IV. ENVIRONMENTAL IMPACT ANALYSIS
G. HYDROLOGY AND WATER QUALITY

INTRODUCTION

This Draft SEIR chapter describes the environmental setting for the proposed project, including a description of the watershed and groundwater basin, surface runoff and drainage, flooding, and water quality, based on available information provided as part of the project application (Appendix J-1), published reports, and a site visit. The environmental setting also describes the project regulatory framework. Following the setting, impacts that could result from implementation of the proposed project are evaluated, and mitigation measures to reduce impacts to a less-than-significant level are recommended, where appropriate.

ENVIRONMENTAL SETTING

Watershed and Groundwater Basin Characteristics and Project Site Topography, Stormwater Runoff, and Drainage

Watershed Description

The project site is located within the Corte Madera Creek watershed. Corte Madera Creek is a perennial stream draining twenty-eight square miles of primarily forested Coast Range Mountains and narrow valley flats within the urbanized corridor of central eastern Marin County, discharging into San Francisco Bay.

The watershed is bounded on the west by a steep, forested ridge running northwest from the East Peak of Mount Tamalpais (elevation 2,571 feet) to Pine Mountain and then north-northeast to White's Hill (elevation 1,430 feet) and Loma Alta (elevation 1,592 feet). Major tributaries to Corte Madera Creek include San Anselmo Creek, Fairfax Creek, Sleepy Hollow Creek, Ross Creek, Tamalpais Creek, and Larkspur Creek. San Anselmo and Fairfax Creeks are perennial tributaries which rise along the western forested ridge and drain onto relatively steep and narrow valley flats; these creeks combine as San Anselmo Creek. Fairfax Creek is tributary to San Anselmo Creek in the Town of Fairfax.

Several intermittent tributaries rise on the grassland and grass-oak woodland-covered hills along the northern and eastern edges of the basin. Sleepy Hollow Creek joins San Anselmo Creek in San Anselmo near Saunders Avenue.

San Anselmo Creek flows southeast through Ross Valley, bounded on the east by a southeast running sandstone ridge. San Anselmo Creek becomes named Corte Madera Creek where it is joined by the major tributary Ross Creek in Ross. Ross Creek is an intermittent tributary descending from the northern flank of Mount Tamalpais. The upstream two square miles of the Ross Creek watershed are impounded by Phoenix Dam to create an emergency water supply reservoir owned and operated by Marin Municipal Water District. The reservoir covers a surface area of approximately 28 acres.

Beginning in Ross, Corte Madera Creek is contained within an approximately one mile long concrete lined flood control channel. The Army Corps of Engineers constructed the trapezoidal concrete channel between 1967 and 1971. The completed sections of the Corte Madera Creek Flood Control Project also include a periodic dredging maintained earthen channel downstream the concrete channel. The concrete and earthen channels are operated and maintained by the Marin County Department of Public Works. The concrete channel drains into the earthen channel section at Kentfield. The earthen channel section is entirely below sea level. It is flanked by remnants of the tidal salt marsh. Tamalpais Creek discharges via a double-barrel concrete culvert to Corte Madera Creek just downstream from the concrete channel. Tamalpais Creek drains a residential area within foothills at the base of the east flank of Mount Tamalpais to a trapezoidal concrete flood control channel section near Woodland Avenue before entering the double-barrel culvert running beneath the valley flat occupied by College of Marin campus. Larkspur Creek discharges to Corte Madera Creek near Corte Madera via a narrow constructed earthen channel. Larkspur Creek drains a steep slope on the southeast flank of Mount Tamalpais and a portion of the residential and urban areas within the City of Larkspur. Overall, Corte Madera Creek has approximately 29 named tributaries comprising a total length of approximately 44 miles.[1]

The valley floors are entirely urbanized and the parts of the forested hillslopes not in open space protection are developed for residential land uses. Approximately 60 percent of the watershed is urbanized.[2] The overall imperviousness of the watershed is estimated to be 5-10 percent.[3] Historical land use changes including deforestation and livestock grazing in the late 1800s and increasing urbanization throughout the 1900s have changed Marin County watershed's sediment yield and hydrology leading to channel incision and increased peak flood flows.[4] A similar pattern of historical land use impacts has been documented in the Corte Madera Creek watershed.[5] The Corte Madera Creek main channel upstream from the Army Corps of Engineers built flood control project and its major tributary creek channels occurring within urbanized areas are incised. The rate of bed elevation decline has subsided as natural bedrock outcrops have been exposed on the bed and grade control structures were installed to protect bridge crossings. Although the incised channels have not yet reached a stable equilibrium width, the rate of channel widening and bank retreat has been slowed by widespread installation of bank revetments, mostly at outside bend channel positions. About sixty to seventy percent of

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1 *Friends of Corte Madera Creek. http://friendsofcortemaderacreek.org/new_site/watershed/*

2 *California Dept. of Forestry, 2003,http://frap.cdf.ca.gov/data/frapgisdata/select.asp*

3 *Reilly, James, Stetson Engineers Inc., pers. comm., March 17, 2010, refers to unpublished GIS analysis of USGS data.*

4 *Montgomery, D.R. 1999. Erosional Processes at the Head of an Abrupt Channel Head: Implications for Channel Entrenchment and Discontinuous Gully Formation. In: S.E. Darby and A. Simon, eds., Incised River Channels: Processes, Forms, Engineering, and Management. Chichester, UK: John Wiley & Sons.*

5 *Smeltzer, M., J. Reilly, and D. Dawdy. 2000. Geomorphic Assessment of the Corte Madera Creek Watershed. Final Report to the Friends of Corte Madera Creek and the Marin County Department of Public Works, December 31, 2000. http://www.friendsofcortemaderacreek.org*

the stream banks of the Corte Madera Creek main channel and its major tributary creek channels occurring within urbanized areas are still unmodified by channelization and bank revetments.[6] About sixty-five percent of the banks of San Anselmo and Fairfax Creeks within the Town of Fairfax are still unmodified, and about ten percent are experiencing ongoing severe bank erosion.[7] A greater percentage of Ross Creek banks have been permanently stabilized. Perhaps accordingly, a smaller percentage remains in a severely eroding condition. Fifty-three percent of the banks of Ross Creek within the Town of Ross are still unmodified, and about two percent are severely eroding.[8]

According to the Water Quality Control Plan for the San Francisco Bay Basin (Basin Plan),[9] beneficial uses of Corte Madera Creek and its tributaries are commercial and sport fishing; cold freshwater habitat; fish migration; preservation of rare and endangered species; fish spawning; warm freshwater habitat; wildlife habitat; contact water recreation; non-contact water recreation; and navigation. The Basin Plan lists municipal and domestic water supply and freshwater replenishment as additional beneficial uses for headwater tributaries to Ross Creek upstream from Phoenix Dam. All of the other major tributaries have the same listed beneficial uses as Corte Madera Creek except for not including commercial and sport fishing. Also, Fairfax Creek and Larkspur Creek are not listed for fish migration. Fairfax and Larkspur Creeks have known existing fish passage barriers near their mouths.[10]

Corte Madera Creek provides critical habitat for state and federally threatened species steelhead trout and Coho Salmon. NOAA-NMFS designates critical habitat for Central California Coast Steelhead occurring within 18 stream miles in the watershed, including the entire main channel, and substantial parts of tributaries Larkspur Creek, Tamalpais Creek, Ross Creek, Sleepy Hollow Creek, Upper San Anselmo Creek, and Cascade Creek.[11] The critical habitat area for steelhead includes the section of Ross Creek within Natalie Coffin Greene Park which borders the project site. In 1969, California Dept. of Fish and Wildlife collected 109 steelhead from Ross Creek within the park, estimating the total juvenile population in the reach to be approximately 3,000.[12] Leidy and Lewis identified steelhead in Ross Creek near the

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[6] *Smeltzer, Matt, geomorphDESIGN, referring to published and unpublished field data from multiple sources.*

[7] *Smeltzer and Orum, 2006. Geomorphic Assessment of Fairfax and San Anselmo Creeks in Fairfax, California. Report to Town of Fairfax, July 31, 2006.*

[8] *Smeltzer, 2007. Prospects for Restoring Riparian Canopy and Physical Habitat for Fish on Ross Creek: Geomorphic Reconnaissance Report. Report to Friends of Corte Madera Creek. March 7, 2007. http://www.friendsofcortemaderacreek.org*

[9] *San Francisco Bay Regional Water Quality Control Board. San Francisco Bay Basin (Region 2) Water Quality Control Plan (Basin Plan), incorporating all approved amendments as of 31 December 2011.*

[10] *Ross Taylor and Assoc. 2006. Corte Madera Creek Stream Crossing Inventory and Fish Passage Evaluation. Prepared for Friends of Corte Madera Creek Watershed with funding from the National Fish and Wildlife Foundation. 54 pp and appendices. http://www.friendsofcortemaderacreek.org*

[11] *NOAA Marine Fisheries, August 2005, http://swr.nmfs.noaa.gov/salmon/layers/finalgis.htm*

[12] *Leidy, R.A., G.S. Becker, B.N. Harvey, 2005. Historical distribution and current status of steelhead/rainbow trout (Onchorhynchus mykiss) in streams of the San Francisco Estuary, California. Center for Ecosystem Management and Restoration, Oakland, CA.*

downstream end of the park (where the project site's "Swan Swale" discharges to Ross Creek), and estimated the population to be about 25-200 individuals. Certain tributaries to Ross Creek are considered to have "intrinsic potential" to provide steelhead habitat under historical and presumably future, restored watershed conditions.[13] These tributaries do not include "Swan Swale", "Frog Swale", and the two smaller unnamed ephemeral creeks located on the project site.

Corte Madera Creek also provides critical habitat for Central California Coast Coho occurring within the main channel from San Francisco Estuary to the upstream end of the concrete channel. Corte Madera Creek and Arroyo Corte Madera del Presidio (watershed draining the Mill Valley vicinity to the immediate south) are the only two San Francisco Estuary streams designated as critical habitat for Coho. A temporary grade control structure with a poorly performing fish ladder there is a known fish passage barrier.[14] The most recent Coho observation was near the fish barrier in 1986.[15] Coho habitat doesn't presently occur on Ross Creek near the project site, but the reach of Ross Creek bordering the project site is considered to have "intrinsic potential" to provide Coho habitat under historical and presumably future, restored watershed conditions.

The Corte Madera Creek watershed has a semi-arid Mediterranean coastal climate characterized by cool dry summers and mild wet winters. The average annual precipitation ranges from 55 inches on the western ridges to 27.5 inches on the eastern part of the watershed, averaging about 46 inches.[16] Characteristic of the region, about 80-90 percent of the rainfall occurs between November and April. The average annual rainfall for the period October 1979 through September 1996 measured by Roy Farrington Jones on Olive Avenue in Ross was 49.33 inches. The lowest rainfall during that period was 28.29 inches in water year 1990. The highest was 90.75 inches during water year 1983.[17]

Groundwater Basin Description

The project site is located about 0.7 miles west of the Ross Valley Groundwater Basin (California Department of Water Resources (DWR) Basin No. 2-28), which has a surface area of 2.8 square miles. Unconsolidated Holocene alluvial deposits are the primary water-bearing formations in the basin.[18] According to DWR, there are no published data relating to groundwater table level fluctuations and storage volume of the Ross Valley Groundwater Basin.

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[13] *NOAA Marine Fisheries, 2005. http://swfsc.noaa.gov/*

[14] *Ross Taylor and Assoc. 2003. Marin County stream crossing inventory and fish passage evaluation. Final report to Marin County of Public Works.*

[15] *CDFG, Coho Distribution, May 2007.*

[16] *California Dept. of Forestry, 1990. http://frap.cdf.ca.gov/data/frapgisdata/select.asp*

[17] *Friends of Corte Madera Watershed, http://www.friendsofcortemaderacreek.org*

[18] *California Department of Water Resources, 2003. Bulletin 118.*
http://www.water.ca.gov/groundwater/bulletin118/san_francisco_bay.cfm

According to the Basin Plan[19] existing beneficial uses of the groundwater basin include municipal and domestic water supply and agricultural water supply. Potential beneficial uses of the groundwater basin are industrial process water supply and industrial service water supply.

Project Site Characteristics

The project site is entirely forested, and sloping, rising from approximately 85 feet above mean sea level (msl) along its eastern margin occurring near the top of bank of Ross Creek to a maximum elevation of approximately 675 feet msl near the western margin. The site is bounded by open space to the east (Natalie Coffin Greene Park), south (Marin Municipal Water District holding), and west (Town of Ross holding). To the north, the site is bounded by residential properties accessed by Upper Road.

The project site is relatively steeply sloping, unpaved, and covered with vegetation. The only impervious areas are the existing asphalt-concrete driveway surface and failed/failing roofs and/or foundations of the existing buildings and water storage tanks. There is no on-site stormwater drainage system.

The large majority of the project site drains from west to east. The project site contains two linear non-wetland water features, colloquially known as Frog Swale and Swan Swale and two additional ephemeral drainages. These drainage features are natural watercourses that are tributary to Ross Creek. A watercourse is defined by CDFG as a stream channel in which water currently flows, or has flowed over a given course as defined by the topography that confines the water to this course when the water rises to its highest level (CDFG 2010). Swan and Frog Swales meet the regulatory definition. The largest watercourse, "Swan Swale", drains the central portion of the site including an open space headwater area west of the site, discharging to Ross Creek just off the property to the east near the downstream end of Natalie Coffin Greene Park. "Frog Swale" drains a smaller watershed almost entirely within the site boundaries and immediately to the south of Swan Swale. There are also two smaller unnamed creeks draining areas entirely or almost entirely within the site boundaries (Figure IV.G-1).

[19] *San Francisco Bay Regional Water Quality Control Board. 2011, op. cit.*

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MARIN COUNTY
PUBLIC WORKS
AERIAL TOPOGRAPHY

DETAILED SITE
TOPOGRAPHY

POC # 6
Q_{25}= 9.60 cfs
Q_{100}= 12.20 cfs

POC # 5
Q_{25}= 1.33 cfs
Q_{100}= 1.68 cfs

POC # 4
Q_{25}= 43.08 cfs
Q_{100}= 54.96 cfs

POC # 3
Q_{25}= 3.62 cfs
Q_{100}= 4.58 cfs

POC # 2
Q_{25}= 14.98 cfs
Q_{100}= 19.43 cfs

POC # 1
Q_{25}= 8.77 cfs
Q_{100}= 11.14 cfs

AREA 1
41.96 ac
C=0.59

AREA 2
1.00 ac
C=0.59

AREA 3
2.63 ac
C=0.59

AREA 4
13.02 ac
C=0.59

AREA 5
6.79 ac
C=0.59

AREA 6
7.78 ac
C=0.59

POINT C
POINT D
POINT E
POINT F
POINT H
POINT J

(UNNAMED SWALE)
12" CMP (EXISTING)
10" CMP (EXISTING)
24" CMP (EXISTING)
(SWAN SWALE)
(FROG SWALE)
ROSS CREEK

WAIS
WEISEL
GREENBERG
STUART
TOWN OF ROSS
M.M.W.D.
M.M.W.D.
NATALIE COFFIN
GREENE PARK

0 200

LEGEND:

- CREEK/SWALE
- OVER LAND PATH OF FLOW
- EXISTING WATERSHED BOUNDAR'

POC	AREA #	AREA (ac)	C	Q_{25} (cfs)	Q_{100} (cfs)
1	5	6.79	0.59	8.77	11.14
2	4	13.02	0.59	14.98	19.43
3	3	2.63	0.59	3.62	4.58
4	1	41.96	0.59	43.08	54.96
5	2,6	8.78	0.59	11.50	14.56

Figure IV.G-1. Existing Conditions Hydrology Plan

Upper Road Land Division Project
Town of Ross, California

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ENVIRONMENTAL CONSULTANTS

Date: OCTOBER 2012
Source: CSW | Stuber-Stroeh Engineering Group, Inc.

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A small percentage of the site drains to the north to a fifth watercourse occurring partly on but practically adjacent to the project site, an intermittent unnamed creek running east-northeast along the northern property margin. Part of the northern site area drains by overland flow directly into the creek along the property margin upstream from where the creek passes under Upper Road via an existing 24-inch-diameter culvert. The remaining part of the northern site area drains to the creek downstream from the Upper Road culvert by three pathways: (1) primarily intercepted by the existing driveway and conveyed to the creek via a network of stormwater drainage facilities within the Upper Road right-of-way, including inboard earthen ditches and existing 10-inch-diameter and 12-inch-diameter culverts; (2) driveway intercepted runoff bypassing the inboard ditch inlet at the driveway entrance and passing to the creek as sheet flow over the Upper Road surface; and (3) probably small amount of runoff escaping interception by the existing driveway and passing via the historical overland flow pathway onto the residential property to the northeast and ultimately entering the creek at a downstream location. All three runoff pathways are to the unnamed creek upstream from where it discharges to Ross Creek immediately downstream from Glenwood Avenue Bridge via an ad-hoc network of open channel sections and private and public stormwater drainage facilities. The Town of Ross does not hold design documents for the stormwater drainage network or its individual facilities.

Flooding and Coastal Hazards

Corte Madera Creek and Project Site

Broad flood inundation is relatively common in several floodplain and low-lying areas of the Corte Madera Creek watershed, including residential and commercial areas within Fairfax, San Anselmo, Ross, and Kentfield.[20] These broad flood inundation areas are located approximately 0.7 miles to the east of the project site. Part of the eastern margin of the project site is within the riparian corridor of Ross Creek. This section of Ross Creek contains the one percent chance flood.[21] The entire project site area is designated on the Federal Emergency Management Agency's (FEMA) Flood Insurance Rate Map (FIRM) as Zone X.[22]

Dams and Levees

There are no levees in the project vicinity.[23] A large part of the project site is located within a dam failure inundation hazard area mapped along Ross Creek downstream from Phoenix Dam. The hazard area is determined by the California Office of Emergency Services and mapped by

[20] *Stetson Engineers Inc. 2011. Capital Improvement Plan Study for Flood Damage Reduction and Creek Management in Flood Zone 9/Ross Valley. Report to Marin County Dept. of Public Works, May 2011.*

[21] *FEMA, National Flood Insurance Rate Map, Marin County, California, Community Panel Number 06041C0454D, effective date, May 4, 2009.*

[22] *Zone X is defined by FEMA as an area of minimal flood hazard, usually depicted on Flood Insurance Rate Maps as above the 500-year flood level.*

[23] *FEMA, 1981, op. cit.*

the Association of Bay Area Governments.[24] The hazard area depicts the potentially flood submerged areas should Phoenix Reservoir quickly drain into Ross Creek in the event of catastrophic failure of Phoenix Dam. The hazard area maps onto upland areas at the project site rising more than 150 feet above the banks of adjacent Ross Creek. Depending on multiple factors, the actual inundation area on the project site resulting from potential (e.g., earthquake induced) catastrophic failure of Phoenix Dam may not rise to 150 feet above the banks of Ross Creek, but would overlap a substantial part of the site area between Ross Creek and the east-facing hillslope which would be occupied by the proposed building envelopes.

Sea Level Rise

Over the past century, sea level has risen nearly eight inches along the California coast, and modeling scenarios suggest very substantial increases in sea level resulting from climate change over the coming century. Pacific Institute estimates that sea level could rise as much as 55 inches by the year 2100.[25] Pacific Institute generated maps showing areas at risk of flooding due to the projected 55 inch increase in sea level. The maps show areas estimated to be inundated by the 100-year flood under both current conditions and future projected conditions with 55 inch higher sea level. The maps were generated at 1:24,000 scale corresponding to the 7.5-minute USGS quadrangle map series. The project area is located in the San Rafael USGS quadrangle map. The map shows that the project would not be at risk from sea level rise.[26]

Tsunamis

Tsunamis are long-period waves generated during earthquakes or underwater landslides that disturb the ocean floor. Tsunami inundation maps for the San Rafael Quadrangle in Marin County show that the project site is not located within a tsunami inundation hazard area.[27]

Water Quality Conditions

Corte Madera Creek and Ross Creek

The Marin County Stormwater Pollution Prevention Program (MCSTOPP) was assisted by the Sustainable Land Stewardship Institute (SLSI) in implementing a Bioassessment Sampling Program for major creeks tributary to San Francisco Bay.[28] SLSI conducted benthic macroinvertebrate sampling at ten sites on Corte Madera Creek and its tributaries in 1999-2002 (September 1999, April 2000, and Spring 2002). SLSI analyzed sampling data to calculate EPT

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[24] *Association of Bay Area Governments, "Bay Area Dam Inundation Hazards," http://www.abag.ca.gov/bayarea/eqmaps/damfailure/damfail.html, Accessed January 19, 2011.*

[25] *Pacific Institute, The Impacts of Sea-Level Rise on the California Coast, May 2009.*

[26] *Pacific Institute, California Flood Risk: Sea Level Rise, San Rafael Quadrangle, 2009.*

[27] *California Emergency Management Agency, University of Southern California, and the California Geological Survey, Tsunami Inundation Map for Emergency Planning, San Rafael Quadrangle, State of California, County of Marin, June 15, 2009.*

[28] *Marin Countywide Stormwater Pollution Prevention Program, http://www.krisweb.com/kris_ems/krisdb/webbuilder/selecttopic_marin_county_de.htm*

(*Ephemeroptera, Plecotera, Trichoptera*) taxa, percent dominant taxon, taxonomic richness, and total Index of Biological Integrity (IBI) score at the sites. The degree of water quality impairment at the sites is inferred by comparing to reference values developed by the California Department of Fish and Wildlife for the Russian River Index of Biological Integrity using California Stream Bioassessment Procedure for first to third order streams (Harrington et al., 1999). In general, the sampling data indicate that the degree of water quality impairment reduces along the mainstem Corte Madera Creek moving upstream into the tributaries. The data indicate highly impaired water quality at all of the sites located within or downstream from urbanized sections of Corte Madera Creek and its tributaries. Two of the ten sites are located within undeveloped upper watershed areas. Data collected at these upstream sites indicated the highest water quality, generally not exceeding the "highly impaired" thresholds established by Harrington et al. (1999). One of the upstream sites is located on Bill Williams Creek tributary to Ross Creek upstream from Phoenix Dam, about 0.7 miles south of the project site. The closest mainstem Corte Madera Creek is near downtown Ross about 0.7 miles east of the project site.

The Friends of Corte Madera Creek began coordinating water quality data collection activities in the watershed in 1999.[29] First, as part of a watershed-scale fishery resource conditions study, A.A. Rich and Associates (2000) installed and monitored thermographs that recorded summer water temperature at numerous locations during the summer of 1999.[30] Summer water temperatures were found to be higher than suitable for steelhead trout, except in upper watershed locations with reliable spring fed summer base flows.

Friends-coordinated volunteers gathered water samples in Corte Madera Creek and its tributaries for bacteria testing during six sampling periods from 2003 to 2006. The samples were tested for bacteria count by the EPA Region 9 Laboratory and the Marin County Public Health Laboratory. The laboratory results were highly variable by location and over time. Measured bacteria levels sometimes exceeded contact recreational limits. After 2006, the Ross Valley Sanitary District started a regular bacteria monitoring program at five creek locations.

Friends-coordinated volunteers also measured water temperature, pH, dissolved oxygen, and specific conductivity in San Anselmo Creek near Downtown San Anselmo at Bridge Avenue from June through October 2008.[31] Dissolved oxygen generally ranged from 4 to 6 mg/L and temperature generally ranged from 17 to 21 degrees Celsius. Volunteers measured water temperature, pH, dissolved oxygen, and specific conductivity in Ross Creek and in depth profiles within Phoenix Lake from May through October 2008, and May through mid-November 2009.[32] Friends documented a degradation of water quality in upper Ross Creek during the

[29] *http://friendsofcortemaderacreek.org/new_site/restoration/water-quality/*
[30] *http://friendsofcortemaderacreek.org/rep/FisheriesES.pdf*
[31] *http://www.friendsofcortemaderacreek.org/proj/BridgeT_DO.pdf*
[32] *http://www.friendsofcortemaderacreek.org/proj/RossCreekPhoenixLake2008.pdf*

summer when flows are low.[33] Specifically, levels of iron and manganese were found to be undesirably high for aquatic life in Ross Creek within 1,600 feet from Phoenix Dam. The project site borders Ross Creek about 0.5 miles downstream from Phoenix Dam.

Phoenix Lake will be retrofitted to reduce discharges into Ross Creek during flooding imminent conditions in flood prone sections of Corte Madera Creek downstream. In 2011, the Department of Water Resources awarded grant funding to the Marin County Flood Control District's Ross Valley Watershed Flood Protection Program for the Phoenix Lake Retrofit Project. The heart of the project is retrofitting and seismically upgrading the dam at Phoenix Lake, allowing the lake to be operated for flood management, drinking water supply, water quality improvements in Phoenix Lake and Ross Creek, ecosystem restoration, and public recreation improvements. The project will be developed in partnership with Marin Municipal Water District.

In collaboration with the Phoenix Lake Retrofit Project, Friends added two temperature loggers (recorders) in Corte Madera Creek in Spring 2012, located upstream and downstream from the Ross Creek confluence. Also in collaboration with the Retrofit Project, samples taken from Phoenix Lake will be analyzed for chlorophyll-a, a measure of algal growth, and for iron and manganese. Also, a "Secchi disk" will be used to measure water transparency.

More recently, Friends has placed temperature loggers in Fairfax Creek, San Anselmo Creek in Fairfax, and Sleepy Hollow Creek, to update temperature information first gathered in 1999.

Corte Madera Creek is on the Clean Water Act (CWA) 2010 303(d) list due to impairment from Diazinon.[34] Potential sources of Diazinon include urban runoff/storm sewers. This listing was made by U.S. Environmental Protection Agency (USEPA) for the 1998 303(d) list. For 2006, diazinon was moved by USEPA from the 303(d) list to the being addressed list because a Total Maximum Daily Load (TMDL)[35] for Diazinon in Corte Madera Creek was completed in 2007.

Ross Valley Groundwater Basin

The DWR reports that groundwater quality data for the basin are minimal. No published data were found regarding impairments.[36] Limited 1954 data suggested no sea-water intrusion. 1972 reports suggested possible sea-water intrusion in the lower portions of the basin.[37]

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[33] *Friends of Corte Madera Creek Watershed Memorandum: Iron and Manganese Levels in Ross Creek, Summer 2011. http://www.friendsofcortemaderacreek.org/proj/FeMn_Report_2011.pdf*

[34] *http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml*

[35] *A TMDL is a written plan that describes how an impaired water body will meet water quality standards, which contains: (1) a measurable feature to describe attainment of the water quality standard(s); (2) a description of required actions to remove the impairment and; (3) an allocation of responsibility among dischargers to act in the form of actions or water quality conditions for which each discharger is responsible.*

[36] *California Department of Water Resources, 2003, op. cit.*

[37] *California Department of Water Resources, 1975, Sea Water Intrusion in California, Inventory of Coastal Ground Water Basins, Bulletin 63-5, October 1975.*

REGULATORY SETTING

Municipal Stormwater Management Requirements

Federal, State and Regional Requirements

Pursuant to Section 402 of the Clean Water Act (CWA)[38] and the Porter-Cologne Water Quality Control Act,[39] municipal stormwater discharges in the Town of Ross (the Town is part of the Marin Countywide Stormwater Pollution Prevention Program) are regulated under the San Francisco Bay Region Phase II Municipal Regional Stormwater National Pollutant Discharge Elimination System (NPDES) Permit, Order No. 2003-0005-DWQ, NPDES General Permit No. CAS000004 adopted April 30, 2003 (2003 MRP). The 2003 MRP is overseen by the San Francisco Bay Regional Water Quality Control Board (Water Board).

Provision D.2.e of the 2003 MRP addresses post-construction stormwater management requirements for new development and redevelopment projects that disturb greater or equal to one acre. Provision D.2.e requires the Town to develop and implement strategies, which include a combination of structural and/or non-structural BMPs, required by ordinance or other regulatory mechanism, and ensure adequate long-term operation of the BMPs.

On February 5, 2013, the Water Board adopted new Phase II Permit regulations controlling municipal stormwater discharges in the Town of Ross, Water Quality Order No. 2013-0001-DWQ, NPDES General Permit No. CAS000004. The 2013 Order (Phase II Small MS4 General Permit, or 2013 Phase II Permit) implements new waste discharge requirements (WDRs) for stormwater discharges from small municipal separate storm sewer systems (MS4s). The 2013 Phase II Permit requires Permittees such as the Town of Ross to require certain ground disturbing development and redevelopment projects ("Regulated Projects") depending on project type to comply with certain of a set of specific design elements and standards known as "E.12 Post-Construction Requirements" outlined in Section E.12 Post-Construction Stormwater Management Program, including but not limited to: site design and source control measures, low impact development (LID) standards, hydromodification measures, operation and maintenance of stormwater control measures, etc.

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[38] *Federal regulations for controlling discharges of pollutants from municipal separate storm sewer systems (MS4s), construction sites, and industrial activities were incorporated into the National Pollutant Discharge Elimination System (NPDES) permit process by the 1987 amendments to the Clean Water Act (CWA) and by the subsequent 1990 promulgation of federal stormwater regulations issued by the U.S. Environmental Protection Agency (EPA). In California, the EPA delegated its authority to the State Water Resources Control Board (State Water Board) to issue NPDES permits.*

[39] *Under the Porter-Cologne Water Quality Control Act (Porter-Cologne), the State Water Board has the ultimate authority over state water rights and water quality policy. Porter-Cologne also established the nine Regional Water Quality Control Boards to oversee water quality at the local/regional level. The State Water Board shares authority for implementation of the CWA and the Porter-Cologne Act with the Regional Water Quality Control Boards.*

In general, proposed land development or redevelopment projects that create or replace impervious area and require discretionary permits from the Permittee, such as building permits, not deemed complete for processing processing by June 30, 2015 will be required to meet the E.12 Post-Construction Requirements. Certain projects requiring permits not deemed complete for processing by June 30, 2016 will be required to also meet the Section E.12.f Hydromodification Management Requirements of the E.12 Post-Construction Requirements.

Marin County and Town of Ross Requirements

In compliance with the 2003 Order, the Town, as part of a group of entities under the Marin County Stormwater Pollution Prevention Program (MCSTOPPP) umbrella, prepared a Stormwater Management Plan in 2001.[40] The MCSTOPPP Stormwater Management Plan lists as a performance standard establishment of requirements for developers to control stormwater quality impacts of their projects by using appropriate BMPs during construction activities, such as by, among other things, requiring developers to submit for review and approval an effective erosion and sediment control plan. In 2008, MCSTOPPP issued a document titled "Guidance for Applicants: Stormwater Quality Manual for Development Projects in Marin County."[41] A "Stormwater Quality Control Plan Checklist" is provided at page 3-2. In 2009, MCSTOPPP issued guidelines and selected BMP design standards titled "Minimum Erosion/Sediment Control Measures for Small Construction Projects."[42]

In compliance with the 2013 Phase II Permit, MCSTOPPP will issue later in 2014 an update to the 2008 Guidance document titled "E.12 Technical Guidance for Applicants: Stormwater Quality Manual for Development Projects in Marin County (or similar)" (E.12 Technical Guide, E.12 Post-Construction BMP Guidance Document, Stormwater Technical Guide, or similar). Projects required to meet the E.12 Post-Construction Requirements shall need to incorporate design elements and meet standards outlined in the 2013 Phase II Permit, including but not limited to elements and standards also outlined in MCSTOPPP's E.12 Technical Guide. MCSTOPP will also issue later in 2014.

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[40] *EOA, Inc. 2001. Stormwater Management Plan. Action Plan 2005. Prepared for Marin County Stormwater Pollution Prevention Program, Jan 2001.* http://www.waterboards.ca.gov/water_issues/programs/stormwater/swmp/marin_swmp.pdf

[41] *Stormwater Quality Manual for Development Projects in Marin County: Guidance for Applicants.* http://www.marincounty.org/depts/pw/divisions/mcstoppp/development/~/media/Files/Departments/PW/mcstoppp/GuidanceforApplicantsv_2508.pdf

[42] *Marin County Stormwater Pollution Prevention Program: Minimum Erosion/Sediment Control Measures for Small Construction Projects. Available at:* http://www.marincounty.org/depts/pw/divisions/mcstoppp/development/~/media/Files/Departments/PW/mcstoppp/development/MECM_final_2009.pdf

The Town of Ross Municipal Code Section 12.28.090(3) titled "Best Management Practices for New Developments and Redevelopments"[43] stipulates that, among other things:

- Appropriate BMPs shall be implemented to prevent the discharge of construction wastes or contaminants from construction activities from entering a town storm drain.
- All construction plans and building permit applications shall consider the potential for erosion and sedimentation at the construction site, and include appropriate erosion and sedimentation controls and BMPs, such as site planning considerations, construction staging and timing, and installation of temporary detention ponds or other treatment facilities.
- Controls may be placed on the volume and rate of stormwater runoff to minimize peak flows or total runoff volume, including limits on impervious area or requiring on-site detention and retention of site runoff.
- Requirement of permanent structural controls designed for removal of sediment and other pollutants.

Town Code Section 15.54.010 titled "Low impact development for stormwater management and requirement for drainage plans" stipulates that:

- No down spouts shall be connected directly to the Town storm drain system or drain directly into any water course or creek without first going through a treatment area such as flowing over a landscaped area, lawn, French drain, or other approved area or facility that cleans, filters, slows the speed and amount of water leaving a property.
- A drainage plan may be required demonstrating that the project will produce no net increase in the rate and volume of peak runoff from the site compared to pre-project conditions (no net increase standard).
- Applicants/Owners may be required to enter into and/or record a maintenance agreement for drainage facilities.

The Town of Ross will soon consider ordinances to update applicable Town Code Sections for complying with the Water Board's 2013 Phase II Permit.

[43] *Town of Ross Municipal Code Chapter 12.28: Urban Runoff Pollution Prevention.* *http://www.townofross.org/pdf/resource_center/municipal_code/12.28%20Urban%20Runoff%20Pollution%20Prevention.pdf*

Construction Phase Stormwater Management Requirements

Federal and State Requirements

Pursuant to CWA Section 402 and the Porter-Cologne Water Quality Control Act, on April 30, 2003, the State Water Resources Control Board (State Water Board) adopted an NPDES General Permit No. CAS000004 (Construction General Permit). To obtain coverage under the Construction General Permit, the project applicant must provide via electronic submittal, a Notice of Intent (NOI), a Storm Water Pollution Prevention Plan (SWPPP), and other documents. Activities subject to the Construction General Permit include clearing, grading, and disturbances to the ground, such as grubbing or excavation. The permit also covers linear underground and overhead projects such as pipeline installations. Construction General Permit activities are regulated at a local level by the San Francisco Bay Regional Water Quality Control Board (Water Board).

The Construction General Permit uses a risk-based permitting approach and mandates certain requirements based on the project risk level (i.e., Level 1, Level 2, or Level 3, with Level 3 having the highest risk). The project risk level is based on the risk of sediment discharge and the receiving water risk. The sediment discharge risk depends on the project location and timing (i.e., wet season versus dry season activities). The receiving water risk depends on whether the project would discharge to a sediment-sensitive receiving water, defined by specific beneficial uses of the receiving water in the Basin Plan (i.e., cold freshwater habitat, fish migration, and fish spawning), a listing on the CWA 303(d) list due to sediment impairment, or having a Total Maximum Daily Load in place to address excessive sedimentation. The proposed project would not be Risk Level 1 because it would discharge to a sediment-sensitive creek (Ross Creek has existing beneficial uses of cold freshwater habitat, fish spawning, and fish migration). The determination of the project as Risk Level 2 or 3 would be made by the project applicant when the NOI is filed.

The performance standard in the Construction General Permit is that dischargers shall minimize or prevent pollutants in stormwater discharges and authorized non-stormwater discharges through the use of controls, structures, and management practices that achieve Best Available Technology (BAT) for treatment of toxic and non-conventional pollutants and Best Conventional Technology (BCT) for treatment of conventional pollutants.[44] The permit also imposes numeric action levels[45] (Level 2 and Level 3 projects) and numeric effluent limits (Level 3 projects) for pH and turbidity, as well as minimum BMPs that must be implemented at all sites.

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[44] *As defined by U.S. EPA, Best Available Technology (BAT) is a technology-based standard established by the CWA as the most appropriate means available on a national basis for controlling the direct discharge of toxic and non-conventional pollutants to navigable waters. The BAT effluent limitations guidelines, in general, represent the best existing performance of treatment technologies that are economically achievable. Best Conventional Technology (BCT) is a technology-based standard that applies to treatment of conventional pollutants, such as total suspended solids.*

[45] *Numeric action levels are used as a warning to evaluate if BMPs are effective and to take necessary corrective actions.*

A SWPPP must be prepared by a Qualified SWPPP Developer that meets the certification requirements in the Construction General Permit. The purpose of the SWPPP is to (1) to help identify the sources of sediment and other pollutants that could affect the quality of stormwater discharges; and (2) to describe and ensure the implementation of BMPs to reduce or eliminate sediment and other pollutants in stormwater as well as non-stormwater discharges resulting from construction activity. Operation of BMPs must be overseen by a Qualified SWPPP Practitioner that meets the requirements outlined in the permit. For Level 2 and Level 3 projects, the discharger must also prepare a Rain Event Action Plan as part of the SWPPP that must be designed to protect all exposed portions of the construction site; a Rain Event Action Plan must be prepared 48 hours before each predicted qualifying rain event.

The SWPPP must also include a construction site monitoring program. The monitoring program includes, depending on the project risk level, visual observations of site discharges, water quality monitoring of site discharges (pH, turbidity, and non-visible pollutants, if applicable), and receiving water monitoring (pH, turbidity, suspended sediment concentration, and bioassessment).

The 2013 Phase II Permit requires Permittees such as the Town of Ross, prior to issuing a grading or building permit to require each operator of any soil disturbing construction activity within its jurisdiction to prepare and submit an erosion and sediment control plan (ESCP) for the Permittee's review and approval, and implement BMPs year-round. For larger projects, the SWPPP developed pursuant to the Construction General Permit may substitute for the required ESCP, should the SWPPP meet the requirements of the Permittee's construction site stormwater runoff control ordinance and the 2013 Phase II Permit.

ENVIRONMENTAL IMPACTS

This section analyzes hydrologic and water quality impacts that could result from implementation of proposed project during the construction and post-construction (operational phase) periods. The section begins with the criteria of significance, which establish the threshold for determining whether an impact is significant. Impacts determined to be less than significant in the Initial Study are discussed, followed by impacts considered to be potentially significant per the Initial Study. Mitigation measures are recommended as necessary to reduce identified impacts to less-than-significant levels.

Thresholds of Significance

Based on the CEQA Guidelines, the project would be expected to have a significant drainage, flooding, or water quality impact if it would:

a) Violate any water quality standards or waste discharge requirements;

b) 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;

c) 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;

d) 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;

e) Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff;

f) Otherwise substantially degrade water quality;

g) Place housing within a 100-year flood hazard area as mapped on a Federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map;

h) Place within a 100-year flood hazard area structures that would impede or redirect flood flows;

i) 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; or

j) Expose people or structures to inundation by seiche, tsunami or mudflow.

Hydrology and Water Quality Issues not Further Analyzed

The following issues were addressed in the Initial Study (see Appendix A) and Section IV.A of the Draft SEIR and were determined to result in no impact or a less-than-significant impact and not warrant further analysis:

- Depletion of Groundwater Supplies and Interference with Groundwater Recharge
- Placing Housing within a 100-Year Flood Hazard Area
- Placing Structures within a 100-Year Flood Hazard Area that Could Impede or Redirect Flood Flows
- Risk from Sea Level Rise, Tsunamis, and Seiches

The potential for the project site to be inundated by mudflows is addressed in Section IV.E (Geology and Soils).

Project Impacts and Mitigation Measures

Impact HYDRO-1: Construction Phase Water Quality Impacts

Project construction period activities could generate stormwater runoff that could cause or contribute to a violation of water quality standards or waste discharge requirements, provide substantial additional sources of polluted runoff, or otherwise substantially degrade the water quality of Unnamed Creek, Ross Creek, and receiving Corte Madera Creek.

In areas of active construction, soil erosion may result in discharges of sediment-laden stormwater runoff directly into Unnamed Creek and Ross Creek, if not properly controlled. Additional sediment input to the creeks from project construction activities could contribute to degradation of downstream water quality and impairment of beneficial uses. Sediment can also be a carrier for other pollutants, such as heavy metals, nutrients, pathogens, oil and grease, fuels and other petroleum products. In addition to sediment, other pollutants associated with construction activities, such as trash, paint, solvents, and sanitary waste from portable restrooms, can discharge into and impair Unnamed Creek, Ross Creek, and Corte Madera Creek if released during construction. This is a ***potentially significant*** impact.

Mitigation Measure HYDRO-1, which requires preparation and implementation of a site-specific SWPPP in accordance with the Construction General Permit, in combination with obtaining a grading permit from the Town, and complying with the Erosion and Sediment Control and Construction BMPs required by the *Project Applicant Checklist for NPDES Permit Requirements*, would reduce the project's potentially significant impacts to water quality associated with discharges of construction site runoff to a less-than-significant level. If the project's building and grading permit applications and tentative map submittals are not submitted to the Town and deemed by the Town ready for processing prior to June 30, 2015, then Mitigation Measure HYDRO-1 shall further require that the SWPPP also comply with the 2013 Phase II Permit requirements, including Section E.10 Construction Site Storm Water Runoff Control Program.

Mitigation Measure HYDRO-1: Construction Phase Water Quality

Consistent with the requirements of the statewide Construction General Permit, the project applicant shall prepare and implement a SWPPP designed to reduce potential adverse impacts to surface water quality through the project construction period. The SWPPP shall be designed to address the following objectives: (1) all pollutants and their sources, including sources of sediment associated with construction, construction site erosion and all other activities associated with construction activity, are controlled; (2) where not otherwise required to be under a Water Board permit, all non-stormwater discharges are identified and either eliminated, controlled, or treated; (3) site Best Management Practices (BMPs) are effective and result in the reduction or elimination of pollutants in stormwater discharges and authorized non-stormwater discharges from construction activity to the Best Available Technology and Best Conventional Technology (BAT/BCT) standard; (4) calculations and design details as well as BMP controls for site run-on are complete and correct, and (5) stabilization BMPs installed to reduce or eliminate pollutants after construction are completed.

The SWPPP shall prepared by a Qualified SWPPP Developer. The SWPPP shall include the minimum BMPs required in Attachment D for Risk Level 2 dischargers (Appendix J-2), or Attachment E for Risk Level 3 dischargers (Appendix J-2) (as applicable, based on final determination of the project's Risk Level status [to be determined as part of the Notice of Intent for coverage under the Construction General Permit]). The SWPPP shall also include the erosion and sediment control and construction BMPs required by the MCSTOPPP "Stormwater Quality Control Plan Checklist" at page 3-2 in its 2008 document *Guidance for Applicants:*

Stormwater Quality Manual for Development Projects in Marin County,[46] as well as guidelines and selected BMP design standards in the MCSTOPP document *Minimum Erosion/Sediment Control Measures for Small Construction Projects.*[47] The SWPPP shall also be consistent with the Town of Ross Municipal Code Section 12.28.090(3) titled *Best Management Practices for New Developments and Redevelopments*.[48] BMP implementation shall be consistent with the BMP requirements in the most recent version of the California Stormwater Quality Association (CASQA) Stormwater Best Management Handbook-Construction[49] or the Caltrans Storm Water Quality Handbook Construction Site BMPs Manual.[50]

If the project's building and grading permit applications and tentative map submittals are not submitted to the Town and deemed by the Town ready for processing prior to June 30, 2015, then Mitigation Measure HYDRO-1 shall further require that the SWPPP also comply with the 2013 Phase II Permit requirements, including Section E.10 Construction Site Storm Water Runoff Control Program, and updated versions of the above referenced Guidance and BMP manuals.

The SWPPP shall include a construction site monitoring program that identifies requirements for dry weather visual observations of pollutants at all discharge locations, and as appropriate, depending on the project Risk Level, sampling of the site effluent and receiving waters (receiving water monitoring is only required for some Risk Level 3 dischargers). A Qualified SWPPP Practitioner (QSP) shall be responsible for implementing the BMPs at the site. The QSP shall also be responsible for performing all required monitoring, and BMP inspection, maintenance and repair activities. If the project is Risk Level 2 or 3, the project applicant shall also prepare a Rain Event Action Plan as part of the SWPPP.

The following are the types of BMPs that shall be implemented for the project and incorporated into the SWPPP, as appropriate. The project construction BMPs are subject to review and approval by the Water Board.

Wind Erosion BMPs: Application of water or other dust palliatives to prevent of minimize dust nuisance.

Erosion Control BMPs:

- Scheduling
- Preservation of Existing Vegetation

[46] *http://www.marincounty.org/depts/pw/divisions/mcstoppp/development/~/media/Files/Departments/PW/mcstoppp/GuidanceforApplicantsv_2508.pdf*

[47] *http://www.marincounty.org/depts/pw/divisions/mcstoppp/development/~/media/Files/Departments/PW/mcstoppp/development/MECM_final_2009.pdf*

[48] *http://www.townofross.org/pdf/resource_center/municipal_code/12.28%20Urban%20Runoff%20Pollution%20Prevention.pdf*

[49] *California Stormwater Quality Association, Stormwater Best Management Handbook-Construction, November 2009.*

[50] *Caltrans, Storm Water Quality Handbook Construction Site Best Management Practices (BMPs) Manual, March 2003.*

- Hydraulic Mulch
- Hydroseeding
- Soil Binders
- Straw Mulch
- Geotextiles & Mats
- Wood Mulching
- Earth Dikes and Drainage Swales
- Velocity Dissipation Devices
- Slope Drains
- Compost Blankets
- Soil Preparation / Roughening
- Non-Vegetative Stabilization

Temporary Sediment Control BMPs:

- Silt Fence
- Sediment Basin
- Sediment Trap
- Check Dam
- Fiber Rolls
- Gravel Bag Berm
- Street Sweeping and Vacuuming
- Sandbag Barrier
- Straw Bale Barrier
- Storm Drain Inlet Protection
- Active Treatment Systems
- Temporary Silt Dike
- Compost Socks and Berms
- Biofilter Bags

Tracking Control BMPs:

- Stabilized Construction Entrance/ Exit
- Stabilized Construction Roadway
- Entrance/Outlet Tire Wash

Non-Stormwater Management BMPs:

- Water Conservation Practices
- Dewatering Operations
- Paving and Grinding Operations
- Clear Water Diversion
- Illicit Connection/Discharge
- Potable Water/Irrigation
- Vehicle and Equipment Cleaning
- Vehicle and Equipment Fueling
- Vehicle and Equipment Maintenance
- Concrete Curing
- Concrete Finishing
- Material and Equipment Use
- Demolition Adjacent to Water

Waste Management and Materials Pollution Control BMPs:

- Material Delivery and Storage
- Material Use
- Stockpile Management
- Spill Prevention and Control
- Solid Waste Management
- Hazardous Waste Management
- Contaminated Soil Management
- Concrete Waste Management
- Sanitary/ Septic Waste Management
- Liquid Waste Management

Impact HYDRO-2: Post-Construction (Operational) Phase Impacts

Impact HYDRO-2A: Stormwater Runoff Peak Flows

The proposed project would increase the impervious area of the approximately 35.97 acre site by approximately 1.10 acres compared to the existing condition, which is primarily unpaved and contains only a few dilapidated structures. The 1.10 acres (approximately 48,000 square feet) of new impervious surfaces include the common access roadway, and project designated driveway and building envelopes for each of the three residential development sites. The increased impervious area has the potential to increase peak stormwater runoff from the site

discharging to Ross Creek, unnamed creek, and the Upper Road stormwater drainage network. This is a ***potentially significant*** impact.

The proposed project is subject to Town of Ross Code Section 15.54.010 stipulating that a drainage plan may be required demonstrating that the project will produce no net increase in the rate and volume of peak runoff from the site compared to pre-project conditions (no net increase standard). The applicant's engineer prepared an existing conditions hydrology map (Figure IV.G-1), a proposed conditions hydrology map (Figure IV.G-2) and a supporting hydrology report (Appendix J-1) which demonstrate that the proposed project would achieve the no net increase standard by slightly reducing peak stormwater runoff.

Achieving the no net increase standard would be achieved through a combination of drainage divide revisions and permanent detention basins located in Swan Swale. Most of the proposed new impervious surface (0.82 acres) will be located in the northerly drainage area tributary to Unnamed Creek and the Upper Road stormwater drainage system. Site grading will move the drainage divide farther to the north than it is under existing conditions, reducing the northerly drainage area by 0.26 acres. Therefore, although the project would introduce 0.82 of new impervious surfaces in the northerly drainage area, the potential increase in site runoff from the area is offset by the overall drainage area reduction. The proposed project would reduce peak runoff from the northerly drainage area compared to existing conditions.

Accordingly, the project would increase the southerly drainage area tributary to Ross Creek by 0.26 acres. The project would also introduce 0.28 acres of new impervious surface area in the southerly drainage area. By constructing and maintaining two detention basins in Swan Swale, the proposed project would reduce peak runoff from the southerly drainage area compared to existing conditions.

Figure IV.G-2 (Proposed Conditions Hydrology Map) shows the locations and configurations of proposed detention basins on Swan Swale. The associated Hydrology Report (Appendix J-1) documents hydrologic and hydraulic calculations demonstrating small reduction and therefore no net increase in peak runoff from both the northerly and southerly drainage areas. The calculations include reservoir routing of design hydrographs through the proposed detention basins on Swan Swale. These documents have been prepared according to current standard practice in civil engineering for hydrologic and hydraulic analysis of development impacts on runoff, including consistency with the County of Marin's Hydrology and Hydraulics Manual, and Town of Ross drainage plan submittal guidelines.

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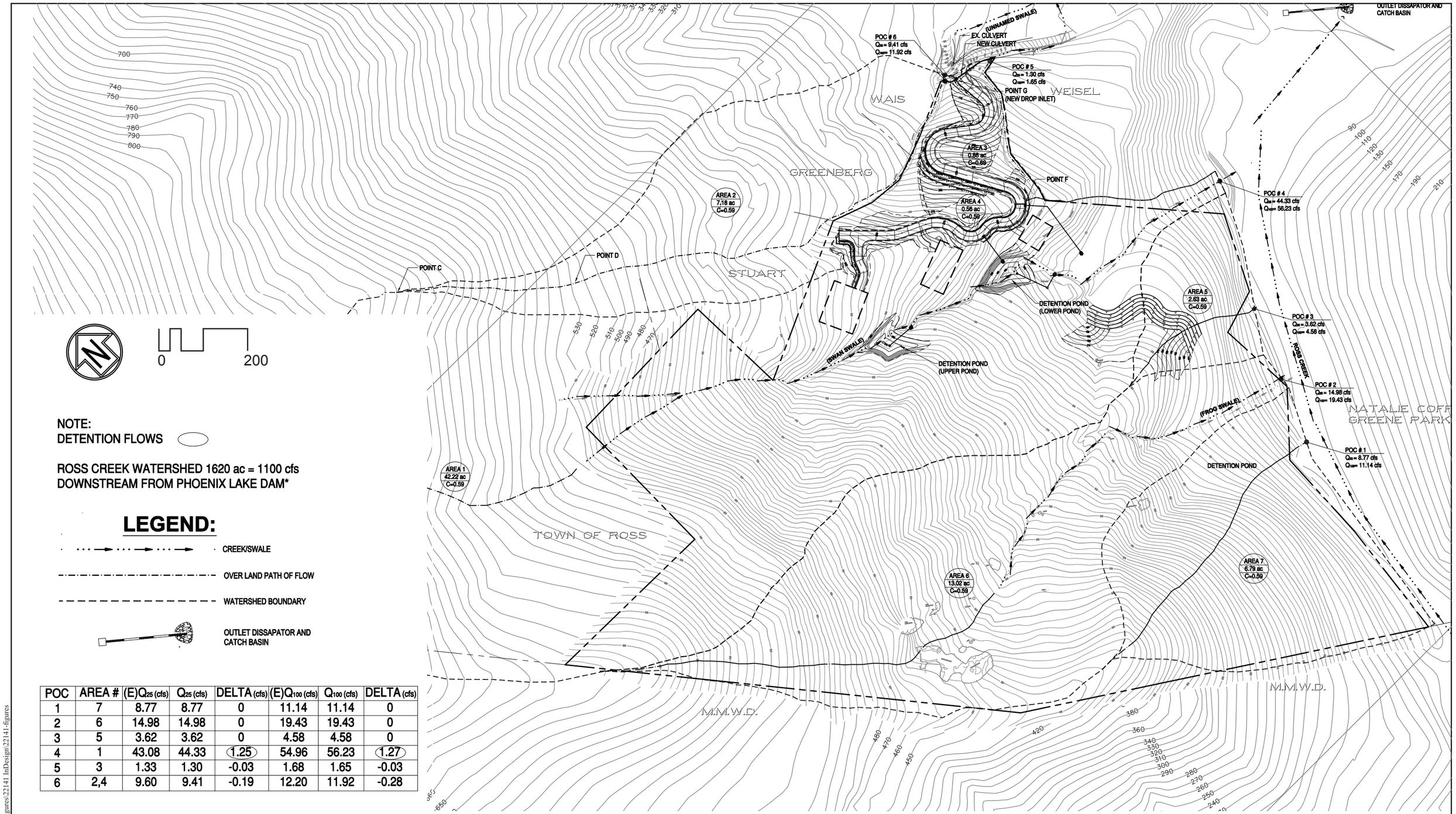

0 200

NOTE:
DETENTION FLOWS

ROSS CREEK WATERSHED 1620 ac = 1100 cfs
DOWNSTREAM FROM PHOENIX LAKE DAM*

LEGEND:

- CREEK/SWALE
- OVER LAND PATH OF FLOW
- WATERSHED BOUNDARY
- OUTLET DISSAPATOR AND CATCH BASIN

POC	AREA #	(E)Q_{25} (cfs)	Q_{25} (cfs)	DELTA (cfs)	(E)Q_{100} (cfs)	Q_{100} (cfs)	DELTA (cfs)
1	7	8.77	8.77	0	11.14	11.14	0
2	6	14.98	14.98	0	19.43	19.43	0
3	5	3.62	3.62	0	4.58	4.58	0
4	1	43.08	44.33	1.25	54.96	56.23	1.27
5	3	1.33	1.30	-0.03	1.68	1.65	-0.03
6	2,4	9.60	9.41	-0.19	12.20	11.92	-0.28

Figure IV.G-2. Proposed Conditions Hydrology Plan

Upper Road Land Division Project
Town of Ross, California

wra
ENVIRONMENTAL CONSULTANTS

Date: OCTOBER 2012
Source: CSW | Stuber-Stroeh Engineering Group, Inc.

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POC # 6
Q_{25} = 9.41 cfs
Q_{100}= 11.92 cfs

EX. CULVERT
NEW CULVERT

POC # 5
Q_{25} = 1.30 cfs
Q_{100}= 1.65 cfs

POINT G
(NEW DROP INLET)

AREA 2
7.18 ac
C=0.59

AREA 3
0.86 ac
C=0.69

AREA 4
0.56 ac
C=0.59

POINT F

LEGEND

- Area 3 Watershed Boundary
- Area 4 Watershed Boundary
- Flow Concentration

0 20

Figure IV.G-3. Proposed Conditions Hydrology Plan - Enlarged

Upper Road Land Division Project
Town of Ross, California

wra
ENVIRONMENTAL CONSULTANTS

Date: OCTOBER 2012
Source: CSW | Stuber-Stroeh Engineering Group, Inc.

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Without adequate mitigation and implementation of drainage and detention facilities shown in the proposed conditions hydrology map and analyzed in the hydrology report prepared by the applicant's engineer (Appendix J-1), the potential for the project to impact stormwater peak flows received by Unnamed Creek, Ross Creek, and the Upper Road stormwater drainage system during the post-construction phase is ***potentially significant***. These impacts can be reduced to a less-than-significant level via the implementation of Mitigation Measure HYDRO-2A.

If the project's building and grading permit applications and tentative map submittals are not submitted to the Town and deemed by the Town ready for processing prior to June 30, 2016, then Mitigation Measure HYDRO-2A shall further require that the development project also comply with the 2013 Phase II Permit requirements, including Section E.12.f Hydromodification Management.

Mitigation Measure HYDRO-2A: Post-Construction (Operational) Phase Stormwater Runoff Peak Flows

In accordance with the 2003 MRP, MCSTOPPP, and the Town of Ross's requirements, the project applicant shall submit a *Project Applicant Checklist for NPDES Permit Requirements* to the Town during the building permit phase that shows the post-construction BMPs that will be incorporated in the project to maintain or enhance hydrologic pre-project conditions.

The critical post-construction BMPs for preventing peak flow increases or reducing peak flows include:

Southerly Drainage Area

- Curb drop inlet at unlabeled point approximately 100 feet west of Point F (Sheet H3, Proposed Conditions Hydrology Map – Enlargement)
- Upstream Detention Basin on Swan Swale (Sheet H2, Proposed Conditions Hydrology Map)
- Downstream Detention Basin on Swan Swale (Sheet H2, Proposed Conditions Hydrology Map)

Northerly Drainage Area

- Curb drop inlet at Point F (Sheet H3, Proposed Conditions Hydrology Map – Enlargement)
- Curb drop inlet at Point G (Sheet H3, Proposed Conditions Hydrology Map – Enlargement)

Southerly Drainage Area. The detention basins are critical to achieving the no net increase standard because they are necessary to offset the project's otherwise increasing effect on peak flows. The design performance of the basins depends on the basins:

- being constructed in the same or better (more conservative) hydraulic configurations as shown on the proposed conditions maps and analyzed in the engineer's report;

- capturing runoff from their entire intended (design) drainage areas, as specifically requires performance of the curb inlet at unlabeled point approximately 100 feet west of Point F (Sheet H3, Proposed Conditions Hydrology Map – Enlargement);
- not becoming substantially filled with sediment or large woody debris from Swan Swale, adjacent hillslopes, or failure of their constructed banks; and,
- not having the inlets of their low-level outlets (42-inch-diameter risers) substantially plugged with debris and sediment.

Northerly Drainage Area. The curb drop inlets at Point F and Point G are critical to achieving the no net increase standard and maintaining appropriate stormwater pathways because they maintain the drainage and subdrainage area divides underpinning the post-project conditions hydrology calculations. The calculated peak flow reductions assume that each of the curb inlets intercepts 100% of the stormwater delivered in the gutter to their locations and conveys that stormwater to the designated outfall location. If a substantial portion of the gutter flow bypasses one of the curb inlets, then greater than anticipated peak flows may occur at Point of Concentration #6 (Unnamed Creek) or Point of Concentration #5 (Upper Road stormwater drainage network). The design performance of the curb drop inlets depends on the inlets:

- being designed with large enough inlet capacity to intercept 100% of the design peak flow, accounting for inefficiencies caused by steep gutter slopes, if applicable; and,
- not being substantially blocked by debris during the design peak flow.

Post-Construction BMP Design Criteria - Peak Flow Protection.

- To provide a factor of safety, the curb drop inlets at Point F and Point G shall be designed to convey a discharge equal to or greater than 150% of the calculated post-project conditions peak flow at their location;
- The post-project conditions peak flow at Point F shall be calculated assuming 100% bypass of the drop curb inlet at the unlabeled point approximately 100 feet west of Point F (i.e., simulating blockage by debris at unlabeled point); and,
- To provide a factor of safety, the detention basin shall be designed to provide live storage volume (portion of volume below the spill elevation) equal to or greater than 125% of the live storage volume required to reduce the peak flow at Point of Concentration #4 to below existing conditions.

Post-Construction BMP Operations and Maintenance Plan. The project applicant shall also submit an Post-Construction BMP Operation and Maintenance (O&M) Plan to the Town with the application for the building permit. The O&M Plan shall identify the party responsible for long-term maintenance and repairs of the critical post-construction BMPs (including but not limited to the critical post-construction BMPs identified in Mitigation Measures HYDRO-2A and HYDRO-2B), funding sources, and a maintenance plan including a schedule of activities for the BMPs. The O&M Plan shall directly incorporate or refer to a Maintenance Agreement that the project

applicant or property owner shall enter into with the Town. The Maintenance Agreement shall indicate that the project applicant or property owner is responsible for long-term performance evaluation, maintenance, and necessary repairs of the critical post-construction BMPs. The Maintenance Agreement shall stipulate that failed performance of the BMPs caused by under-design, normal wear and tear, local flooding damage, impractical maintenance requirements during individual storms, flooding inundation by Phoenix Dam failure, etc., may require physical modification or replacement of the facilities to meet the original design performance standards documented in the engineer's drainage plan and hydrology report. The Maintenance Agreement shall transfer from the project applicant or property owner to new property owner in the event of sale of the property. The project applicant or property owner shall submit an annual report to the Town documenting the O&M activities for and observed performance of the BMPs. At a minimum, the routine monitoring and maintenance activities documented in each annual report shall include measurement of the total volume and live storage volume of each detention basin on Swan Creek demonstrating that the prior to October 15th of each year:

- the live storage volumes of each detention basin (below the spill elevation) required under Mitigation Measure HYDRO 2-A is not less than 90% of the original design live storage volume, and
- the live surface storage volume (below the elevation of the outlet) of each bioretention area required under Mitigation Measure HYDRO 2-B shall be documented to be not less than 90% of the original design live storage volume.

If the project's building and grading permit applications and tentative map submittals are not submitted to the Town and deemed by the Town ready for processing prior to June 30, 2015, then Mitigation Measure HYDRO-2A shall further require that the development project's Post-Construction BMP's be designed to also comply with the 2013 Phase II Permit requirements, including Operations and Maintenance Requirements contained in Section E.12.h Operation and Management of Storm Water Control Measures.

If the project's building and grading permit applications and tentative map submittals are not submitted to the Town and deemed by the Town ready for processing prior to June 30, 2016, then Mitigation Measure HYDRO-2A shall further require that the development project's Post-Construction BMP's be designed to also comply with the 2013 Phase II Permit requirements, including Section E.12.f Hydromodification Management.

Impact HYDRO-2B. Post-Construction Phase Water Quality Impacts

Under existing conditions, the project site is largely unpaved and covered with vegetation, and the only impervious areas are the existing narrow driveway and the failed roofs of the existing dilapidated buildings. The completed project would generate runoff from roofs and driveway and access road surfaces which may include typical contaminants (e.g., related to building materials, household activities and maintenance, and vehicle maintenance and traffic, etc., such as sediment; metals; organic compounds such as pesticides, polynuclear aromatic hydrocarbons, and oil and grease; pathogens; nutrients; and trash and debris) that would be

deposited on impervious surfaces and mobilized in stormwater runoff. The project therefore has the potential to increase the delivery of pollutants to Unnamed Creek, Ross Creek, and receiving Corte Madera Creek. Impacts to the quality of surface water and groundwater that could result in a violation of water quality standards or waste discharge requirements are ***potentially significant***.

The drainage plan and associated hydrology report prepared by the applicant's engineer contains BMPs for preventing increases in peak flows exiting the site boundaries, but does not include BMPs for water quality protection beyond identifying that all concentrated runoff would be discharged to an unimproved overland flow path upstream from the points of concentration at the project property boundaries. By implementing Mitigation Measure HYDRO-2B, below, the potential for the project to impact stormwater quality during the post-construction phase would be less-than-significant.

If the project's building and grading permit applications and tentative map submittals are not submitted to the Town and deemed by the Town ready for processing prior to June 30, 2016, then Mitigation Measure HYDRO-2B, if applicable, shall further require that the development project's Post-Construction BMP's be designed to also comply with the 2013 Phase II Permit requirements, including Section E.12.f Hydromodification Management.

Mitigation Measure HYDRO-2B: Post-Construction Phase Water Quality

In accordance with the MRP, MCSTOPPP, and the Town of Ross's requirements, project applicant shall submit a *Project Applicant Checklist for NPDES Permit Requirements* to the Town during the building permit phase that shows the post-construction BMPs that will be incorporated in the project to preserve pre-project stormwater quality.

The critical post-construction BMPs for stormwater quality protection include:

Southerly Drainage Area

- Live storage volume portion of the upstream detention pond on Swan Swale;
- Live storage volume portion of the downstream detention pond on Swan Swale; and,
- Vegetated surface bioretention area between the outlet of the stormwater down-drains originating from Point F and Swan Swale downstream from the detention ponds.

Northerly Drainage Area

- Vegetated surface bioretention area between the new access road entrance and the right bank of Unnamed Creek near the inlet of the existing culvert running beneath Upper Road (i.e., immediately upstream from Point of Concentration #6).
- Vegetated surface bioretention area within the Town of Ross right-of-way and stormwater drainage system between the new access road entrance and the inlet of the existing culvert running beneath Upper Road (i.e., immediately upstream from Point of Concentration #5).

Post-Construction BMP Design Criteria - Water Quality Protection.

- The live storage volume portion of the upstream detention pond on Swan Swale shall occupy a surface area not less than 4 percent of the post-construction developed area draining to Swan Swale upstream from the detention pond dam (not including undeveloped, unimproved natural areas);
- The live storage volume portion of the downstream detention pond on Swan Swale shall occupy a surface area not less than 4 percent of the post-construction developed area (not including undeveloped, unimproved natural areas) draining to Swan Swale between the upstream and downstream detention pond dams (including total area tributary to curb drop inlet at unlabeled point approximately 100 feet west of Point F);
- The bioretention area receiving stormwater discharge from the curb drop inlet at Point F shall have a total surface area below the downstream spill or rim elevation not less than 4 percent of the total post-construction developed area (not including undeveloped, unimproved natural areas) tributary to the curb drop inlet at Point F, Suitable design provisions shall be made to ensure that discharge from the bioretention area does not erode the land surface or creek bank surface between the outlet and Swan Swale;
- The bioretention area receiving stormwater discharge from the curb drop inlet at Point G and the remainder of the post-construction developed area tributary to Point of Concentration #5 shall have a total surface area below the downstream spill or rim elevation not less than 4 percent of the total post-construction developed area tributary to Point of Concentration #5 (Area 3) (Sheet H3, Proposed Conditions Hydrology Map – Enlargement); and
- The bioretention area receiving stormwater discharge from the post-construction developed area tributary to Point of Concentration #6 shall have a total surface area below the downstream spill or rim elevation not less than 4 percent of the total post-construction developed area tributary to Point of Concentration #6 (Area 4) (Sheet H3, Proposed Conditions Hydrology Map – Enlargement).

Post-Construction BMP Operations and Maintenance Plan. These critical post-construction water quality BMPs shall be maintained according to the O&M Plan and Maintenance Agreement described above for Mitigation Measure HYDRO-2A.

If the project's building and grading permit applications and tentative map submittals are not submitted to the Town and deemed by the Town ready for processing prior to June 30, 2015, then Mitigation Measure HYDRO-2B shall further require that the development project be designed with site design, source control, Post-Construction BMP's, and Low Impact Development (LID) measures which comply with the 2013 Phase II Permit requirements, including Operations and Maintenance Requirements contained in Section E.12.h. Operation and Management of Storm Water Control Measures.

If the project's building and grading permit applications and tentative map submittals are not submitted to the Town and deemed by the Town ready for processing prior to June 30, 2016, then Mitigation Measure HYDRO-2B, if applicable, shall further require that the development project's Post-Construction BMP's be designed to also comply with the 2013 Phase II Permit requirements, including Section E.12.f Hydromodification Management.

Impact HYDRO-3: Substantial Erosion or Siltation through Alteration of Drainage Patterns

The project would not significantly alter site drainage patterns in so far as site runoff leaving the property boundaries would be contained within the same natural and man-made channels. However, grading to accommodate the access road and the three building envelopes would result in transferring 0.26 acres of drainage area from the northerly to the southerly drainage area. This drainage area transfer has the potential to increase the peak flows in the southerly drainage area which are conveyed within Swan Swale to Ross Creek. This is a ***potentially significant*** impact which can be reduced to a less-than-significant level via implementation of Mitigation Measures HYDRO-1 and HYDRO-2A.

Impact HYDRO-4: Flooding by Altering Drainage Patterns or Generating Runoff that Exceeds the Capacity of the Stormwater Drainage System

As discussed above under Impact HYDRO-2A, the project would implement critical post-construction BMPs including detention basins and curb drop inlets to achieve no net increase in stormwater peak flows exiting the site into each of the receiving waterbodies, including the affected portion of the Town's stormwater drainage system on Upper Road. However, without adequate mitigation and implementation of the recommendations included in the hydrology report prepared by the applicant's engineer, and according to the design criteria given in Mitigation Measure HYDRO-2A, the impact for the project to result in flooding that exceeds the capacity of the stormwater drainage system is ***potentially significant***. These impacts can be reduced to a less-than-significant level via the implementation of the project drainage plan according to design criteria and implementing the maintenance and monitoring plan given in Mitigation Measure HYDRO-2A.

Impact HYDRO-5: Expose Structures to Risk of Damage Due to Flooding as a Result of Phoenix Dam Failure.

A significant impact, including potential for loss of life, would occur if the project installed structures at locations on the site that could be inundated by flooding, including flooding due to failure of a levee or dam. There are no levees in the project vicinity. A large part of the project site is located within a dam failure inundation hazard area mapped along Ross Creek downstream from Phoenix Dam. The hazard area is determined by the California Office of Emergency Services and mapped by the Association of Bay Area Governments.[51] The mapped dam failure hazard area covers upland portions of the project site which rise more than 150 feet

[51] *Association of Bay Area Governments, "Bay Area Dam Inundation Hazards," http://www.abag.ca.gov/bayarea/eqmaps/damfailure/damfail.html, Accessed January 19, 2011.*

above the banks of Ross Creek, including the portion of the site where three residential structures are planned. However, because the hazard area boundaries do not correspond to a gradually reducing elevation profile moving downstream from Phoenix Dam, the boundaries were evidently not determined with a hydraulic model. Rather, the grid-patterned shape of the hazard area suggests that it was mapped at a very low resolution (i.e., large pixels) with general information. Therefore, the boundaries do not correspond to analytically predicted limits of flooding.

Phoenix Dam failure induced flooding would be substantially more likely to damage the bioretention area identified in Mitigation Measure HYDRO-2B at the base of the stormwater down-drain conveying from Pt F than the it would the detention ponds on Swan Swale or the residential structures proposed by the project. Damage to the bioretention area is a ***potentially significant*** impact which can be reduced to a less-than-significant level via implementation of Mitigation Measure HYDRO-2A, which requires the project to prepare for review and approval by the Town an Operations and Maintenance (O&M) Plan. The O&M Plan which would include provisions for repair and maintenance of the project's critical post-construction BMPs, including the bioretention area downslope from Point F, which is the feature most likely to be damaged by dam failure related flooding inundation.

CUMULATIVE IMPACTS

This section addresses the incremental effects of the proposed project in connection to the effects of other closely related past, present, and reasonably foreseeable probable future projects. The geographic area for the cumulative impacts analysis is the Ross Creek watershed. The effect of the incremental contribution of the proposed project on cumulative water quality impacts is discussed below.

Construction phase cumulative water quality impacts to Ross Creek would be ***less than significant***. This is because cumulative projects that would disturb one or more acre of land would be subject to the BMP and risk level requirements in the Construction General Permit. Project applicants must prepare and implement a SWPPP according to the project risk level, which is designed to reduce potential adverse impacts to surface water quality through the project construction period.

Cumulative operational impacts associated with stormwater runoff and non-stormwater discharges in the watershed would also be ***less than significant***. In accordance with the MRP and the Marin County Stormwater Pollution Prevention Program, any development project in the watershed that would disturb one or more acre of land must incorporate site design, source control and stormwater treatment measures into the project to minimize the discharge of pollutants in stormwater runoff and non-stormwater discharges during the post-construction phase. Furthermore, any project requiring a building permit in the Town of Ross may be required to prepare a drainage plan documenting that the project includes post-construction BMPs or hydromodification controls to prevent increases in peak runoff.

Finally, because the proposed project would implement mitigation measures to ensure compliance with the water quality objectives in the Basin Plan, the master water quality control planning document that addresses cumulative water quality impacts in the region, the incremental contribution the proposed project would not be cumulatively considerable. For the construction period, compliance with the Construction General Permit and preparation of a SWPPP would assure compliance with the Basin Plan, as the Construction General Permit requires that stormwater discharges must not contain pollutants that cause or contribute to an exceedance of any applicable water quality objective contained in the Basin Plan. Similarly, the MRP states that it is an essential mechanism for achieving water quality objectives necessary for protecting beneficial uses as established in the Basin Plan; therefore compliance with Provision D.2.e. in the MRP assures compliance with the Basin Plan for the project operational phase.

LEVEL OF SIGNIFICANCE AFTER MITIGATION

Impacts related to hydrology and water quality would be ***less than significant*** with implementation of the recommended mitigation measures.