project effects on runoff rates. The HEC-1 modeling results seem reasonable for conducting a comparative analysis to predict the percentage change in peak flows due to land use modification. However, the absolute values of peak stream discharge may be conservatively overstated when compared to estimates prepared using other hydrologic methodologies.

Similarly, rational runoff methods used for the smaller-scale project area runoff analysis may tend to overestimate peak flows. Despite the differences between empirical estimation techniques and the peak runoff techniques used in these analyses, the techniques used are appropriate for the intended use: developing quantitative estimates of the likely percentage of change in peak flow under project conditions. Potential peak flow increases in tributaries of Grasshopper Creek or Little Creek were not evaluated because project-associated impacts to these watersheds were anticipated to be significantly less than those projected on Patchett Creek.

HEC-1 Model Analysis

Peak storm flows were determined at two locations (Nodes) on the Patchett Creek as shown on Figure 3.7-8. Node 1 is located just below the second major confluence on Patchett Creek (estimated to be approximately 4,800 feet downstream from the vineyard discharge point), where the creek is described as having a very steep section that “blocks the migration of salmonids,” according to the RWQCB PH1 report (Erickson March 26, 2002). The tributary area at this node is 830 acres. Below this location Patchett Creek would be defined as a Class I watercourse. Node 2 is defined as the confluence of the Patchett Creek and the Wheatfield Fork of the Gualala River. The tributary area for this node is approximately 1,124 acres. Peak runoff calculations were made for the 24-hour 2-year, 10-year and 100-year events using an HEC-1 model of the watershed.

Although the runoff from approximately 36 acres (out of a total 830 acres draining to Node 1) on the project site will be captured in the onsite storage reservoir, it was conservatively assumed for purposes of this analysis that the reservoir would be full and that all flows would be directed to Patchett Creek. However, during most storm events, the reservoir will not be full and a small portion of the total site runoff would be collected and pumped to the reservoir for storage. Under such operating conditions, the peak runoff under a 2-year storm is estimated to decrease by 4 percent at Node 1 and by 3 percent at Node 2.

The HEC-1 model requires the following input parameters to define peak runoff:

- Basin Area
- Weighted Average Curve Number
- Precipitation Depth
- Lag Time

Following a description of each of these parameters, a summary of the results from the HEC-1 analysis peak flow are presented. Please refer to the Hydrologic Evaluation (Draft EIR Appendix O) for detailed information.

Basin Area

The study area was delineated into subsheds for each individual tributary area within the project site, as shown in Figure 3.7-9. Each of these sub-basin areas were defined using a scaled USGS quad map and an aerial photograph on which the vineyard project boundaries were overlaid. Areas estimated using the AutoCAD computer program are presented in Table 3.7-11.

Table 3.7-11
Estimated Tributary Areas for Nodes on Patchett Creek

Node	Area
Node 1	1.30 sq.mi. (830 acres)
Node 2	1.76 sq.mi. (1,124 acres)

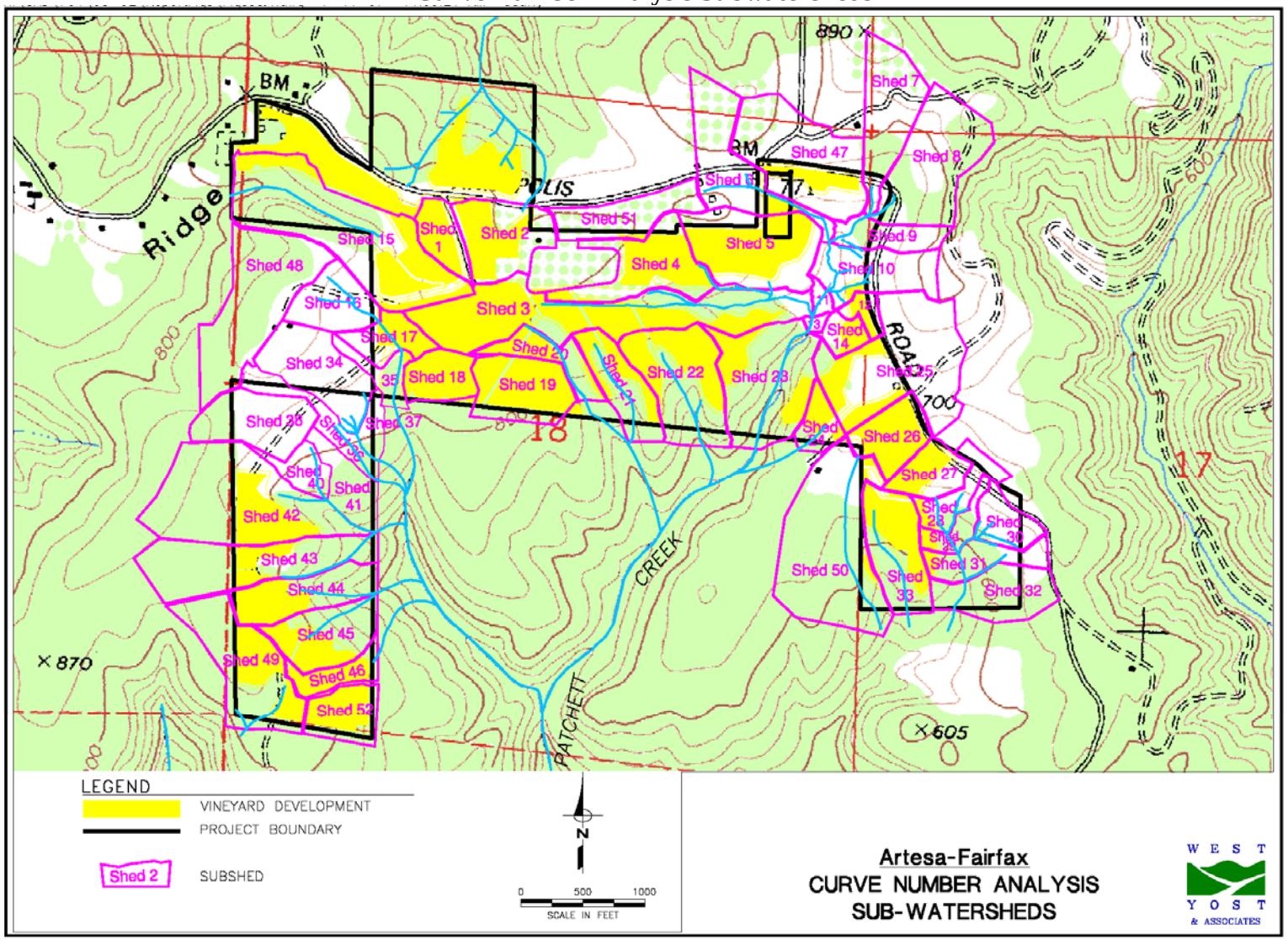
Note: Areas draining into Patchett Creek include some areas beyond the project boundary.

Source: West Yost & Associates, July 15, 2008.

Weighted Average Curve Number

Using the USGS quad map and available aerial photographs, the percentages of each type of land use and cover was estimated for both the existing and future conditions within each subshed, and the weighted average curve number was calculated. Curve Numbers for the Forest and Open Pasture land uses within the project area were obtained from the NRCS manual. However, NRCS does not define a Curve Number for vineyard areas; therefore, a value was assumed for this area that is slightly lower than open pasture. This is justified because groundcover in the vineyard area would be closely managed to approximately 80 percent cover. Furthermore, in the event that groundcover crops are not adequate to assure 80 percent coverage, mulching at a rate of 2 tons per acre would be applied.

Figure 3.7-9
Curve Number Analysis Subwatersheds



Precipitation Depth

Rainfall intensity for Sonoma County is defined in the Sonoma County Water Agency Flood Control Design Criteria Manual. The calculated 2-year, 10-year, and 100-year 24-hour precipitation depths are shown in Table 3.7-12.

Table 3.7-12
Estimated Precipitation Depth for Patchett Creek Watershed

Return Period	24-Hour Rainfall, inches
2-yr	6.73
10-yr	8.52
100-yr	11.95

Source: West Yost & Associates, July 15, 2008.

Lag Time

Table 3.7-13 provides a summary of the estimated travel time (in minutes) calculated for each node described above. As noted in the table below, the estimated travel time for the pre- and post-project conditions is not anticipated to change.

Table 3.7-13
Estimated Travel Time for Nodes within the Patchett Creek Watershed

Storm Event Return Period	Total Travel Time to Node 1, minutes	Total Travel Time to Node 2, minutes
2-yr	43.3	56.4
10-yr	35.6	43.4
100-yr	35.6	43.4

Note: Travel times for pre- and post-project conditions are not anticipated to change.

Source: West Yost & Associates, July 15, 2008.

Peak Flow Estimates at Project Boundaries

Owing to the small size of the drainage areas involved, modest data requirements, and relative simplicity of the technique, the "rational runoff method" was selected by O'Connor Environmental for their Hydrologic Analysis. This technique is often used in developing flow estimates for culvert sizing and other hydraulic design problems. The rational method utilizes a simple formula, Q = C I A, where instantaneous stream discharge, Q (cfs) is the product of a runoff coefficient pertaining to the character of the watershed C, the precipitation rate I (in/hr), and the drainage area A (ac).

The limitations of estimating peak flows using any method, including the rational runoff method, are substantial. Hydrologic systems are complex, many of the variables are

difficult to quantify, and models rarely produce precise results. The method employed by O'Connor Environmental is expected to give peak flow estimates that are of the proper order of magnitude, but of undetermined accuracy. Of greater importance is generating an estimate of relative change for pre- and post-project conditions, and the technique used provides repeatable estimates of relative change using accepted methods and data inputs of a level of detail consistent with available data.

The O'Connor Hydrologic Analysis utilized GIS data and tools to compute pre- and post-project conditions. Geographic Information System (GIS) tools were used to calculate watershed drainage areas for different portions of the project area and adjacent portions of the landscape. This required creating a series of attributes for areas within the analysis including existing vegetation type (grassland, woodland, or existing cultivated crops), future cover and land use type (new proposed vineyard areas), local slope gradient of the land surface, and existing and future drainage characteristics (natural subwatersheds and future drainage routed through proposed sedimentation basins). The GIS was also used to produce maps illustrating critical components of the hydrologic and erosion analyses.

The project area, including adjacent upstream drainage areas, was sub-divided into 18 sub-watersheds terminating in small stream channels at drainage nodes at or near the project boundary. The average contributing drainage area to these 18 drainage nodes is 23.8 acres.

Two adjacent drainage nodes on the northern edge of the project area contribute flow to Grasshopper Creek. Another two other nodes on the western edge of the project area contribute flow to two unnamed tributaries of the Wheatfield Fork west of Patchett Creek. The remaining 14 drainage nodes contribute flow to Patchett Creek.

Water Supply Methodology

The applicant has designed the project such that the vineyard water supply would be developed from surface water runoff from a 36-acre watershed within the project area. Major factors of concern when evaluating the potential runoff that can be collected from this watershed are as follows:

- Runoff Factors
- Annual Average Rainfall
- Sump Pumping Capacity

Runoff Factor

In the Water Availability Report,[11] Erickson Engineering estimates that the surface runoff factor for this area ranges between 30 and 60 percent. Sonoma County Water Agency (SCWA) Flood Control Design Criteria Plate B-1 shows an appropriate rainfall runoff factor for an area covered in vegetation would be 45 percent. From discussions with SCWA staff, a reasonable estimate for runoff in this area would be 40 percent. Additionally, NOAA has published rainfall and runoff maps for the Annapolis area that

indicates for the period from 1931 to 1970 the average annual runoff was approximately 40 percent. Therefore, 40 percent is assumed to be the annual average runoff factor.

Average Annual Rainfall

Two certified rainfall isohyetal graphs that have been developed for this area were evaluated to determine the approximate annual average rainfall. An isohyetal graph developed by the Sonoma County Water Agency shows an annual average rainfall in the Annapolis area of approximately 70 inches. This average was developed based on a period of record from 1872 to 1983 (111 years). The National Oceanic and Atmospheric Administration (NOAA) has also developed a rainfall isohyetal graph for the area that shows the annual average rainfall for the Annapolis area of approximately 58 inches. This information was developed based on a period of record from 1931 to 1970 (39 years).

Typically, the longer period of record would likely be considered more reliable for long-term planning. However, both of these isohyetal graphs were developed using data from the Fort Ross rain gauge, which is the closest long-term rain gauge near the site. When looking at historic rainfall amounts for this gauge, rainfall amounts from 1872 to 1920 (when old growth redwood forests covered the hills to the east) compared with rainfall from 1921-2000 show a dramatic difference in the average annual total. In the 47 years from 1872-1920, the average rainfall was 54.18 inches annually. This contrasts with an average of 38.38 inches in the 79 years since.

The rainfall data measured at Fort Ross, Healdsburg, and Ukiah are provided in Attachment B of Appendix N to this DEIR. Note that the long-term rain gauge records in the area for Ukiah and Healdsburg do not show the same changes noted for the Fort Ross gauge. However, the rain gauge type at Fort Ross was changed in 1939 to a standard 8-inch model (USDC, 1955), which may have affected these averages. Therefore, although the NOAA period of record is shorter, it may be a more accurate representation of long-term rainfall patterns.

For purposes of the analyses presented in this report, it has been conservatively assumed that the average annual rainfall for the project area is 58 inches when developing water supply estimates. However, for determination of runoff volumes it will be conservatively assumed that the average annual rainfall is 70 inches.

Sump Pumping Capacity and Available Water Supply

Details regarding the sump pumping capacity are provided in the Water Availability Report. Several pump capacities were compared to various runoff events to determine the runoff capture efficiency. The determination was made that a 4 cfs pump would capture about 78 percent of total rainfall volume under an average annual rainfall of 58 inches (assuming 40 percent runoff).

Total capture of both the 36-acres tributary watershed and the 5.5 acres of the sump and reservoir would be about 80 acre-feet. As a result, complete recharge of the reservoir

from dry conditions is anticipated under an average year of rainfall. Capture efficiency would be reduced under wetter than average conditions, but complete recharge is probable because greater rainfall would also occur.

To determine the effects of vineyard conversion and estimate the available water supply, the SWRCB modified rational method was used to estimate the annual runoff from the watershed under both existing and proposed project conditions. The total watershed area encompassing the proposed project, draining to both Patchett Creek and Grasshopper Creek, is about 429 acres. Up to 160 acres is assumed to be converted from woodland to vineyard. Assuming an average annual rainfall of 58 inches, the resulting annual volume of runoff under existing conditions would be about 677 acre-feet and under proposed conditions the annual runoff would be about 754 acre-feet. This is an increase of 77 acre-feet. Therefore, the proposed project appears to have a sufficient water supply without adversely impacting the downstream creeks.

Irrigation Demands

Details regarding the estimated irrigation demands for the proposed vineyard were provided in the Water Availability Report. As discussed in that report, estimated maximum irrigation demands during vine establishment would be 100 gallons per vine per year. At a density of 1,090 vines per acre, the total irrigation demand would be approximately 1/3 acre-foot per acre per year.

The Water Availability Report states that estimated plantable area is approximately 135 acres. However, for determining irrigation demand 160 acres was used to provide flexibility in planting densities and to account for potential variation in plantable acreage during the development of the vineyard site. Therefore, it has been conservatively assumed that a total of 56.3 acre-feet of irrigation demand will be required.

Water for washing and other incidental needs of vineyard workers will be provided by a small onsite well.

System Losses

In addition to irrigation demands, stored water in the vineyard reservoir will be lost due to evaporation and seepage. As discussed in the Water Availability Report, seepage losses will be eliminated by the use of a lined reservoir. It should be noted, however, that if a clay liner is used, some seepage may occur; but a synthetic liner will provide assurances that no seepage occurs. For purposes of this analysis it has been assumed that a synthetic liner will be used.

The Water Availability Report estimates that evaporative loses in the Annapolis area are approximately 40 inches per year. This also compares closely with information presented by USGS and the California Department of Water Resources (DWR). Therefore, it has been determined that 40 inches per year is a reasonable estimate for evaporation in the

project area. Assuming 40 inches of evaporation, the reservoir would lose about 12.7 acre-feet due to evaporation.

Irrigation system losses may also be a concern for long-term irrigation supply planning. Losses in a subsurface-type irrigation system are limited to deep percolation, which is affected by site-specific conditions such as soil type, crop type, meteorological conditions, system design and management. Typical efficiency ratings for a subsurface irrigation system range from 85 to 95 percent (*Irrigation System Design – An Engineering Approach*, Cuenca, R.H., 1989). Due to the expected high degree of management that would be used on the site, the estimated efficiency of the proposed project irrigation system is assumed to be 95 percent.

Supply-Demand Water Balance

West Yost developed a water balance analysis regarding irrigation demands and storage reservoir capacity for the proposed project under average annual conditions, assuming that the water supply, irrigation demand, and system loss parameters described above adequately represent the project site.

The reservoir capacity required to meet annual irrigation needs and system losses for 160 acres of vineyard is approximately 67 acre-feet. The proposed reservoir has a capacity of approximately 73 acre-feet, providing about 8 percent reserve. Therefore, there should be adequate water supply (with some carry-over water supply) to meet the consumptive demands of the proposed project in an average rainfall year if 160 acres of vineyard are developed. The annual stored water volume required if only 135 acres of vineyard are irrigated as proposed would be about 57 acre-feet.

It should be noted that the analysis presented in this report is only intended to provide an indication of water supply needs. The actual required water supply would be contingent upon very site specific conditions.

Groundwater Recharge and Related Water Balance Analysis

An additional water balance analysis was conducted by O'Connor Environmental as it specifically relates to groundwater supply/recharge. O'Connor Environmental conducted field observations of outcrops of the Franciscan Formation at the project site, in combination with hydrogeologic maps and descriptions, to reveal the general hydrogeologic character of the site. The Caspar Creek data was applied to the site specific information to analyze the project's effects on groundwater recharge, and to develop a water balance analysis.

Fog Drip

The hydrologic effect of fog drip has been directly investigated at Caspar Creek by the USDA Forest Service.[12] Fog drip analysis within this document is based on the findings

of the Caspar Creek studies as outlined in the Hydrologic Effects Analysis conducted by O'Connor Environmental.

Flood Hazard

As part of the Hydrologic Evaluation, West Yost conducted a flooding analysis. The following information related to potential flooding of the proposed project is presented below:

- FEMA Mapping
- Peak Runoff Flows Calculations
- Streambed Alteration Impacts

FEMA Mapping

Although flooding is not likely to be an issue due to the site elevation and terrain, West Yost reviewed FEMA flood insurance rate maps in order to determine if flooding could have a potential impact to the vineyard development area. Upon inspection of these maps, West Yost determined that the proposed vineyard development would not be susceptible to flooding from local creeks.

Peak Runoff Flows

As stated above, peak runoff flows would slightly increase as a result of the proposed vineyard development. However, due to the rural nature of the downstream areas, West Yost found that this increase would not likely contribute to downstream flooding effects.

Streambed Alteration Impacts

West Yost notes that slopes within the project area would be maintained in their natural position as much as possible to avoid modifying existing drainage patterns during project implementation. Furthermore, the proposed project would not result in new equipment entries into the Class II and Class III watercourses adjacent to the proposed timber conversion and vineyard area, and WLPZs would be established around all of these watercourses. Therefore, the proposed project would be exempt from California Department of Fish and Game Streambed Alteration Permit requirements.

Project-Specific Impacts and Mitigation Measures

3.7-1 Impacts relating to irrigation water availability.

The proposed project would result in the harvest of approximately 171 acres of standing timber and development of a 135-acre vineyard on Artesa's 324-acre property. As described in the project Erosion Control and Mitigation Plan (ECP), the proposed vineyard would obtain irrigation water by way of a surface water collection and storage system. The system would capture 100 percent of the

stormwater runoff, as diffuse upland sheet flow, from an approximately 36-acre area. Approximately 62 percent of the volume delivered to the two acre-foot sump pond would then be pumped to an upland off-channel 73 acre-foot reservoir proposed for seasonal storage. The reservoir would be recharged by a combination of captured sheet flow and direct precipitation on an annual basis. The applicant does not propose to use groundwater for vineyard irrigation.

The reservoir would be installed during the summer and fall of the year before vineyard planting would begin; this would allow the reservoir to be filled from winter rains. Vineyard planting in the spring would then have access to a full reservoir to irrigate the young vines. As noted in the Project Description Chapter of this EIR (Chapter 2.0), drought-resistant, deep-rooted grapevine rootstock will be planted on-site for all vineyard units. Furthermore, the vineyard would likely be established over a two to three year period; therefore, the full irrigation amount would not be required immediately. As a result, there would be flexibility to adjust the plantings to climatic conditions should the vineyard begin operations during a below average water year. However, for the purposes of this Draft EIR the analysis conservatively evaluates the full planting of the vineyard during the first year.

The *Vineyard Water Availability Evaluation* (See Appendix P) (VWAE) prepared by Erickson Engineering notes that estimated maximum irrigation demands during the vine establishment phase, typically the first three years, would be 100 gallons per vine per year. However, as noted in the VWAE, during vineyard establishment, small vines do not normally require the full design application rate.

According to the VWAE, at a density of 1,090 vines per acre, the maximum total irrigation demand would be approximately 0.33 acre-feet per acre per year, or roughly 56.3 acre-feet per year (afy).[13] The applicant estimates that irrigation would be necessary every one to three weeks during vine establishment. Although the proposed net (plantable) vineyard area is 135 acres, the reservoir volume was designed conservatively to allow for any minor design changes that may occur; the result is a predicted residual storage volume at the end of each irrigation season. The residual storage volume would carry over to the next year, which would help ensure that with the exception of multiple dry years the vineyard would begin the season with a full reservoir. In addition, given the conservative sizing of the reservoir, a partially full reservoir would be sufficient to irrigate the vineyard during multiple dry years.

Stored water is susceptible to loss through evaporation and seepage. The ECP estimates that evaporative water losses in the Annapolis area are approximately 40 inches per year. However, because evaporative losses were factored into the reservoir design, viticultural demand would be met throughout the season under such conditions. Additionally, proven non-toxic evaporation control chemicals, which create a film over surface water, are widely available. Seepage losses would be minimized or eliminated by the use of a synthetic liner in reservoir

construction. Use of a synthetic liner is preferable because unlike clay liners, synthetic liners do not experience seepage. Irrigation runoff would not occur with use of the drip system; irrigation system losses from a subsurface irrigation system such as the one proposed are limited to deep percolation. The West Yost Hydrologic Evaluation for the proposed project assumes the estimated efficiency of the proposed irrigation system to be 95 percent.

After vine establishment, water demand would be expected to be reduced substantially. The applicant has stated that once the vines are established (typically three years after planting), dry-farming would be used to the extent feasible. That is, water from the proposed reservoir would not be applied to the vineyard for irrigation purposes under average climatic conditions. The Hydrologic Evaluation notes that according to Rhonda Smith from the U.C. Cooperative Extension, an anticipated 100 gallon per vine water demand is reasonable for this area and dry-farming could potentially occur, depending on site-specific conditions.

However, in the event of dry climatic conditions during the post-establishment phase, water stored in the proposed reservoir could be used for irrigation. Soil moisture monitoring, which would take into account the specific soil characteristics of each vineyard block, would indicate whether or not drip irrigation would be necessary during the season. The proposed project would be seeking low grape yields (2-3 tons per acre) to ensure a high-quality product, because vine growth during the summer months has undesirable effects on grape characteristics, only the minimum amount of water needed to keep the leaves healthy would be used. In the event of unfavorably dry conditions, sub-optimal irrigation practices would conserve water, yet still result in healthy vines and good productivity. Under drought conditions the applicant has indicated that they would forgo a grape crop to maintain the health of the vines. Using trucks to haul water to the site is not considered an option due to the size of the vineyard and the prohibitive cost associated with the practice. The applicant also believes that using water for frost protection would not be necessary at this location, resulting in additional water conservation.

It should also be noted that per CAL FIRE's request, the project applicant has agreed to allow CAL FIRE to utilize the on-site reservoir for short-term water supply purposes in the event of a nearby wildfire. The following discussion demonstrates that even if it is assumed that CAL FIRE would temporarily utilize the on-site reservoir for fire protection purposes -- an event which is considered somewhat unlikely given that, typically, CAL FIRE does not require supplemental water sources -- a more than adequate surplus of water would remain in the reservoir for vineyard irrigation purposes, if necessary.

The proposed reservoir design is for 73 acre-foot (ac-ft) plus a two (2) ac-ft sump. One (1) acre-foot is 43,560 cubic feet (cu. ft.) x 7.49 gallons/cu. ft. = 326,264 gallons. Fire season is typically in the September-October time-frame,

prior to onset of winter rains. Thus, approximately 2/3 -3/4 of the irrigation season will have been completed when the typical fire season commences, and the least critical irrigation time-frame would remain. Assuming 1/4 of 73 ac-ft remains (total reservoir storage volume), there would be approximately 18.25 ac-ft = 5.95 million gallons of water remaining in storage at time of potential CAL FIRE demand. According to the project engineer, any fire service demand will be negligible relative to total storage capacity, and minor relative to probable storage capacity during the fire season.

Based on the conservative assumptions utilized in the Hydrologic Evaluation, the 135-acre (net) vineyard would have adequate water supply during average-year conditions for vineyard establishment purposes. In addition, the project design and proposed vineyard product allows for the reduction of water use during drought years. Therefore the impact of the proposed project relating to irrigation water availability would be considered ***less-than-significant***.

Mitigation Measure(s)
None required.

3.7-2 Impacts to surface water quality from timber harvest and vineyard construction-related erosion and sedimentation.

Timberland harvest involves selective removal of merchantable trees. The subsequent conversion involves residual slash collection and removal, stump removal, root picking, and other activities as discussed in the vineyard development section of the Project Description (See Chapter 2.0). A comprehensive and seamless approach to erosion control and runoff management will be present, covering the transition from temporary harvest and conversion activities through vineyard installation and throughout the year.

Historic logging activities in the region and in this watershed were held to few if any standards with regard to erosion controls, runoff management, logging road removal/management, slash management, and similar factors. As a result, temporary and long-term watershed sediment budgets were likely negatively impacted by the results of those historic activities. Observations as to watershed-wide negative impacts of historic logging activities as expressed in the NCRWQCB *Gualala River Watershed Technical Support Document for Sediment* (TSD) do not necessarily apply to this project, because the operational parameters and methodologies are not comparable. Current Forest Practice Rules, Water Quality objectives, and Sonoma County Vineyard Ordinance rules are much more stringent in this regard, and multiple agencies now exercise considerable review and oversight on planning, implementation, and post-project management of timber harvest and conversion activities. The California Forest Practice Rules, as currently written and enforced, include detailed provisions for water quality protection. The project THP would be reviewed by CDF to ensure that water quality protection measures comply with the current California Forest Practice

Rules. In conformance with the Forest Practice Rules, heavy equipment would be excluded from the Watercourse and Lake Protection Zones (WLPZs) established adjacent to the existing Class II and III watercourses on the 324-acre property. The WLPZs would function as vegetation filter zones surrounding the watercourses between the planned vineyard blocks, and would be of adequate width to ensure that any sediment eroded during the timberland conversion process would be unlikely to reach these watercourses. In order to protect the integrity of the WLPZs, trees marked for harvest and directly adjacent to any WLPZ would be felled away from the creek so as to protect the integrity of the adjacent watercourses during yarding operations.

For a project of this size and complexity, phased development is expected. Incremental areas would be harvested, followed immediately by the initial conversion activities. From a benefit-cost standpoint, and from an installation efficiency standpoint, installing temporary infrastructure-type erosion control measures, followed by replacement with permanent measures in the following year, is not practicable. Therefore, permanent measures such as detention basins and surface drainage improvements would be installed following site preparation to serve both temporary and permanent runoff control functions (see a discussion of this in Impact 3.7-3 below).

Timber harvest and conversion activities, as well as subsequent vineyard installation activities are limited to dry summer months (April 1 to October 15). Likelihood of significant rain is relatively low during the time period April 1 to May 31, however, in some past years there has been significant rainfall and runoff in late spring. In many other years, there has been very little rainfall and runoff in this period. Activity on the project site beginning April 1 would necessarily be conditioned on weather and soil conditions such that the chance of runoff transporting sediment off site would be extremely low and/or mitigated by erosion control measures. In late summer and early fall (i.e. September and early October) runoff in response to initial seasonal rainfall would be mitigated by high expected infiltration of dry soil disturbed by tree removal and related vineyard preparation activity. During the work period, area-wide exposure to wind and rain erosion is expected to be minimal because work would occur during summer months when rainfall is not expected and wind conditions are usually light to moderate. During initial harvest, logging slash would provide effective soil mulch. After stump, root, and slash removal, any necessary minor shaping and grading would occur. Drainage and detention basin systems would be installed. Straw mulch at 4,000 lb/ac would be installed per Sonoma County Vineyard Ordinance requirements and would help maximize soil infiltration rates. The combination of near-continuous ground cover and drainage system development is expected to minimize exposure and risk of sediment transport from vineyard work areas.

Timber removal would result in a temporary haul road system extending into the major harvest areas. The property has been logged in the past, and the basic road and trail system is already present and appropriately located. Reconditioning and reuse of the old haul roads would minimize soil disturbance related to timber harvest. Assuming feeder trails spaced at about 500 feet on center results in an estimated road system length of less than 24,000 feet in the +-190-acre conversion area. For 10-foot road widths, the transportation corridors consume about 5.3 acres, less than 3 percent of the total work area.

Temporary soil compaction due to equipment operation may occur in the transportation corridors, with potential for reduced infiltration, should rainfall occur. The roads would generally be surrounded by areas subject to increased permeability because of soil disturbance associated with stump and root removal. Standard Best Management Practices including straw mulch, outsloped roads, water bars, fiber rolls, and the like would be employed on an as-needed basis to prevent runoff and soil migration from haul roads and other disturbed areas. The combination of dry season construction, advanced planning, effective runoff management, and installation of permanent drainage features is expected to result in no significant risk of sediment mobilization from the work areas.

As part of the permitting process, a State of California mandated Storm Water Pollution Prevention Plan (SWPPP) would be developed and implemented. The Plan requires comprehensive assessment and planning for minimizing risk of sediment export from the work areas. After BMPs are in place, supplemental stockpiled materials would be maintained on-site for use in emergency situations, should they arise.

Conclusion

Nevertheless, construction activities create substantial site disturbance, and removal and replacement of vegetative cover creates potential for accelerated erosion. Some potential exists for erosion to occur in unexpected locations or at unexpected rates, particularly in the first winter after construction. Therefore, the impact would be considered ***potentially significant***.

Mitigation Measure(s)

The current California Forest Practice Rules require the implementation of extensive water quality protection measures for timber harvesting activities such as the one proposed. Implementation of the mitigation measures listed below would reduce timber harvest-related sedimentation impacts to project area waterways to a *less-than-significant* level.

3.7-2(a) *All timber harvesting activities on the project site, including harvest-associated road construction and maintenance, shall comply with California Forest Practice Rules water quality protection measures, as described in the Timber Harvest Plan prepared for the proposed project and approved by the Department of Forestry. These measures include, but are not limited to, the following:*

- *Timber harvesting or timber operations shall not take place within the WLPZ adjacent to the conversion THP area;*
- *The Licensed Timber Operator (LTO) shall utilize directional felling of timber adjacent to the WLPZ away from the zone, in order to protect the integrity of the zone;*
- *The LTO shall not pile dirt and debris within or adjacent to the edge of the WLPZs;*
- *Branches and tops of conifers, root wads, and hardwoods shall not be piled up for burning adjacent to WLPZs;*
- *Timberland conversion operations (i.e., non-merchantable vegetation removal and stump removal) shall be immediately followed by initial vineyard development operations. Where this is not possible, skid trails and areas of exposed mineral soil created by commercial timber harvest operations shall be grass-seeded and mulched at 90 percent cover prior to November 15 of the timber harvesting season;*
- *Operations between October 15 and November 15 shall cease when three (3) inches of rainfall has been recorded on-site;*
- *The LTO shall not place, discharge, or dispose of or deposit in such a manner as to permit to pass into the waters of the state, any substance or materials, including, but not limited to, soil, silt, bark, slash, sawdust, or petroleum, in quantities deleterious to fish, wildlife, beneficial functions of riparian zones, or the quality and beneficial uses of water; and*
- *The LTO shall not remove water, trees, or large woody debris from a watercourse or lake, the adjacent riparian area, or the adjacent flood plain in quantities deleterious to fish, wildlife, beneficial functions of riparian zones, or the quality and beneficial uses of water.*

3.7-2(b) *All temporary roads located within the project area and used to remove timber from the site shall be located away from streambeds, on slopes that are less than 15 percent and in areas that are currently stable. With the exception of the two permanent*

roads, all existing seasonal roads, tractor roads, and landings shall be abandoned and planted with vines and/or groundcovers following completion of timber harvesting operations. In the event that timber harvesting operations cannot be immediately followed by vineyard development, tractor roads shall have drainage and/or drainage collection and storage facilities installed as soon as practicable, but prior to October 15.

3.7-2(c) *Fill material for the two temporary truck crossings shall be removed from the watercourse channel to form channels that are as close to the natural grade and orientation as possible. The constructed channels shall be wider than the existing channels. The excavated material and any resulting cut banks shall be sloped back from the channel and stabilized to prevent slumping and to minimize soil erosion. The two temporary truck crossings shall be removed subsequent to the completion of timber operations. The disturbed soil on the approaches to the crossings shall be seeded and mulched prior to October 15 of the first timber harvesting season.*

3.7-2(d) *Existing permanent roads on the project site shall be improved (and in some cases reconstructed) in conjunction with development of this project, reducing the sediment loadings from existing road gullies.*

3.7-2(e) *Road construction on the project site shall be carried out utilizing the following criteria identified in the ECP as being in conformance with the Technical Support Document (TSD) for the Gualala River Watershed Water Quality Attainment Action Plan for Sediment (CWRCB, 2001):*

- *Roads shall be outsloped and graded to prevent flow in wheel tracks;*
- *Water bars shall be placed at a maximum of 100 feet off center where slopes are greater than 15 percent;*
- *Rocked fords shall be installed through seasonal swales or runoff areas;*
- *Roadside ditches shall be graded and shaped;*
- *Cut and fill slopes shall be consistent with slope stability and available access corridors; and*
- *Side cast materials shall be stabilized by slope limits, compaction, mulching, and seeding.*

3.7-2(f) *Skid trails associated with the project shall not be used during the winter season (November 15th through April 1st), and shall be abandoned upon completion of harvesting activities. In the event*

that timber harvesting operations cannot be immediately followed by vineyard development, skid trails shall be grass seeded and mulched as specified above.

3.7-2(g) *The applicant shall provide for annual inspection of project-associated decommissioned logging roads, to assure gullying and erosion is not occurring..*

Please refer to the Timber Harvest Plan (Draft EIR Appendix E) for further information.

3.7-2(h) *Prior to issuance of grading permits, the applicant shall obtain applicable NPDES permits from the North Coast Regional Water Quality Control Board and comply with all applicable programs. Compliance with the Permit requires the project applicant to file a Notice of Intent (NOI) with the State Water Resources Control Board (SWRCB) and prepare a Storm Water Pollution Prevention Plan (SWPPP) prior to construction. The SWPPP would incorporate Best Management Practices (BMPs) in order to prevent, or reduce to the greatest extent feasible, adverse impacts to water quality from erosion and sedimentation: the SWPPP shall be provided for the review and approval of the SWRCB.*

Post-Construction Monitoring

3.7-2(i) *The following Post-Construction Monitoring Plan shall be implemented by the project applicant for the review and approval of the California Department of Forestry and Fire Protection and the Sonoma County Permit and Resources Management Department. This post-construction monitoring plan is intended to supplement the project ECP and SWPPP for the first winter season after project construction. The monitoring plan may apply to specific sub-areas of the project, and could extend for more than one year, depending on the ultimate construction schedule. This monitoring plan shall be implemented for areas where site preparation has occurred in the prior construction season, including soil preparation, grading and drainage installation. The first-year post-construction monitoring requirement is fulfilled if the monitoring period follows all grading and drainage work, regardless of whether vineyard planting and cover crops have been established. If site preparation work is conducted, but final grading and drainage installation is not complete, this monitoring plan will extend to the subsequent winter until final grading and drainage work is complete. This monitoring plan may be combined with provisions of the ECP or SWPPP as appropriate subject to governing regulations.*

The post-construction monitoring plan has three components:

1. *Review of ECP and SWPPP provisions and implementation.*
2. *Field inspections triggered by rainfall events.*
3. *Response and reporting.*

ECP and SWPPP Review

These erosion and drainage control plans are prepared by professional engineers, and are reviewed and enforced under local and State regulatory authority. The monitoring plan will use these plans, consisting of maps with specific installations and Best Management Practices (BMPs), to define specific objectives of field inspections. The ECP and SWPPP will define anticipated erosion locations and processes. The monitoring plan will consist of a checklist and maps derived from the ECP and SWPPP that guide field inspection of project work areas, particularly the perimeters where eroded sediment and runoff would be delivered from source areas.

Field Inspections

On-site inspections of portions of the project area subject to monitoring will occur in response to rainfall events as specified here. ECP and SWPPP requirements typically include complete installation of winter erosion control measures between October 1 and October 15. Rainfall reported for the Venado gage site located in the Coast Range in northwest Sonoma County will be used to determine the timing of field inspections. Real time data from this rain gage can be accessed via the internet from either of the following URLs:

- *http://cdec.water.ca.gov/*
- *http://www.cnrfc.noaa.gov/precipMaps.php?group=rn&hour=24&synoptic=0*

The first field inspection will occur within two days following the first rainfall exceeding 1-inch in a 24 hour period beginning October 1. The second field inspection will occur when one of the two following conditions are met: 1-inch of rainfall in a 24 hour period after cumulative seasonal rainfall of 6 inches has occurred, or 2 inches of rainfall in a 24 hour period. A third inspection would occur after 1-inch of rainfall in a 24 hour period following seasonal accumulation of 12 inches of rainfall. Thereafter, inspections would occur following 2 inches of rainfall in 24 hours

or within four weeks of the previous inspection, whichever occurs first.

It is expected that any significant erosion problems will have developed and been addressed within the first few substantial rainstorms, and that there would be a diminishing likelihood of identification of new problems after the first few inspections. After a total of six inspections have been performed according to the protocol above, subsequent inspections are optional and may be performed at the discretion of the project proponent. Inspections are not required within 7 days of any prior inspection, regardless of rainfall.

Field inspectors will survey the portions of the site subject to monitoring and complete a visual inspection of the site guided by the checklist and maps developed during the ECP and SWPPP review. Supplemental documentation of conditions using photography is encouraged, but is not required. The checklist developed will be the primary reporting document and will include the following elements:

- *Observation date, time, weather conditions, precipitation event or other circumstances requiring inspection, observers name and contact information, name and contact information for project personnel responsible for maintenance and repair of erosion control measures.*
- *A map developed for the monitoring program with cross-references between areas identified on ECP and SWPPP maps and checklist items.*
- *Field assessment of erosion control measures as adequate or requiring immediate additional controls or repairs.*
- *Measurements or quantitative estimates of volume of eroded and deposited material, referenced to a location, and assessment of whether sediment was delivered to a watercourse.*

Response and Reporting

The field inspector will provide advance notice of inspections, to the extent possible, to responsible project personnel to facilitate immediate response should it be necessary. If the field inspection identified any locations requiring immediate attention to repair or expand erosion control measures, the inspector shall contact responsible project personnel as soon as possible. A copy of the inspection checklist will be provided to responsible project personnel via facsimile or e-mail for review within 24 hours of the

inspection. Project personnel will provide a written summary of any erosion control measures implemented in response to the field inspection within 5 calendar days of receipt of the inspection report. A summary report for each winter monitoring season will be submitted not later than June 15 to the regulatory authorities responsible for review and implementation of the ECP (County of Sonoma) and SWPPP (NCRWQCB).

3.7-3 Impacts to surface water quality from vineyard-related erosion and sedimentation.

Development of the approximately 190-acre vineyard project site would involve substantial changes to the existing hydrological setting. Potential changes would include increased peak flows, which could lead to increased soil erosion and sedimentation.

Project Peak Flows

Project Boundary Estimates

Changes in topography and runoff management in the vineyard are expected to change surface flow paths relative to existing site conditions. Furthermore, removal of forest vegetation is expected to result in increased run-off rates. As a result, increases in winter peak flows could occur.

The O'Connor runoff analysis estimated the magnitude of peak flows pre- and post-project at several points around the project site where concentrated and/or dispersed runoff would be routed by the vineyard drainage system. The drainage nodes are shown in Figure 3.7-2. Calculated drainage areas and vegetation types for existing and proposed conditions and estimated design storm peak discharge for existing and proposed conditions and percentage change in discharge are summarized in Table 3.7-14.

The largest flow increase is about 76 percent at Drainage Node 60 and results from diversion of runoff from about 5 acres to a proposed sedimentation basin to minimize potential delivery of sediment from vineyard fields to stream courses. The next largest peak flow increase is 32 percent at Drainage Node 37, and several other drainages are predicted to experience peak flow increases between 20 and 30 percent. These predicted increases result from a relatively high proportion of conversion area in the watersheds contributing runoff to those drainage nodes.

Table 3.7-14
Existing and Post-Project Peak Flows (Estimated 2-yr Recurrence Interval Flows)

		Existing Conditions		Proposed Project Conditions		Peak Discharge		
Drainage Node	**Total Area (ac)**	**Woodland (ac)**	**Grassland & Cultivated (ac)**	**Woodland (ac)**	**Grassland & Cultivated (ac)**	**Existing (cfs)**	**Proposed Project (cfs)**	**% change**
N01	23.0	22.1	0.8	13.0	9.9	12.3	13.9	13%
N07	41.9	41.9	0	21.6	20.3	22.1	25.7	16%
N17	12.6	12.6	0	4.3	8.2	6.6	8.1	22%
N20	40.8	19.6	21.2	9.4	39.1 [a]	25.2	25.8 [b]	2% [b]
N26	5.8	5.8	0	1.2	4.6	3.1	3.9	26%
N30	22.3	10.7	11.6	3.7	18.6	13.8	15.0	9%
N31	38.8	36.1	2.7	27.1	11.7	21.0	22.5	8%
N33	10.5	10.5	0	5.6	4.9	5.5	6.4	16%
N35	3.5	3.5	0	0.9	2.6	1.8	2.3	24%
N37	8.0	8.0	0	0.3	7.8	4.2	5.6	32%
N40	6.9	6.9	0	2.3	4.6	3.6	4.4	22%
N45	27.8	27.8	0	6.5	13.5 [a]	14.7	12.9 [a]	-12% [a]
N50	111.2	58.4	52.8	47.5	63.7	68.0	69.9	3%
N20+N50	151.9	77.9	74.0	56.9	102.8	93.2	95.7 [b]	3% [b]
N56	27.2	22.7	4.5	18.7	8.5	15.2	15.9	5%
N60	12.1	11.9	0.3	3.9	13.2 [c]	6.5	11.4 [c]	76% [c]
N61	20.8	6.1	14.7	6.1	14.7	13.6	13.6	0%
N62	9.5	9.5	0	7.0	2.4	5.0	5.4	9%
N63	6.6	2.5	4.1	0.1	1.5 [c]	4.2	1.1 [c]	-73% [c]
Total	429.2	316.5	112.7	179.4	249.8			
				Total-Reservoir Filling		**246.5**	**263.9 [b]**	**7% [b]**
				Total-Reservoir Full, No Spill		**246.5**	**270.6**	**10%**

Notes: a) 7.8 acres of contributing area in Drainage Node 45 is diverted to Drainage Node 20 for reservoir supply.
b) Assumes 6.7 cfs of peak flow (pump capacity of 3000 gpm) diverted to reservoir at Node 20 with no spill from reservoir.
c) 5.0 acres in Drainage Node 63 diverted to Drainage Node 60 for treatment in sedimentation basin.

The large decrease (-73 percent) at Drainage Node 63 results from the diversion of 5 acres of contributing area to Drainage Node 60. The 5 acre of drainage area is a large proportion of the total drainage area for Drainage Node 63. The decrease in peak flow at Drainage Node 45 (-12 percent) reflects the diversion of 7.8 acres of watershed to the reservoir collection system located in Drainage 20; 7.8 acres represents a modest proportion of the drainage area for Drainage Node 45.

The project reservoir is located in the watershed of Drainage Node 20. During the period of reservoir filling, runoff collected in the reservoir sump (located very near to Drainage Node 20) would be pumped to the reservoir at a maximum rate of 6.7 cfs (3,000 gpm). A small increase (2 percent) in design storm peak flow is predicted at Drainage Node 20 during periods of reservoir filling. At Drainage

Node 50, including runoff from Drainage Node 20 (N20 + N50 in Table 6), peak flow increase is estimated to be about 3 percent when the reservoir is filling. When the reservoir is full, drainage to the reservoir sump is routed through from the sump to the bedrock channel at the bottom of Drainage 20. In this scenario, peak flow would increase about 29 percent at Drainage Node 20. At Drainage Node 50, with the increased runoff at Drainage 20 included, peak runoff is predicted to be about 10 percent.

The runoff collection system in the watershed above Drainage Node 20 will substantially reduce surface flows in the channel draining this area. Under existing conditions, the 2-yr recurrence interval design flow is about 25 cfs; under project conditions, the design flow would decrease to about 5 cfs. This flow reduction is expected to substantially reduce channel and bank erosion in this drainage and is discussed in greater detail in the Erosion Analysis.

Overall peak flow for the analysis area in aggregate increases about 10% if the reservoir is full and runoff is routed through the sump to Drainage Node 20. If the reservoir is being filled, then the aggregate change in peak runoff is an increase of about 7 percent.

Patchett Creek Watershed Estimates

Peak storm flows were determined by West Yost and Associates at two locations (Nodes) on the Patchett Creek as shown on Figure 3.7-8. Node 1 is located just below the second major confluence on Patchett Creek (estimated to be approximately 4,800 feet downstream from the vineyard discharge point), where the creek is described as having a very steep section that "blocks the migration of salmonids", according to the RWQCB PH1 report (Erickson March 26, 2002).

Estimated peak flows for existing and post project conditions are provided for Node 1 and Node 2 in Tables 3.7-15 and 3.7-16, respectively.

Table 3.7-15
Estimated Peak Flows for Node 1 on Patchett Creek

Return Period	Flow Under Existing Conditions, cubic feet per second (cfs)	Post-Project Conditions Flow, cubic feet per second (cfs)	Increase, percent
2-yr	585	614	5
10-yr	1,230	1,270	3
100-yr	2,126	2,172	2

Source: West Yost & Associates, July 15, 2008.

Table 3.7-16
Estimated Peak Flows for Node 2 on Patchett Creek

Return Period	Flow Under Existing Conditions, cubic feet per second (cfs)	Post-Project Conditions Flow, cubic feet per second (cfs)	Increase, percent
2-yr	675	703	4
10-yr	1,500	1,541	3
100-yr	2,604	2,652	2

Source: West Yost & Associates, July 15, 2008.

In general, the results of the HEC-1 model analysis indicate that the peak discharge flow would increase slightly due to the modified land use. The model results also show that the impacts to runoff flows decrease further downstream within the watershed. These conclusions were also demonstrated through the O'Connor analysis. Therefore, it has been concluded that the time of concentration and peak discharge flow calculations adequately describe the proposed project, and a minor impact to downstream water bodies is anticipated with respect to increased flows.

Protection of the Natural Hydrograph

With the anticipated slight increase in the 2-year, 10-year and 100-year peak runoff at Node 1 due to the change in the ground cover as a result of the establishment of the vineyard, the project with the 4 cfs diversion to storage for irrigation supply will not cause an appreciable diminishment of the natural hydrograph and the frequency and magnitude of the high flows necessary for channel maintenance.

In addition, the runoff diverted to storage will result in less than a two percent reduction in the expected runoff during a normal water year at Node 1 under existing conditions. The maximum volume stored in the irrigation supply reservoir is 67 acre-feet as previously discussed in the water supply section. The expected volume of runoff available at Node 1 under post project conditions during the period of October 1 through March 31 in a normal water year is estimated to increase from about 1,065 acre-feet to about 1,120 acre-feet. The maximum stored volume of 67 acre-feet is about 8 percent of the expected total runoff in the wet season at Node 1. However, when compared to the pre-project conditions, the resultant runoff at Node 1 with the diversion to the irrigation reservoir is estimated to be 1,051 acre-feet, or about 1.3 percent less than under existing conditions. This reduction in the volume of runoff is not expected to cause an appreciable change in the creek flow at Node 1 or further downstream.

Onsite Drainage Sensitivity to Increased Peak Flows

The potential for increased sedimentation is the primary concern related to potential increases in peak flows, as high volume, high velocity water can result in increases in gullying and bank erosion. O'Connor Environmental conducted field surveys of the project site in January 2002 and January 2007 to evaluate the sensitivity of on-site drainages to increased peak flows. Distinct, systematic differences among groups of channel were not apparent. Consequently, channels were described and assessed individually with respect to sensitivity to potential peak flow increases associated with conversion of forest to vineyard.

To assess the sensitivity of each drainage to peak flow increases, the field data was evaluated with respect to evidence of fluvial erosion processes at present, and for the likely response to peak flow increase. The magnitude of expected peak flow increase (described in the previous section) was also considered.

Detailed summaries of each drainage node's sensitivity to peak flows are included in the O'Connor Environmental Hydrological Analysis. The following discussion of the drainage and channel conditions considers both predicted peak flow increases and likely potential for channel response to determine the relative sensitivity to peak flow.

Sensitivity was generally considered low if peak flow increases were less than 10 percent and drainage and channel conditions were moderately stable. Low sensitivity channels are not expected to substantially change in response to expected hydrologic effects.

Sensitivity was considered to be moderate in a wider range of situations. Moderate sensitivity channels are not expected to significantly change in response to expected hydrologic effects. Because there is greater potential for response of these channels to expected hydrologic effects, a monitoring program has been developed to evaluate actual response. Examples of moderate sensitivity channels are:

- If peak flow was greater than 10 percent and drainage and channel conditions were somewhat unstable; or
- Peak flow increases greater than 20 percent combined with unusually stable drainage conditions or unstable conditions are of limited extent.

High sensitivity would be applied to channels with moderately unstable conditions and predicted peak flow increases in excess of 50 percent. Such circumstances are likely to induce channel response manifested by extensive bed and/or bank erosion over a substantial length of drainage or channel. Peak flow sensitivity is summarized in Table 3.7-17.

Table 3.7-17
Drainage Sensitivity to Peak Flow Increases

Watershed	Drainage Channel	Drainage Node	Sensitivity to Peak Flow
Unnamed Tributary to Wheatfield Fork	40	40	Moderate
Unnamed Tributary to Wheatfield Fork	4	1	Low
Grasshopper Creek	70	7	Moderate
Grasshopper Creek	2	7	Moderate
Grasshopper Creek	3	7	Moderate
Grasshopper Creek	7	7	Moderate
Grasshopper Creek	38	37	Moderate
Patchett Creek	36	37	Moderate
Patchett Creek	35	35	Moderate
Patchett Creek	34	33	Moderate
Patchett Creek	33	33	Moderate
Patchett Creek	32	31	Low
Patchett Creek	31	31	Low
Patchett Creek	30	30	Low
Patchett Creek	28	30	Moderate
Patchett Creek	27	26	Moderate
Patchett Creek	26	26	Moderate
Patchett Creek	45B	45	Low
Patchett Creek	45A	45	Moderate
Patchett Creek	18	45	Moderate
Patchett Creek	17	17	Moderate
Patchett Creek	16	17	Moderate
Patchett Creek	20	20	Low
Patchett Creek	50C	50	Low
Patchett Creek	50D	50	Low
Patchett Creek	50E	50	Low
Patchett Creek	50A	50	Moderate
Patchett Creek	50B	50	Moderate
Patchett Creek	56	56	Moderate
Patchett Creek	60B	60	Low
Patchett Creek	60A	60	Moderate

Source: O'Connor Environmental Hydrologic Effects Analysis, May 2008.

As can be seen in Table 3.7-17, the extent and degree of channel sensitivity does not represent a likely significant effect, defined as accelerated erosion processes inducing a significant increase in sediment delivery rates to Patchett Creek, particularly relating to degradation of habitat for coldwater fish. Moderate sensitivity channels are common, however, and, as stated above, these channels are not expected to significantly change in response to expected hydrologic effects. Yet, because there is greater potential for response of these channels to expected hydrologic effects, a monitoring program (See Mitigation Measure 3.7-3(b)) has been developed to evaluate actual response.

Sediment Yields at Project Boundaries

As noted previously, the project site is located within the Gualala River watershed, which is classified by the USEPA as impaired due to sediment. The TSD prepared by the North Coast RWQCB addressed the potential for sedimentation due to viticulture in the Gualala Basin. The O'Connor Erosion Analysis used the RUSLE2 computer model to analyze pre- and post-vineyard erosion on the project site.

It should be noted that for the proposed project conditions (shown in Table 3.7-16), a substantial portion of the drainage area runoff (and eroded soil) would be routed to receiving watersheds via proposed sedimentation basins, or to the reservoir. Sedimentation basins were designed by Erickson Engineering to capture sediment greater than approximately 0.1 mm in diameter. Consequently, runoff routed through the sediment basins is expected to reduce sediment yield by about 50 percent. More importantly, sedimentation basins should reduce delivery of the sediment size fraction (sand and fine gravel) that tends to have the greatest potential for impairment of spawning habitat.

The erosion rates shown in Table 3.7-10 were applied to the existing and proposed distribution of acreage by slope class and the drainage that runoff would flow to in the project area (See Tables 3.7-18 and 3.7-19).

Table 3.7-18
Existing Slope Class Acreages

Vineyard, Goldridge soil				
Slope Class	**5%**	**15%**	**25%**	**35%**
Patchett Creek	4.0	17.5	9.1	2.7
Forest, Goldridge soil				
Slope Class	**5%**	**15%**	**25%**	**35%**
Unnamed tributaries	3.6	8.1	5.9	11.4
Grasshopper	6.4	16.3	10.8	16.7
Patchett Creek	12.7	42.6	27.9	28.4
Forest, Hugo soil				
Slope Class	**5%**	**15%**	**25%**	**35%**
Patchett Creek	13.0	37.3	28.9	48.9
Grassland (pasture), Goldridge soil				
Slope Class	**5%**	**15%**	**25%**	**35%**
Unnamed tributaries	0.3	0.4	0.1	0.0
Grasshopper	0.3	0.8	0.1	0.0
Patchett Creek	17.2	46.1	8.0	2.0

Source: O'Connor Environmental, Erosion Analysis, May 2008.

Table 3.7-19 Proposed Slope Class Acreages				
Proposed vineyard, Goldridge soil, drainage to sediment basin				
Slope Class	**4%**	**8%**	**12%**	**16%**
Unnamed tributaries	0.2	0.5	0.9	4.4
Grasshopper	1.5	2.5	2.5	4.8
Patchett Creek	3.6	7.0	9.9	20.6
Proposed vineyard, Goldridge soil, normal drainage				
Slope Class	**4%**	**8%**	**12%**	**16%**
Unnamed tributaries	1.2	1.5	1.4	4.1
Grasshopper	0.7	1.1	1.3	7.2
Patchett Creek	0.7	2.1	3.4	8.9
Proposed vineyard, Hugo soil, drainage to sediment basin				
Slope Class	**4%**	**8%**	**12%**	**16%**
Patchett Creek	4.4	6.5	7.0	25.1
Proposed vineyard, Hugo soil, normal drainage				
Slope Class	**4%**	**8%**	**12%**	**16%**
Patchett Creek	2.0	3.3	3.7	16.1
Existing vineyard, Goldridge soil, drainage to sediment basin				
Slope Class	**5%**	**15%**	**25%**	**35%**
Patchett Creek	0.2	1.2	1.0	0.2
Existing vineyard, Goldridge soil, natural drainage				
Slope Class	**5%**	**15%**	**25%**	**35%**
Patchett Creek	3.8	17.3	8.1	2.5
Forest, Goldridge soil				
Slope Class	**5%**	**15%**	**25%**	**35%**
Unnamed tributaries	1.6	2.8	2.6	8.1
Grasshopper	2.9	7.4	6.5	11.7
Patchett Creek	8.3	27.8	18.4	21.5
Forest, Hugo soil				
Slope Class	**5%**	**15%**	**25%**	**35%**
Patchett Creek	3.7	10.9	11.9	33.6
Grassland (pasture), Goldridge soil, natural drainage				
Slope Class	**5%**	**15%**	**25%**	**35%**
Unnamed tributaries	0.2	0.3	0.1	0.0
Grasshopper	0.3	0.8	0.1	0.0
Patchett Creek	10.7	22.1	3.8	1.4
Grassland (pasture), Goldridge soil, drainage to sediment basin				
Slope Class	**5%**	**15%**	**25%**	**35%**
Patchett Creek	4.1	8.5	1.5	0.5
Source: O'Connor Environmental, Erosion Analysis, May 2008.				

The estimated sediment yield from surface erosion for the project site (shown in Figure 3.7-5, including adjacent non-project vineyards) draining to Patchett Creek is summarized in Table 3.7-20. Sedimentation basins as designed are predicted to reduce sediment yield by 50 percent, primarily by capturing sand and fine gravel greater than 0.1 mm diameter. Finer suspended sediment that passes through the sediment basins is relatively mobile in energetic stream systems such as Patchett Creek. Most of the sediment from the project site, following treatment in sedimentation basins, is expected to remain in the water column as the sediment is transported through Patchett Creek with relatively little deposition. As shown in Table 3.7-20, the sedimentation basins (and the reservoir collection system) reduce the predicted increase in sediment yield by about two-thirds, leaving an estimated net increase at the project area boundary of approximately 11 tons per year, an increase of 12 to 14 percent. Additional reductions in sediment yield by erosion mitigation designed to repair and control gully erosion at five sites in the project area is expected to reduce erosion rates by at least 21 t/yr (low range estimates) to 31 t/yr (high range estimates). These estimated sediment savings result in net decreases in sediment yield under project conditions of 10 to 21 t/yr.

Table 3.7-20
Sediment Yield for Project Area*

Cover Type	Drainage Type	Low Estimate (t/yr)	High Estimate (t/yr)
Existing Conditions			
Non-project Vineyard	Natural	17.4	17.4
Grassland	Natural	58.7	77.7
Forest	Natural	0.28	0.3
Total		**76.4**	**95.4**
Project Conditions			
Project Vineyard	Natural	9.8	11.3
Sed. Basin		18.8	22.6
Non-project Vineyard	Natural	16.0	16.0
Sed. Basin		1.4	1.4
Grassland	Natural	42.9	56.7
Sed. Basin		15.8	21.0
Forest	Natural	0.3	0.3
Total Sediment Yield		**105.0**	**129.3**
Total-Sed. Yield with Sed. Basin Mitigation		**87.0**	**106.8**
Change in Sediment Yield		28.6	33.9
Change in Yield, Sed. Basin Mitigation		10.6	11.4
% Change in Sediment Yield		37%	36%
% Change in Yield, Sed. Basin Mitigation		14%	12%

*Project area is shown in Figure 3.7-5, and includes existing non-project vineyards.

Source: O'Connor Environmental, Erosion Analysis, May 2008.

Patchett Creek Sediment Yield Estimates – Method 1 (Using Existing Data and Field Observations)

The erosion analysis conducted by O'Connor Environmental then analyzed the sediment yield in relation to sedimentation within the Patchett Creek watershed. The estimated sediment yield for Patchett Creek is summarized in Table 3.7-20, including estimated surface erosion from the project site using RUSLE2 for both existing and project conditions. Estimated sediment yield from the proposed project site decreases by about 10 to 21 t/yr for low and high range estimates, respectively. This represents a decrease of from 1.8 to 2.4% for low range and high range existing conditions sediment yield estimates, respectively.

Sediment yield under project conditions is reduced owing to design mitigations and other sediment mitigation to repair and prevent gully erosion on the project site (discussed below). Sediment yield from vineyard fields has been largely controlled by erosion control practices, and further limited by construction of sedimentation basins at vineyard drainage outfalls. Sedimentation basins reduce estimated vineyard erosion by about two-thirds (Table 3.7-20), resulting in a net increase in sediment yield of about 11 t/yr. Additional reductions in sediment yield by erosion mitigation designed to repair and control gully erosion at five sites in the project area is expected to reduce erosion rates by at least 21 t/yr (low range estimates) to 31 t/yr (high range estimates). These estimated sediment savings result in net decreases in sediment yield under project conditions of 10 to 21 t/yr (See Table 3.7-21).

Table 3.7-21
Existing Sediment Budget for Patchett Creek

Erosion Source or Process	Low range Rate t/yr	High Range Rate t/yr
Bank erosion, ordinary slope conditions	133	133
Bank erosion in rockslides	66	131
Shallow landslides	77	77
Active gullies in project area	25	40
Roads; surface and point source	180	352
Existing vineyards and orchards	17	17
Existing pastures and abandoned orchards	59	78
Total-Existing Conditions	**557**	**828**
Estimated Natural	**244**	**309**
Total-Project Conditions	**547**	**807**

Source: O'Connor Environmental Erosion Analysis, May 2008.

Specific mitigation measures that have been incorporated into the project design to reduce overall sedimentation rates in the project area by 10 to 21 tons/year are described below.

Patchett Creek Sediment Yield Estimates – Method 2 (Application of Sediment Input Rates Developed For Wheatfield Fork Sub-watershed in the Gualala Sediment TMDL to Patchett Creek on a Unit-Area Basis)

This approach uses watershed scale erosion rates for the Wheatfield Fork for specified erosion processes as per (RWQCB 2001, Table 6.1, p. 98), and applies them to the 1.76 mi^2 drainage area of Patchett Creek. In the following list, the first two items represent the natural erosion rate (380 $t/mi^2/yr$), while the remaining six comprise the human-caused erosion rate (810 $t/mi^2/yr$):

- Natural mass wasting (180 $t/mi^2/yr$)
- Stream bank erosion (200 $t/mi^2/yr$)
- Road related mass wasting (310 $t/mi^2/yr$)
- Road-stream crossing failures (40 $t/mi^2/yr$)
- Road related gullying (210 $t/mi^2/yr$)
- Road related surface erosion (120 $t/mi^2/yr$)
- Skid trail surface erosion (20 $t/mi^2/yr$)
- Other harvest related delivery (110 $t/mi^2/yr$)

Applying these rates to the Patchett Creek watershed (1.76 mi^2) yields mean annual natural sediment inputs and human-caused inputs of 669 t and 1,426 t, respectively. The total estimated erosion rate for Patchett Creek using this method is about 2,090 t/yr. This is roughly 3 to 4 times greater than the erosion rate estimated using data specific to Patchett Creek.

Erosion Control and Remediation Measures to be Implemented on the Project Site

As outlined in the Project Description, the sediment yield under project conditions would be reduced owing to design mitigations and other mitigations to repair and prevent gully erosion on the project site. The project reservoir collection system would largely eliminate runoff to a 1,200 ft reach of Class III channel immediately south of the proposed reservoir site. The channel has developed in an abandoned road or tractor trail. The channel erosion and bank creep processes in this section of channel are expected to be significantly reduced under project conditions. Based on an estimated 75% reduction in creep rate for this section of stream channel, mean annual sediment yield would be reduced by 1.7 t/yr.

The reservoir collection system would also largely eliminate storm runoff delivered to two large gullies located between the proposed reservoir and reservoir sump. To further mitigate erosion from these gullies, interception drains would be installed along the vineyard perimeter above these gullies to curtail

seepage erosion processes in the gullies. The reduction in water delivered to these gullies is expected to eliminate significant erosion processes. Based on estimated reduction in erosion rates in these gullies of at least 75%, mean annual sediment yield would be reduced by 8.3 to 15.8 t/yr for the low range and high range estimates respectively.

Significant gully erosion existing on the project site under current conditions was observed at three additional locations affecting existing temporary or abandoned roads. Erosion rates for these gullies were estimated based on field observations to total 14.1 to 17.7 t/yr for low range and high range estimates, respectively. Project mitigation for erosion at these sites would be implemented to correct inadequate drainage conditions that have caused gully erosion. Based on estimated reduction in erosion rates in these gullies of at least 75%, mean annual sediment yield would be reduced by 10.6 to 13.3 t/yr for the low and high range estimates, respectively.

Conclusion

The estimated existing erosion rate for the Patchett Creek watershed against which potential vineyard erosion can be compared may range from as low as about 557 t/yr to as high as about 2,090 t/yr. The range of natural erosion rates is from about 244 t/yr to 669 t/yr. Sediment yield estimates for existing conditions specific to Patchett Creek developed for this project range from 557 to 828 t/yr. Sediment yield from the proposed project decreases by about 10 t/yr, (low range estimate) to 21 t/yr (high range estimate) with erosion and sedimentation mitigation. Patchett Creek sediment yield is predicted to decrease to 547 t/yr (low range estimate) or to 807 t/yr (high range estimate) equivalent to a decrease of about 2% relative to existing conditions for both the low and high range estimates.

The proposed TMDL load allocation for sediment (RWQCB 2001, Table 6.2, p. 102) is 475 t/mi^2/yr. This is equivalent to 836 t/yr in Patchett Creek (475 t/mi^2/yr x 1.76 mi^2). Based on the erosion rate estimates in Table 3.7-10, the high range (worst case) estimate of 807 t/yr under project conditions is 26 t/yr (~3%) below the proposed sediment load allocation, and the low range estimate of 547 t/yr is about 289 t/yr (~35%) below the proposed sediment load allocation. *The estimated decrease in the Patchett Creek sediment yield of 10 to 21 t/yr increases the margin of sediment yield below the TMDL proposed sediment load allocation.*

These data indicate that current erosion rates in Patchett Creek are relatively low compared to other portions of the Gualala River watershed, and that water quality attributes related to erosion and sedimentation processes may not be significantly impaired in Patchett Creek. The relatively large differences between the Patchett Creek sediment yield estimate and TMDL estimates of sediment yield for the same area reflect common difficulties with erosion and sedimentation studies, including variations in methods, geographic scale and specificity of assessment, and wide naturally-occurring variation in erosion processes and rates. The data

indicate that the magnitude of potential erosion from the project is not significant in relation to both existing and natural background rates.

In summary, compliance with the BMPs recommended in the ECP would help ensure that the proposed project would not substantially degrade surface water quality as a result of vineyard development activities. However, without appropriate monitoring of post-project sedimentation rates in the field, a ***potentially significant*** impact could occur if sedimentation increases above the rates estimated in the project analyses.

Mitigation Measure(s)
Implementation of the following mitigation measures would maintain or reduce the sediment yield of the project site. Therefore, implementation of the following mitigation measures would reduce impacts to a *less-than-significant* level.

3.7-3(a) *Prior to the issuance of grading permits, the applicant shall provide proof to the Department of Forestry and the Sonoma County Permit and Resource Management Department that the erosion and sediment control recommendations in the project Erosion Control Plan and the O'Connor Hydrologic Analysis have been incorporated in the construction plans. These measures shall include, but are not limited to, the following:*

- *Establishment of a permanent hillside cover crop in the first year growing season;*
- *Provision of contour planting, terracing, grading, or v-ditches in all vineyard block areas;*
- *Inspection of all features for winter preparedness, and maintenance and repair of all hydraulic features and storm water control facilities as necessary prior and during to the winter season;*
- *Provision of straw mulching at an application rate of two (2) tons per acre in areas where cover cropping does not meet 90 percent coverage;*
- *Monitoring of major drainages before and after major winter storms; and*
- *Performance of any additional actions as necessary to ensure function of the drainage system facilities.*

3.7-3(b) *The following Channel Erosion and Sedimentation Basin Monitoring Plan shall be implemented by the project applicant for the review and approval of the California Department of Forestry and Fire Protection and the Sonoma County Permit and Resource Management Department.*

Monitoring Plan - Class III Channel Response to Potential Peak Flow Increases, Artesa Fairfax THP & Conversion

Motivation

This monitoring plan is motivated by findings of the O'Connor Hydrologic Analysis indicating the potential magnitude (Table 6, p. 29) and potential significance (Table 12, p.52) of expected peak flow increases. Erosion rates in existing stream channels could be accelerated by increased runoff and peak flow expected to result from the project.

There is no compelling evidence that hydrologic change will cause significant erosion in Class III channels draining the project area. Channel response to peak flows is controlled by the size of channels, channel substrate, and the proximity of bedrock and boulder controlled channels downstream. Potential erosion of channels draining the project area is limited to varying degrees by these factors. Furthermore, peak discharge for high-magnitude, low-frequency flows (> 5 yr recurrence interval events) under current conditions indicate that the largest increases in peak flows (2 yr recurrence interval events) predicted under project conditions would be well within the range of flows transmitted by the existing channels in most locations. Hence, the potential for significant channel erosion related to peak flow change is limited by several factors.

Given the relatively high variability and complexity of hydrologic and geomorphic processes, channel response to identified potential peak flow increases is somewhat uncertain. While the predictable potential effects of the project with mitigation are not significant, unpredictable events or unexpected responses could have substantial impacts. Consequently, a monitoring program is presented below at a conceptual level including substantial detail.

Objective

The objective of the monitoring plan is to observe and document erosion response, if any, of Class III channels draining the project area and verify that the magnitude of response does not rise to a significant level. No net increase in sediment yield from the project area is an environmental objective of the project.

The Erosion Analysis concluded that the project (with mitigation) is expected to reduce sediment yields by 10 to 21 t/yr. The specific objective of this monitoring plan is to determine whether potential

increases in sediment yield associated with accelerated channel erosion are less than 10 to 21 t/yr. In addition, the performance of sedimentation basins will be monitored to provide measurements of vineyard field erosion and sedimentation basin trapping efficiency. These measurements are warranted because they could lead to revisions of predicted vineyard field erosion, which could either increase or decrease the threshold of significance of channel erosion.

Monitoring Plan

The monitoring plan has three components:

1. *Detailed topographic surveys of selected channels;*
2. *Annual survey of erosion of "sensitive" channels; and*
3. *Survey of selected sedimentation basins.*

Topographic Surveys of Selected Class III Channel Reaches

This element of the monitoring plan would include detailed topographic surveys using a total survey station to measure changes in channel elevation for sample sections of selected Class III stream channels. This study approach has been previously implemented by O'Connor Environmental for Class III streams in Humboldt County to fulfill monitoring requirements of the Pacific Lumber Company Habitat Conservation Plan. The strength of this approach is that it develops accurate, objective quantitative data documenting the dimensions and elevation of channels before the project and three years after project completion. This will provide statistical measures (using parametric techniques), of channel erosion rates that can be extrapolated to assess the magnitude of channel erosion in the project area. The study will be designed so that a range of hydrologic change is observed that will indicate whether peak flow change is correlated with channel erosion rate. Specifically, six channels (2, 20, 31, 40, 45B and 60A; see Hydrologic Analysis, Figure 6 for locations of these channels and Table 6 for the magnitude of expected peak flow change) would be monitored to determine erosion rates over a three year period.

Annual Surveys of Class III Channels

This annual survey would be conducted for the 21 channels considered to be moderately sensitive to peak flow (Hydrologic Analysis, Table 12). The survey technique to be employed would systematically observe and measure the surface area and depth of fresh channel and bank erosion features as a measure of annual erosion rates. This technique, while objective, requires field

estimates that have only moderate levels of precision. The advantage of this approach is that it allows for broad coverage of the monitoring sites and is likely to detect significant changes in the rates of channel and bank erosion. Statistical tests for change would most likely utilize techniques for non-parametric data. These surveys would be conducted four times: once prior to project implementation to document baseline conditions, and then annually in late winter/early spring when annual erosion features are relatively easy to detect and measure. These annual surveys developed over a broad project area are also important in that they would likely detect unexpected rates of change in a time frame that would allow for timely response, if necessary.

Annual Surveys of Selected Sedimentation Basins

This annual survey would measure the volume of accumulated sediment and the grain size distribution of accumulated sediment in a sample of about 25% of the sedimentation basins in the project. By comparison to grain size distribution of the vineyard soils, the deposited sediment size distribution and volume can be used to estimate the erosion rate of the vineyard fields and the sedimentation basin trapping efficiency (see Reid and Dunne, 1996, Rapid Evaluation of Sediment Budgets, p. 49). The monitoring would be comprised of annual measurements of depth of accumulated sediment in selected basins and collection and laboratory analysis of samples of accumulated sediment. The selection of basins for monitoring would include a range of sediment basin sizes. Data analysis would include comparison of pre-project estimates of vineyard erosion rates and sediment trapping efficiency to measured rates and efficiency.

Adaptive Management

If monitoring data indicate that sediment yields from the project area are greater than predicted in the pre-project analyses, either from unexpected erosion of Class III channels or higher-than expected delivery rates of sediment eroded from vineyard fields, appropriate on- and off-site erosion mitigation will be developed with oversight by the lead CEQA agency or an alternative regulatory authority designated by lead CEQA agency.

On- and off-site erosion mitigation, if deemed necessary and appropriate, may include identification of additional and presently unidentified erosion sites on the project site or on other property in the Patchett Creek watershed. Potential erosion sites could include road-related erosion sites, gullies, eroding stream banks, eroding

landslide deposits, or other erosion sites delivering or potentially delivering substantial quantities of sediment to the stream channel network. Off-site projects should be developed in cooperation with any property owner involved, and should include an appropriate level of contribution from each property owner. Disused or informally abandoned logging roads and skid trails are probably the most appropriate type of erosion site to target for off-site mitigation, however, other types of sites should be considered if identified. If suitable or practical sites cannot be located in the Patchett Creek watershed, then sites in the Wheatfield Fork Gualala River watershed should be considered.

3.7-4 Water quality impacts pertaining to chemical contamination from timber harvest and vineyard operations.

The use of equipment-related fuels, lubricants, and coolant would be necessary components of the proposed project. In addition, the project applicant may choose to apply agricultural chemicals during vineyard operations if such action is deemed necessary. The use of such materials on the site would result in the potential for water contamination if proper handling procedures were not observed.

Timber Harvesting

During timber harvesting operations, fuels and oils would be stored only temporarily and in small quantities at or near landings. Any fuel stored on the site would be stored away from WLPZs in approved storage containers. Vehicles used in the timber harvest would be required to be properly maintained, and used oil from on-site equipment would be disposed of in accordance with State law. Additionally, all vegetation proposed for removal under the conversion THP would be removed via mechanical means instead of chemical means, as outlined in the THP. Due to the use of mechanical treatment of vegetation, and proper storage and disposal of fuel and oil on the project site, the proposed timber operations would not be expected to result in chemical contamination of the project area watersheds. The THP also points out that the risk of contamination from chemical dust abatement methods, if used, would be minimal, because most of the roads within or adjacent to the project site are located away from watercourses and the vegetation filter strips between roads and watercourses are typically dense. Therefore, the proposed timber harvest is expected to pose a negligible threat to water quality from chemical contamination.

Vineyard Development and Operation

Chemical contamination of the watersheds would not be anticipated to result from the proposed vineyard development or operation.

Pest Management

The applicant intends to use Integrated Pest Management (IPM) in the maintenance of the vineyard. IPM focuses on long-term prevention or suppression of pest problems with minimum impact on human health, the environment, and non-target organisms, by minimizing the use of pesticides and emphasizing alternative practices. Such methods may include, but are not limited to, selection of resistant planting stock; modification of planting schedules and timing; sound irrigation and organic waste disposal procedures; and use of traps, mulches, cover crops, non-toxic spray oils, and natural pest enemies (biological control). The THP (p. 45) notes that as a part of the proposed vineyard development and maintenance, chemicals will only be used when a feasible alternative does not exist. In the event that pesticide or herbicide use is deemed necessary during the development and operation of the vineyard, the applicant would strictly adhere to federal, State, and local regulations pertaining to the use of permitted chemicals. Furthermore, the applicant intends to control nuisance mites with predacious mites. Predacious mites are purchased and placed in the vines; as they repopulate, they feed on the pest mites. This IPM strategy has been successfully used on one of the applicant's other vineyards and as a result, the applicant has not had to apply insecticides for mite control.

If the determination is made that additional measures are required, beyond the IPM methods outlined above, pest and disease control activities would take place generally between April and July depending on the type of grapes and weather conditions. If required, materials would be applied approximately every seven to fourteen days throughout this period, for a total of seven to nine applications. Each application would take place over two days and would require the use of a 60-hp tractor. Materials would be applied at night between 3:00 a.m. and 9:00 a.m. Nighttime or early-morning application provides cool temperatures and little wind, minimizing the chance of spray drift onto nearby properties. Any pesticides would be stored in a locked storage container (approximately eight feet by 20 feet). The vineyard employees would be trained annually in the usage, storage, and handling of all pesticides that would be used.

Weeds would be controlled mechanically and chemically. Mechanical weed control would include manual hoeing, and tractor mowing (between vine rows). Chemical weed control would involve the minimal use of a chemical such as Roundup under the vines, and would be limited to non-leaching pre- or post-emergence formulations. Applications of Roundup would be made between the rows as spot treatments to eliminate unwanted weeds that grow in the planted cover crop. The under-vine controls would be applied approximately two to three times annually between February and June. Application between vine rows would occur approximately two to three times between May and September. After the first three years of vine growth, weed control is usually not required, because the cover crop has become established. Fifteen gallons of Roundup would be stored at a time in one-15 gallon container.

One pallet of dusting sulfur (approximately 3,000 pounds) would be stored on the site and used early in the growing season. Because the use of dusting sulfur later in the growing season is undesirable, burning plants and enhancing mite populations, water-soluble fungicides such as Serenade would instead be used at that time.

The West Yost Hydrologic Evaluation found that based on the procedures outlined above, the proposed herbicide and fungicide applications should be appropriate. Furthermore, because drip irrigation would be used at prescribed agronomic rates and rain is minimal during the growing season when these chemicals would be applied, these constituents would not be likely to run off into the surrounding streams. Finally, the presence of forested buffer areas (WLPZs) between the vineyard blocks and onsite waterways would help to prevent these chemicals from leaving the site in the event that significant runoff did occur following an application.

Fertilizer Applications

For the purposes of this environmental review, it has been assumed that Artesa Vineyards will not apply fertilizers as recommended in the Crop Care Baseline Soil Analysis Report prior to vineyard establishment. However, in the spring and through the growing season fertilizer may need to be injected into the drip irrigation system using approximately 10 to 15 gallons of concentrated fertilizer per acre per year. This application will likely be done once during the growing season, but only during those years when needed. In addition, an application of 12-26-26 fertilizer or gypsum (form of calcium, dry material) may be used at a rate of 500 to 1,000 pounds tons per acre when called for, but not every year.

The gypsum or solid fertilizer will either be broadcast with a tractor and a spreader over the entire area at the higher rates, or at the lower rates placed under the drip emitters for each vine. Liquid fertilizer will be injected into the drip irrigation system. The quantity of fertilizer needed per application will be a maximum of about 15 gallons per acre. Fertilizer will be delivered in plastic containers to the vineyard site and injected at the specific blocks where the application is needed. Any spills that may occur will be directly in the vineyard and will be diluted with water and contained with dirt berms to avoid any run off. The injection sites will not be adjacent to wells.

As with any fertilizer application, there is potential for excessive nutrients in the site runoff to affect downstream water bodies. However, since the drip irrigation system will be used to apply fertilizers at agronomic rates (and rain is minimal during the growing season when they would be applied), it is likely that these constituents would not runoff into the surrounding streams. Furthermore the presences of 50-foot forested buffer areas between the vineyard blocks and onsite waterways will likely entrap applied fertilizers before leaving the site in the event that significant runoff does occur following an application.

Conclusion

In summary, as a part of the proposed vineyard development and maintenance, IPM practices would be used. Chemicals would only be applied in the absence of a feasible alternative, thereby minimizing the chance of residues entering waterways adjacent to the vineyard blocks. Only chemicals permitted for use by federal, State, and local regulations would be used, and their application would conform to all applicable regulations. Furthermore, chemical application would be conducted under the supervision of qualified, properly certified vineyard management individuals. Therefore, the pest management and chemical application methods proposed by the applicant would provide adequate mitigation to reduce the potential adverse chemical contamination-induced water quality impacts. However, should an accident occur during the movement, or application of agricultural chemicals, the possibility exists that a ***potentially significant*** impact to water quality could occur.

Mitigation Measure(s)

Implementation of the following mitigation measure would provide for a proper response to potential chemical spills, which would protect water quality from any accident occurring during the transport or use of agricultural chemicals. Therefore, implementation of the following mitigation measures would reduce impacts to a *less-than-significant* level.

3.7-4 *Prior to the issuance of grading permits, the applicant shall provide the Department of Forestry and the Sonoma County Permit and Resource Management Department with an Agricultural Chemical Use and Storage Contingency Plan. The Plan shall include the measures that will be taken in the occasion that a spill occurs. Potential measures include: the deployment of straw wattles or other barriers stored on-site, instructions for diverting any overland flow away from onsite drainages, the on-site storage of absorbent materials to clean up any spills, and a prominent listing of accident and hazard responding agencies, including: the Sonoma County Department of Emergency Services and the Sonoma County Hazardous Materials Response Team. The Plan shall be mad available to all workers handling pesticides and shall be posted on the corporation yard building.*

3.7-5 Water quality impacts pertaining to organic debris during project timber harvest activities.

Organic debris can range in size from fine particles of decomposing flora or fauna to forest floor litter such as leaves, or to downed branches and entire trees. As noted in the project THP, organic debris in a watercourse can have either positive or negative effects, depending on the size and stability of the material. In the 1960s and 1970s, large woody debris (LWD) was actively removed from project

area waterways because LWD was believed to create impassable fish barriers. LWD is now thought to be an important factor in storing and metering sediment in watercourses, as well as providing habitat for various aquatic organisms, in part through the creation of pools. An excess of smaller organic debris, however, may have undesirable effects by contributing to sedimentation and water quality problems.

The project THP notes that a moderate amount of LWD is present in watercourse channels on and adjacent to the plan area from historic logging 30 or more years ago, and from windfalls and fallen snags. As stated in the THP, the Class II and Class III streams on the property are generally too small and shallow in slope to move significant amounts of LWD downstream to enhance salmonid habitat. Field observations by NCRM staff within similar watersheds have indicated that about 2,500 feet of length and 620 feet of vertical fall within the watercourse channel are required to create the necessary head (or force) to move LWD downstream. Because these conditions are not satisfied in the watercourse segments on or immediately adjacent to the project site, LWD is generally unlikely to be transported downstream by these Class II or Class III waterways. However, the LWD on and near the project site acts as a check that slows waterborne sediment and reduces the potential for downcutting of the channel.

The project THP would be reviewed by CDF to ensure that water quality protection measures comply with the current California Forest Practice Rules; please refer to Impact Statement 3.7-2 above. The buffered areas provided by WLPZs during the proposed timber harvesting activities and vineyard development and operations would effectively prevent significant amounts of fine organic debris from entering the nearby Class II and Class III watercourses. Timber to be harvested within the conversion areas adjacent to WLPZs would be removed from the site or piled for burning well away from WLPZs. Existing LWD in and near project site watercourses (i.e. within the WLPZs) would not be disturbed during timber harvest or vineyard development activities. Additionally, the retention of all trees in the WLPZs would ensure future recruitment of LWD into the Class II and Class III stream channels on the site. For these reasons, the proposed timber harvest activities would not be expected to result in adverse effects to the existing organic debris content of the Class II and III watercourses adjacent to the conversion area, and the impact would be considered ***less-than-significant***.

<u>Mitigation Measure(s)</u>
None required.

3.7-6 Project-related impacts to groundwater storage and recharge.

The proposed project would result in the removal of approximately 171 acres of timber for vineyard development. All surface runoff from a 36-acre watershed would be captured and stored in a proposed 73 acre-foot reservoir for vineyard irrigation. With inclusion of the reservoir and sump areas, the Hydrologic Effects

Analysis identified total runoff/precipitation capture area for the proposed project as 47 acres. Groundwater would not be used for irrigation; however, the project would include a small well providing drinking and washing water to vineyard employees. The well is anticipated to yield less-than 10 gallons per minute, and would be drilled to the approximate depth of 200 feet.

Effects of Timber Harvesting

As noted previously in the Environmental Setting, studies of the Caspar Creek Experimental Watersheds show that removal of forest vegetation may affect groundwater recharge of small drainages. The information developed in conjunction with these watershed studies can be used to estimate the likely impacts to downstream summer flows associated with the proposed timber harvesting project; however, it should be noted that these studies do not demonstrate the potential hydrologic impacts associated with vineyard development.

The Hydrologic Analysis water balance analysis notes that the Caspar Creek study information suggests annual water yield and summer stream flows fed by groundwater beneath the project site could potentially be expected to increase with implementation of the proposed project. Evapotranspiration losses would be substantially reduced as trees were replaced with grapevines, which use less water. In addition, the proposed deep ripping and soil conditioning measures would likely counteract the decreased infiltration rates that are generally expected when converting forested areas to agricultural fields owing to reduced root mass and soil compaction from agricultural practices. In addition, as noted previously, the proposed project would utilize winter runoff flows stored in the proposed reservoir to meet vineyard irrigation demands, avoiding the use of groundwater for irrigation.

Additionally, the loss of fog drip as a water source on the project site would not be expected to significantly affect groundwater availability. As noted previously, the role of fog drip in coastal forest streamflow and groundwater recharge has been investigated in forest management research conducted on the Caspar Creek Experimental Watersheds at Jackson State Forest during 1998-1999. The amount of fog drip under the forest canopy was found to be highly variable, ranging from 0 to a maximum of 18 mm (0.70 inch) per event and totaling 99 mm (3.89 inch) during the 1999 season. However, within the forested plots where collectors were randomly located, seasonal fog drip under the canopy was only 3 mm greater than accumulations in the clearcut opening at one site, and not significantly different at the other. The researchers concluded that the hydrologic effect of fog drip on groundwater and baseflow processes, while highly variable, is hydrologically insignificant in the redwood/Douglas-fir forest type at Caspar Creek. Following timber harvests, streamflow increases stemming from reduced interception and evapotranspiration were found to exceed diminishment due to the loss of fog drip.

Due to the similarities between the watersheds, similar effects are expected to occur on the project site following project implementation.

As noted in the Hydrologic Analysis, experiments on runoff and erosion processes on vineyard soils in Napa County provide evidence regarding infiltration capacity of vineyard soils.[14] Researchers used an artificial rainfall generator to measure runoff, infiltration, and soil moisture changes in response to simulated rainstorms in February and March 1997 on six year old vineyards with relatively low vegetative cover and tilled soils. Artificial rainstorms had an intensity of 1.6 in/hr and a 40-minute duration. The simulated rainstorms provided 8.5 percent greater energy and 55 percent greater depth than natural 100-year recurrence interval 40 minute rainstorm. Thirty study plots with a mean slope of approximately 10 percent, and mean cover of approximately 35 percent on clay loam soils of the Fagan soil series were studied. The Fagan soils have an infiltration rate of 0.2-0.6 in/hr in the upper 16 in and 0.06-0.2 in/hr at 16-28 inches in depth, substantially lower than those at the project site.

Runoff and infiltration rates observed in the experiment were consistent, with mean runoff of 18 percent of rainfall and mean infiltration of 82 percent. Infiltration ranged from 75 to 89 percent of delivered rainfall, equivalent to about 1.3 inches of rainfall in a 40 minute period. The observed infiltration rate was about three times the maximum typical infiltration rate for this soil type (0.6 in/hr or 0.4 in per 40 minute period). Soil moisture in the upper 4 inches of soil increased 14 percent, equivalent to about 0.6 inches of water, nearly half of infiltrated volume. The remaining balance of infiltrated water was probably distributed to depths greater than 4 inches; the experiment did not measure soil moisture below 4 inches in the soil column.

Extrapolating the hydrologic behavior of the Fagan soils in Napa vineyards to the proposed vineyards at the project site should be cautious; however, given the observations in Napa, qualitative conclusions can be made with considerable confidence. Under unusually intense simulated precipitation, water infiltration to the soil occurred at very high rates on soils that are less permeable and generate more rapid runoff than the Goldridge and Hugo soils on the project site. The Fagan soils at the experimental site in Napa are classified by USDA soil survey criteria in hydrologic group C (slow infiltration rate when thoroughly wet). Soils near the project site in Annapolis are classified in hydrologic group B (moderate infiltration rate when thoroughly wet). Overall, vineyard soils should be expected to be capable of relatively high infiltration of rainfall.

Changes in topography and runoff management in the vineyard are expected to change surface flow paths relative to existing site conditions. Erickson Engineering, Inc., has performed a detailed runoff analysis to calculate 100 yr recurrence interval flows from proposed vineyard areas on the site to verify the design capacity of the proposed reservoir and associated facilities as per requirements of Sonoma County. One component of the runoff analysis was

calculation of the time of concentration (the time required for all points of a watershed to contribute flow to the mouth of the watershed). The analysis found that the time of concentration for two representative sub-drainages of about 5 ac each was approximately 18 minutes under existing conditions and under proposed vineyard conditions. Time of concentration is maintained at pre-project levels because "[t]he post-construction combination of short run of sheet flow, low-slope vee ditching at one-half to one-third existing runoff slopes, and longer more serpentine drainage pathways tend to balance presence of higher velocities in drainage pipes" (Erickson 2001).

Although the time of concentration is unchanged, increased length of flow paths in the vineyards would tend to enhance infiltration processes. As noted above, the shorter flow lengths and more gentle slopes in the system of V-swales compensate for relatively high velocity in drainage pipes. Surface runoff velocity prior to entering drainage pipes is actually slower than under existing conditions, thereby promoting infiltration relative to existing conditions. The effect would be accentuated by the presence of cover crops on the vineyard soil surface.

In summary, significant decreases in infiltration rates and percolation rates are not expected under post-project conditions. Potential changes in soil hydrologic characteristics are unlikely to reduce the quantity of groundwater recharge from the project, and could result in an increase in groundwater recharge. Therefore, the proposed project would not be expected to affect any nearby domestic wells.

Effects of Proposed Irrigation System

With implementation of the proposed project, diffuse upland sheet flow and direct precipitation captured from a 36-acre area would flow into a two acre-foot sump pond, and would then be pumped into the proposed on-site reservoir. The reservoir would be recharged by a combination of captured sheet flow and direct precipitation on an annual basis. The vineyard would be irrigated during the vine establishment phase (probably the first three summers) by means of a drip system supplied by the proposed reservoir. The applicant expects that irrigation demands would be reduced following the grapevine establishment period, due to the fact that excess irrigation of mature vines tends to result in undesirable grape characteristics.

The proposed runoff capture system would not be expected to adversely affect neighboring wells, or general groundwater availability or recharge in the area. This is in part because the project would capture runoff from only 47 acres (approximately 4 percent) of the 1,124-acre Patchett Creek watershed. In addition, as shown in Figures 3.7-6, existing wells are located to the west and north of the project area, and groundwater in the project area flows away from these areas. The County of Sonoma well is located southeast of the project site, but a canyon interrupts the continuity of the Ohlson Ranch formation, and groundwater flow beneath the canyon is unlikely. Consequently, the proposed project is unlikely to

affect any wells listed in Table 3.7-3 or at other dwellings because groundwater flows under the site are toward Patchett Creek and away from habitations to the north and west. Furthermore, the majority of runoff water typically leaves an area quickly after storms via surface drainage, without infiltrating and deep percolating. Therefore, as stated by project engineer Lee Erickson, the majority of precipitation which ordinarily undergoes infiltration and deep percolation into the ground would continue to infiltrate unaffected by the proposed project. Mr. Erickson further notes that well water levels or yield in any area cannot be correlated with local rainfall patterns or surface runoff patterns in any scientifically valid way, because local instream flows are separated from the source of springs and well water by hundreds or thousands of feet of soil and bedrock. By definition, spring and well water originates in fracture zones deep within the local geologic formations and is not directly associated with seasonal surface runoff. In any event, the project is not expected to diminish groundwater quantity; on the contrary, indications are that groundwater would be more likely to increase if there were any measurable effects.

Effects of the Proposed Domestic Well

Water for washing and other incidental needs of vineyard workers would be provided by a small, low-yield well located at the corporation yard on the north side of Annapolis Road. The applicant would install a 1,000- to 5,000-gallon water tank, although water use would be of a seasonal nature and be unlikely to exceed 20 gallons per day.

Groundwater wells in the Annapolis area typically utilize the Ohlson Ranch Formation, a sedimentary rock formation found on ridgetops and that overlies the Franciscan Formation. The Ohlson Ranch Formation is relatively thin, ranging from about 20 to 160 thick. Saturated thickness of the aquifer accessible in wells is typically about 100 ft and well depth is typically about 200 ft. Well yields range between 2 and 36 gallons per minute (gpm), and some wells go dry in fall months (DWR, 1975). Well yield in the Ohlson Ranch aquifer is typically less than 10 gpm based on several proprietary well records reviewed for other projects in the Annapolis area. Wells may also penetrate the Franciscan Formation, however, the yield for the best wells in this aquifer is limited to a few gallons per minute in most locations.

Well yields in the range of several gallons per minute can in some circumstances support vineyard irrigation for relatively small acreage, but are not well suited for extensive irrigation. Assuming that annual vineyard irrigation rates would be 0.5 feet per acre of vineyard, each 1 gpm of well yield could irrigate 1 acre of vineyard if the well is pumped continuously for about 113 days. Hence, a 10 gpm well could be used to irrigate about 10 acres of vineyard, provided the well could support continuous pumping for such a lengthy period and ignoring pumping costs.

Well water could conceivably be used to fill the proposed 73 ac-ft reservoir. As noted above, a 1 gpm well can produce about 0.5 ac-ft of water in a 113 day period of continuous pumping. A well with a yield of 10 gpm could produce 5 ac-ft in the same period; about 15 such wells pumped for about 30% of the year would be required to fill the 73 ac-ft reservoir. While sufficient groundwater could be available in the aquifer to support this level of withdrawal, the expense of developing and pumping this number of wells would be considerable.

To provide sufficient water for vineyard irrigation, several wells of above-average capacity would be required. The cost of development of such a network of wells would be considerable, and would be in addition to the cost of development of the surface runoff collection system and storage reservoir that is intended to supply water for irrigation. If more abundant groundwater were available in the area, irrigation supplies from wells might have been considered; the expense of developing the surface collection facilities should be a sufficient indication of the intent of the project proponent to utilize surface runoff water rather than groundwater for vineyard irrigation.

Conclusion

In summary, although some soil compaction could occur, this will be counteracted by site preparation (limited ripping of soils), and overall higher water delivery to the soil owing to reduced canopy interception is likely to further balance any compaction. Existing compacted soils in historic pasture areas may actually have higher infiltration rates following vineyard development. Cover crops and elongated flow paths in v-swales will reduce sheet flow velocity and encourage infiltration. Groundwater flow gradients affected by the project are toward Patchett Creek (east-southeast), away from know domestic wells. Considering all these factors, there is no reason to believe that the vineyard development will either reduce groundwater percolation or affect domestic wells and water supplies.

The proposed project would not utilize groundwater for irrigation purposes and could be expected to increase groundwater infiltration rates by reducing evapotranspiration. In addition, the proposed on-site well would be small and low-yield. Furthermore, the project engineer has noted that runoff capture would be unlikely to have an effect on groundwater recharge. For these reasons, the project would not be expected to adversely affect groundwater storage or recharge rates in the project area. Therefore, the impact would be considered ***less-than-significant***.

Mitigation Measure(s)
None required.

3.7-7 Impacts pertaining to peak runoff flows and exposure of people or structures to flood hazard.

The project THP, the West Yost Hydrologic Evaluation, and the O'Connor Hydrologic Analysis found that implementation of the proposed project would be likely to result in an increase in peak runoff flows.

The HEC-1 model analysis performed by West Yost also found that minor increases in peak flows would be expected to occur with project development. Estimated changes to peak flows from the proposed project are shown in Tables 3.7-13 and 3.7-14 above.

In general, the results of the HEC-1 model analysis indicate that the peak discharge flow would slightly increase due to the modified land use. However, it should be noted that further downstream from the nodes evaluated, the increase in flow would decrease significantly, comprising an even smaller fraction of total flow, and impacts to runoff flows would therefore be reduced. In addition, O'Connor Hydrologic Analysis found that taking into account the reservoir, peak surface runoff for the 15 minute, 2-year design storm at the project boundary would be expected to decrease by 10 percent under proposed project conditions where approximately one-third of the drainage area is affected by reservoir collection. At the point in the Patchett Creek watershed where all portions of the project area are contributing runoff, the expected peak flow changes are expected to be negligible.

In addition, as noted in the THP, potential increases in peak runoff flows would be limited by the site's gentle slopes and the retention of a high amount of canopy and dense ground cover adjoining the conversion area. During the timber harvest portion of the project, the installation of water breaks would result in a well-drained skid trail system that would disperse water over a wider area immediately following the timber operation, allowing for increased infiltration. Subsequent to timber operations, increased runoff flows would be counteracted in part by increased infiltration resulting from ripping the soil for vineyard development, as well as by capture of all runoff from vineyard Units 2 and 3 by the proposed stormwater collection/storage system. The rapid movement of runoff across the property would be further impeded by the temporary cover provided by straw mulch and by the permanent cover crop of annual and perennial grasses, as well as by the installation of other erosion control features such as v-ditches and swales.

Furthermore, the West Yost Hydrologic Evaluation found that the proposed project would not constitute a significant risk in terms of flood hazard. According to the THP, major high flow events occurred in the Gualala Basin in 1955, 1964, 1974, 1986, 1993, 1995, and 1997. Recent high flow events are believed to have had insignificant adverse impacts to the current hydrologic conditions, although

they have resulted in positive effects by flushing stored sediment through the system.

West Yost determined that flooding potential would be extremely low for this site and downstream, due to site elevation and terrain. The FEMA Flood Insurance Rate Maps (FIRMs) for the project area indicate that the project site would not be susceptible to flooding from local watercourses. Although peak runoff flows could slightly increase with project implementation if water is not routed to the onsite reservoir, West Yost notes that the rural nature of the downstream areas would be likely to minimize flood hazards downstream. The designation of WLPZs during timber harvest activities and minimal disturbance of existing drainage patterns on the site (to the extent feasible) would also minimize the chance of flooding on-site or downstream.

In summary, the Hydrologic Evaluation found that project-related peak flow increases are anticipated to be minor. The largest predicted increase was calculated at five percent over existing conditions at the Node 1 measurement location in a two-year storm if water is not routed to the onsite reservoir. Overall peak flow for the analysis area in aggregate increases about 10 percent if the reservoir is full and runoff is routed through the sump to Drainage Node 20. If the reservoir is being filled, then the aggregate change in peak runoff is an increase of about 7 percent. Furthermore, the Hydrologic Evaluation did not identify potential flood hazards that could result from implementation of the proposed project. Therefore, the impact would be considered ***less-than-significant***.

Mitigation Measure(s)
None required.

3.7-8 Impacts related to fog drip.

Due to the project site's relatively close proximity to the Pacific Coast, the site is subject to fog drip. The USDA Forest Service conducted a study at the Caspar Creek Experimental Watershed in 1998. The study determined that fog drip makes a highly variable, but hydrologically insignificant, contribution to groundwater and baseflow processes in the coastal redwood/Douglas-fir forest type at Caspar Creek. During the study, measurements were conducted underneath the forest canopy and in nearby clearings to identify the volume of precipitation that results from fog drip. The study found that the sites with the largest interception volumes, fog drip accounted for only three percent of the mean annual precipitation. However, fog drip augments dry season precipitation by up to 65 percent. In addition, fog drip serves to increase ambient humidity and moderate air temperatures.

While fog drip augments dry season precipitation, evapotranspiration and water interception by forest cover has a substantially larger effect on soil moisture,

groundwater storage, and summer base flows. As discussed above, the high evapotranspiration rate of forest cover, in combination with the interception of rainfall by tree canopies, has a large effect on soil moisture. The water balance analysis conducted at Caspar Creek found that the reduction in evapotranspiration more than offset the potential decrease in fog drip interception. In fact, annual water yield and summer flows have been observed to increase following timber harvests at Caspar Creek, which indicates that following timber harvest, the effect of reduced interception and transpiration on groundwater and summer flows exceeds diminishment due to the loss of fog drip. Therefore, while fog drip is important to forest ecology, the net effect on groundwater and summer flows is more than offset by the reduction in evapotranspiration and canopy interception.

In addition, for the Fairfax Conversion project site, it should be noted that the site is not entirely forested. Approximately 19 acres of the 190-acre impact area is currently grassland habitat. Coastal scrub habitat is also located on the eastern portion of the project site. Furthermore, the project has been designed to conserve 133 acres of streamside buffers, which include conifers and hardwoods. As a result of the above-described study's findings, the project's incorporation of conservation areas containing mature trees, and the consideration of the current site conditions, a ***less-than-significant*** impact to fog drip would occur.

Mitigation Measure(s)
None required.

Cumulative Impacts

Cumulative impacts to Hydrology and Water Quality are analyzed in Impact Statement 4-8 of Chapter 4, Cumulative Impacts.

Endnotes

[1] O'Connor Environmental, Inc. *Hydrologic Analysis, Artesa Fairfax THP and Conversion*, May 2008.
[2] O'Connor Environmental, Inc. *Erosion Analysis, Artesa Fairfax THP and Conversion*. May 2008.
[3] West Yost & Associates, Inc. *Fairfax Timberland Conversion and Vineyard Development Project – Hydrologic Evaluation.* July 15, 2008.
[4] Erickson Engineering, Inc. *Erosion Control and Mitigation Plan.* April 14, 2008.
[5] North Coast Resource Management, Inc. *Timber Harvesting Plan, Fairfax Conversion.* July 2007.
[6] County of Sonoma. *General Plan.* March 23, 1989 as amended through December 31, 1998.
[7] County of Sonoma. *General Plan Update Environmental Impact Report.* December 1986.
[8] California Department of Forestry and Fire Protection, *Forest Practice Rules 2007*, 2007.
[9] County of Sonoma. *Sonoma County Code, Chapter 30, Article 4, Section 30-60*, May 2007.
[10] Inland Ecosystems, *Fairfax Conversion Fisheries Assessment*, July 2007.
[11] Erickson Engineering, Inc., *Vineyard Water Availability*, June 5, 2007.
[12] Keppeler, E. (2007) Effects of Forest Management on Fog Drip and Streamflow, Caspar Creek Experimental Watersheds, Mendocino County, California. In Proceedings of the Redwood Science

Symposium, "What does the future hold?" March 15-17, 2004, Rohnert Park, California, USDA Forest Service General Technical Report PSW-GTR-194, pp. 85-93.

[13] Erickson Engineering, Inc., *Vineyard Water Availability*, June 5, 2007.

[14] Battany, M.C. and Grismer, M.E. (2000) Rainfall runoff and erosion in Napa Valley vineyards: effects of slope, cover and surface roughness. Hydrological Processes 14:1289-1304