4.7 HYDROLOGY AND WATER QUALITY

4.7.1 Introduction

This section presents existing hydrologic conditions at the project site and its vicinity and analyzes the potential for implementation of the proposed Helios project to affect hydrologic resources. Information presented in the discussion and analysis presented below was drawn from site visits, and previous environmental documents prepared by Lawrence Berkeley National Laboratory (LBNL).

In response to the Notice of Preparation for this Environmental Impact Report (EIR), one commenter expressed concern regarding the project's effect on hydraugers and groundwater in the project area, including the effect of dewatering on No Name Creek. This scoping comment is addressed in the impact assessment presented below.

4.7.2 Environmental Setting

The discussions below described existing surface and groundwater conditions on the LBNL site and in its vicinity, concentrating primarily on aspects that are specific to the Helios project site.

Regional Setting

LBNL is located in the East Bay hills, near the western edge of the Coast Range physiographic province. The hills are roughly parallel to the northwest-southeast trend of the major mountain ridges in the province with spur ridges and canyons oriented perpendicular to main ridges. The majority of LBNL is situated in the upper portion of one of these east-west trending canyons – Strawberry Canyon, which is drained by the South Fork of Strawberry Creek. A small portion of LBNL lies within Blackberry Canyon, which is drained by the North Fork of Strawberry Creek. The two forks of Strawberry Creek join approximately 3,500 feet southwest of LBNL's western boundary on the University of California Berkeley (UC Berkeley) campus.

Climate

LBNL experiences a Mediterranean climate, with almost all precipitation falling between the months of October and April. The long-term mean annual rainfall is approximately 30.6 inches, calculated from more than 30 years of records (water years[1] 1975 to 2006) at the LBNL rain gauge. This is an appropriate value for hydraulic design and analysis purposes in the LBNL area. Year-to-year variability in rainfall

1 Hydrologic monitoring in much of the western United States is often carried out on a water year basis to account for the seasonality of winter rains and summer dry periods. The water year begins on October 1 and ends on September 30 of the named year. For example, water year 2007 began on October 1, 2006, and ends on September 30, 2007.

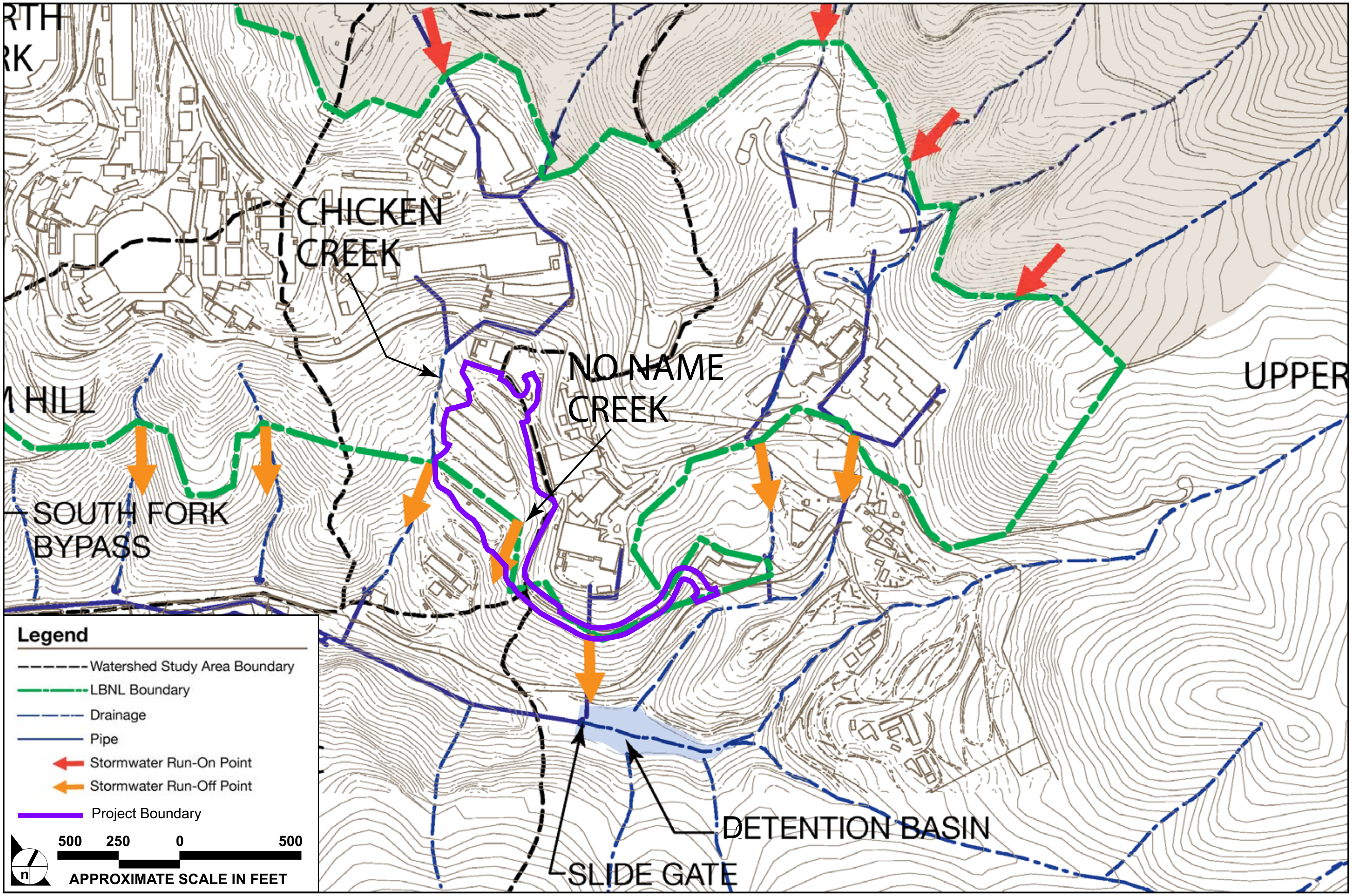
can be considerable. Based on the long-term precipitation record at the LBNL rain gauge, in any particular month, the maximum rainfall can be twice the long-term monthly average or it can be almost zero. Evaporation rates and evapotranspiration rates are typically low during the late fall and winter months, then rise in spring in response to warmer weather.

Stormwater Drainage

Stormwater at LBNL is handled by a combination of engineered features such as storm drains, down drains and v-ditches as well as by creeks that flow into Strawberry Creek. Drainage at the project site is strongly influenced by its position on a slope within a hilly terrain. As shown in **Figure 4.7-1, Existing Drainage Near Project Site**, the Helios project site is located near the drainage divide between Chicken Creek to the west and No Name Creek to the south. Chicken Creek and No Name Creek are the two small, north-south trending tributaries of the South Fork of Strawberry Creek in the project area. The upper 25 acres of the overall 63-acre Chicken Creek watershed are located outside of LBNL in an area characterized by open space and the Lawrence Hall of Science. Less than 5 acres of the upper watershed are covered by impervious surfaces. Approximately 25 acres of the Chicken Creek watershed are located within LBNL, and another 13 acres of the watershed are downstream of LBNL, on UC Berkeley property. Much of the perennial Chicken Creek within LBNL, upslope of the Helios project, has been realigned within underground storm drains installed to capture runoff from LBNL buildings and associated infrastructure. Approximately 12.5 acres of impervious surfaces are present within the 25-acre portion of the watershed within LBNL. Chicken Creek emerges as a surface stream in the vicinity of the Helios project but re-enters a culvert just upstream of its confluence with Strawberry Creek, which also flows within a storm drain in that reach.

No Name Creek is an intermittent stream with a drainage area of only about 4 acres.[2] Concrete v-ditches capture runoff from steep slopes below the recently completed Molecular Foundry building and Building 66 and direct flows to the upper reach of No Name Creek. Also, a storm-drain outfall is present near this reach that discharges some of the stormwater flow from the newly completed Molecular Foundry site and surrounding parking areas and access roads via a 'continuous deflector separator' designed to dissipate energy from the runoff. Flows from No Name Creek are captured in a culvert upstream of Centennial Drive, which joins Strawberry Creek just downstream of the mid-canyon detention basin.

2 No Name Creek drains directly to Strawberry Creek via a culvert under Centennial Drive. However, the stream is traditionally considered part of the Chicken Creek sub-watershed.



SOURCE: LBNL Long Range Development Plan - 2006

FIGURE **4.7-1**

Existing Drainage Near Project Site

924-001•11/07

The Strawberry Creek watershed measured from its confluence with Chicken Creek is approximately 570 acres. Most of its area is in a natural state except areas developed within the University of California Berkeley Botanical Garden and several LBNL buildings and supporting infrastructure. A mid-canyon detention basin is present on Strawberry Creek just upstream of the confluence of No Name Creek.

Most stormwater runoff from the project site currently drains overland to No Name Creek. However, existing parking areas and access roads just east of the Helios project site (associated primarily with the recently completed Molecular Foundry building) drain to both the storm drain facilities that empty into the Strawberry Creek mid-canyon detention basin, and to the storm-drain system that drains to No Name Creek via the 'continuous deflector separator' outfall described above.

Flooding

The project site does not fall within the 100-year flood zone as mapped by the Federal Emergency Management Agency (FEMA).

Soils

Mapping by the United States Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS) shows the fine-textured soils that have formed in the shale, siltstone, and sandstone setting (Welch 1981). Altamont clay, 30 to 50 percent slopes, underlies the Helios project site. This is a deep, well-drained soil with low permeability and a high shrink-swell potential. It is categorized as belonging to Hydrologic Group D, the highest runoff potential in the classification system. This soil, however, has been disturbed over much of the site by past grading for the terraced access road, the Building 72 complex, and more recently the Molecular Foundry building.

Groundwater

Due to the high relief and the varying geologic units at the site, depth to groundwater within the LBNL site can vary considerably, both spatially and temporally. A generalized groundwater piezometric map contained within the 2005 LBNL Site Environmental Report (LBNL 2006) shows groundwater levels greater than 40 feet below ground surface (bgs) near the location of the proposed Helios project. However, locally perched water is present at some locations on the LBNL site, often at the beds of landslide deposits or at the interface between the bedrock and overlying soils or other unconsolidated sediments.

Groundwater discharge is evident in areas adjacent to the Helios project site, contributing to near-perennial flow in Chicken Creek, just west of the site.[3] In addition, two hydraugers (one of which is over 1,000 feet long) installed roughly parallel to the Chicken Creek drainage in the 1970s, discharge near the head of No Name Creek. The discharge supports seep wetlands and a small amount of baseflow in the tributary even during very dry years.[4] Subdrains are present within the fill material that underlies much of the proposed Helios project site, though these subdrains only rarely discharge water to No Name Creek (Joe Harkins, LBNL Facilities Division, 2007, personal communication).

Several monitoring wells, maintained by the LBNL Environmental Restoration Program, are present near the Helios project site (see **Figure 4.7-2, Existing LBNL Monitoring Wells**). Two wells (SB31-97-17 and SB31-97-18) are located to the west of the northern edge of the project site (close to Chicken Creek). Periodic water level monitoring since 2004 has recorded groundwater between 19 and 23 feet bgs at the closest well, and between 17 and 22 feet bgs at the further well.[5] The water level in another well (MW31-98-17), located west of the southern edge of the project site (also close to Chicken Creek), is 6 feet bgs. North of the project area, near Lawrence Road, MWP-10 and MW77-97-11 have recorded depths to water between 49 to 56 and 28 to 35 feet respectively. Another well (MWP-9), located northwest of the project site, shows groundwater levels varying between 24 and 37 feet bgs over the same period. At three wells located south and southeast of the Helios project site (MW62-95-16, MW62-92-27, and MW62-92-26), groundwater levels were between 11 and 46 feet bgs.[6]

A series of test borings drilled in the late 1970s east of the Helios project site show that groundwater was present at about 8 feet at one location, 19 feet at another, and not within 20 feet bgs at five other locations (Lewis 2003).[7] In November 1980, water levels in four test borings drilled south of Building 72, just to the east of the Helios project site, ranged from 20 to 32 feet bgs (Korbay and Lewis 1980). In the fall of 2002, depth to groundwater was found to be between 20 and 30 feet bgs in temporary wells east of the Molecular Foundry building, which is adjacent to the southeastern corner of the proposed Helios project. Water levels at two nearby, deeper temporary wells installed in 2003, however, were 31 and 57 feet bgs,

---

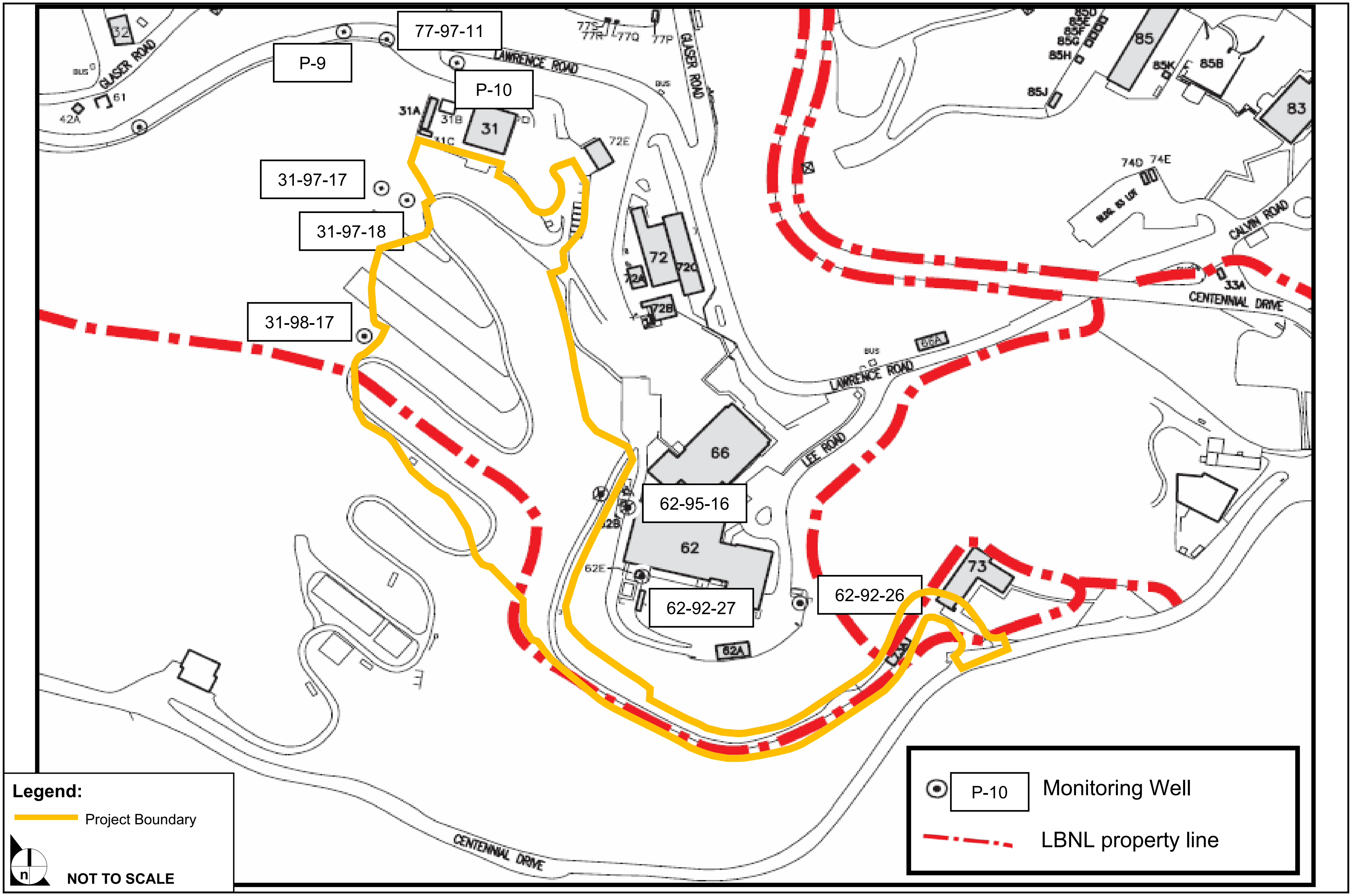
3 While groundwater discharge to Chicken Creek does contribute to baseflow in the creek, the majority of the flow in the creek is the result of discharge (both stormflow and baseflow) from the LBNL stormwater drainage system.

4 During a site visit on August 1, 2007 (a year with significantly below-average rainfall), water was observed discharging from both pipes at a rate of approximately 4 and 0.3 gallons per minute.

5 These ranges discount anomalous readings due to non-equilibrated water levels and/or data entry errors.

6 Monitoring well 62-95-16 was decommissioned in 2005.

7 Water levels in test borings do not necessarily represent the static groundwater levels in the area, as the holes are typically not left open long enough for water levels to equilibrate (especially in low-permeability units). They do, however, provide some insight as to what conditions are likely to be encountered at the Helios project site.



SOURCE: LBNL 2006 Long Range Development Plan - 2006, ESA - 2007

FIGURE 4.7-2

Existing LBNL Monitoring Wells

924-001•10/07

suggesting that the higher water levels may be held within perched aquifers (Lewis 2003), though it may also simply be an artifact of highly varying water levels across the site as a result of relatively low permeability and complex geologic structure (Preston Jordan, LBNL Earth Sciences Division, 2007, personal communication).

Surface Water Quality

The Helios project site is currently occupied by a mix of gravel parking areas, access roads, and undeveloped land dominated by non-native annual grassland. Adjacent and uphill of the project site are paved roads and parking lots, buildings, as well as open-space areas with grasses and trees. These land uses suggest that the area likely contributes pollutants commonly found in urban runoff such as oil, grease, and metal brake dust. LBNL uses only one type of herbicide, which is used locally (no broadcast spraying) to prevent re-sprouting of cut eucalyptus trunks. There are no eucalyptus trees on the Helios project site. Pesticides are used only to control non-flying insects within buildings (no spraying is conducted), and rodents are controlled by non-pesticide methods (trapping). LBNL Environmental Health and Safety (EH&S) reviews these practices annually. Best management practices (BMPs) are in place to control the quality or quantity of stormwater runoff as required by the site-wide National Pollutant Discharge Elimination System (NPDES) General Industrial Permit. Steeply sloping open space areas contribute sediment (turbidity) to receiving waters. Existing run-off and run-on from uphill locations is shown on **Figure 4.7-1**.

Four stormwater sampling stations around LBNL, established in water year 1993, are currently part of the LBNL Storm Water Monitoring Program (SWMP) (LBNL 2005) which was developed as a requirement of the NPDES General Industrial Permit. These stations are located at:

- a manhole within the Chicken Creek watershed, immediately upstream of LBNL, which measures run-on to the site;
- on Chicken Creek, upstream of the proposed Helios facility but downstream of several other LBNL buildings and Lawrence Road;
- on Winter Creek, near the Hazardous Waste Handling Facility in the East Canyon, about 1,000 feet east of the Helios project site; and
- on the North Fork of Strawberry Creek, just downstream of LBNL, about 3,500 feet northwest of the Helios project site.

Several other stations were monitored for whole effluent toxicity in the early years of the SWMP but were dropped from the program after three years of no toxicity findings. Additional stations may be necessary in the future following construction of the Helios project and the recently completed nearby Molecular Foundry building.

Stormwater sampling is conducted at the above-mentioned sites twice yearly in accordance with General Industrial Permit requirements. LBNL uses automated samplers in an effort to capture runoff from the first storm event of the season and one other. Samples are analyzed for a suite of potential pollutants including the radiological constituents gross alpha and beta emitters and tritium, and the nonradiological constituents chemical oxygen demand, metals (aluminum, iron, magnesium, mercury, and zinc), nitrate plus nitrite, oil and grease, pH, specific conductance, total petroleum hydrocarbons-diesel, and total suspended solids. Storm discharges are visually observed monthly during the wet season, and quarterly visits are conducted to check for the presence of unauthorized non-stormwater discharges.

Stormwater sampling results are reported in both the permit-required annual report and the yearly Site Environmental Report. The Site Environmental Report for 2006 (LBNL 2007a)[8] states that analytical results at all stormwater stations in water year 2006 were below detectable concentrations for mercury and oil and grease. Detectable results for other parameters varied by location and storm event. In all cases, the results were within historical levels for LBNL, consistent with background levels, within regional Water Quality Control Plan (i.e., Basin Plan) objectives, and below drinking water standards.

In addition to stormwater sampling, creeks and rainwater are sampled as part of LBNL's overall environmental surveillance program. If water is flowing, grab samples are collected quarterly from on-site locations in Chicken Creek and the North Fork of Strawberry Creek, and from Strawberry Creek on the University of California Berkeley campus. The samples are analyzed for gross alpha and gross beta radioactive particle emitters, tritium, and mercury. Twice yearly, grab samples are collected from seven creeks – Botanical Creek, Cafeteria Creek, Chicken Creek, No Name Creek, the North Fork of Strawberry Creek, Ravine Creek, and Ten-Inch Creek. Samples are analyzed for tritium, metals, and organic compounds. Composite rainfall samples are collected at one on-site location and analyzed monthly for tritium, gross alpha, and gross beta activity. The Site Environmental Report for 2006 states that when detectable results were observed, they were within historical levels for LBNL, within Basin Plan objectives, and below drinking water standards (LBNL 2007a).

Groundwater Quality

Past practices at LBNL have resulted in several areas of groundwater contamination on the LBNL site. The primary chemical constituents of concern are volatile organic compounds, though Polychlorinated

8 The 2006 Site Environmental Report is the most recent report available on the LBNL website (http://www.lbl.gov/ehs/esg/tableforreports/tableforreports.htm).

Biphenyls (PCBs), petroleum hydrocarbons, and small amounts of polynuclear hydrocarbons have also been detected (LBNL 2007a). LBNL has mapped the extent of groundwater contamination and provides quarterly updates of the monitoring program (e.g., LBNL 2007b). The Helios project site does not overlie an area of groundwater contamination, though a tritium plume has been identified northeast of the site, extending south of Lawrence Road near the Chicken Creek drainage (see **Figure 4.7-3, Groundwater Contaminant Plume Map**). This plume is associated with activities at the former National Tritium Labeling Facility (in Building 75). The facility was closed in 2001. Over the past several years migration of the plume has generally slowed or stopped, but LBNL has committed to the Department of Toxic Substances Control that it will continue long-term monitoring of the plume (LBNL 2007b).

4.7.3 Regulatory Considerations

This section describes the local, state, and federal regulatory context to be considered for the Helios project. It also discusses plans and policies adopted in the LBNL 2006 Long Range Development Plan (LRDP) to address hydrology and water quality concerns, including development strategies, stormwater pollution prevention plans, and stormwater management practices, among others.

Federal and State Regulations

Federal and state water quality regulations apply to development projects that may adversely affect the quality of surface waters or groundwater through the discharge of wastewater and stormwater. Section 303 of the Federal Clean Water Act (CWA) and the State's Porter-Cologne Water Quality Control Act establish water quality objectives for all waters in the State. These objectives are implemented locally through Water Quality Control Plans and the NPDES permitting program. Because hydrology is inextricably linked to ecosystem and wildlife health, the California Department of Fish and Game also has regulatory oversight over projects that affect lakes, streambeds and adjacent riparian zones. In addition, Section 404 of the CWA gives the U.S. Army Corps of Engineers authority to regulate discharges of dredged or fill material into Waters of the United States.

Water Quality Control Plan

Pursuant to the CWA and the Porter-Cologne Water Quality Control Act, the California legislature granted authority to protect and enhance water quality in California to the State Water Resources Control Board (SWRCB) and the nine Regional Water Quality Control Boards (RWQCB). The SWRCB provides oversight and coordination while the RWQCBs guide and regulate water quality in streams and aquifers through development of Water Quality Control Plans, or Basin Plans. The Helios project site drains to waters regulated by the Region 2 (San Francisco Bay) Basin Plan which was approved in 1995 and updated in 2006. Beneficial water uses are designated in the Basin Plan for local aquifers, streams, marshes, and rivers, as well as water-quality objectives that must be met to protect these uses. Although beneficial uses have not been specifically designated for Strawberry Creek, they have been designated for Central San Francisco Bay to which it discharges, and it is the local Regional Board policy to protect uses that might reasonably apply to the tributaries of listed waters. Beneficial uses designated for Central San Francisco Bay include ocean, commercial and sport fishing; estuarine habitat; industrial service supply; migration of aquatic organisms; navigation; industrial process supply; rare, threatened, or endangered species; contact water recreation; non-contact water recreation; shellfish harvesting; fish spawning; and wildlife habitat.

Water quality objectives established in the Basin Plan to protect the beneficial uses from the types of potential pollutants that could be generated by the project are included in **Table 4.7-1, Basin Plan Water Quality Objectives to Protect Beneficial Uses**.

Table 4.7-1
Basin Plan Water Quality Objectives to Protect Beneficial Uses

Parameter	Water Quality Objective
Dissolved Oxygen	7.0 mg/L minimum in Cold water habitat 5.0 mg/L minimum in Warm water habitat The median concentration for any three consecutive months shall not be less than 80 percent of the dissolved oxygen content at saturation.
Salinity	Controllable water quality factors shall not increase the total dissolved solids or salinity of waters so as to adversely affect beneficial uses.
Suspended Solids and Settleable Matter	Waters shall not contain suspended material in concentrations that cause nuisance or adversely affect beneficial uses.
Sediment	The suspended sediment load and suspended sediment discharge rate of surface waters shall not be altered in such a manner as to cause nuisance or adversely affect beneficial uses. Controllable water quality factors shall not cause a detrimental increase in concentrations of toxic pollutants in sediments or aquatic life.
Turbidity	Waters shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses. Increases from normal background light penetration or turbidity relatable to waste discharge shall not be greater than 10 percent in areas where natural turbidity is greater than 50 NTU.
pH	The pH shall not be depressed below 6.5 nor raised above 8.5. Controllable water quality factors shall not cause changes greater than 0.5 unit in normal ambient pH levels.
Oil and Grease	Waters shall not contain oils, greases, waxes, or other materials in concentrations that result in visible film or coating on the surface of the water or on objects in the water, that cause nuisance, or that otherwise adversely affect beneficial uses.
Floating Material	Waters shall not contain floating material, including solids, liquids, foams, and scum, in concentrations that cause nuisance or adversely affect beneficial uses.

Parameter	Water Quality Objective
Temperature	The natural receiving water temperature of inland surface waters shall not be altered unless it can be demonstrated to the satisfaction of the Regional Board that such alteration in temperature does not adversely affect beneficial uses. The temperature of any cold or warm freshwater habitat shall not be increased by more than 5ºF (2.8ºC) above natural receiving water temperature.
Toxic Pollutants	All waters shall be maintained free of toxic substances in concentrations that are lethal to or that produce other detrimental responses in aquatic organisms. Detrimental responses include, but are not limited to, decreased growth rate and decreased reproductive success of resident or indicator species. There shall be no acute toxicity in ambient waters. Acute toxicity is defined as a median of less than 90 percent survival or less than 70 percent survival, 10 percent of the time, of test organisms in a 96-hour static or continuous flow test. There shall be no chronic toxicity in ambient waters. Chronic toxicity is a detrimental biological effect on growth rate, reproduction, fertilization success, larval development, population abundance, community composition, or any other relevant measure of the health of an organism, population, or community. Numeral objectives for arsenic, cadmium, chromium III, chromium VI, copper, cyanide, lead, mercury, nickel, selenium, silver, tributyltin, and zinc are provided in the Basin Plan.
Diazinon	Diazinon concentrations in urban creeks shall not exceed 100 ng/L as a one-hour average (Basin Plan amendment awaiting U.S. EPA approval).

Source: RWQCB 2006

Total Maximum Daily Load – Section 303(d) of the Clean Water Act

The State of California is required by Section 303(d) of the CWA to provide the United States Environmental Protection Agency (U.S. EPA) with a list of water bodies considered by the State to be impaired (i.e., not meeting water quality standards and not supporting their beneficial uses). The list also identifies the pollutant or stressor causing impairment, and establishes a schedule for developing a control plan to address the impairment, typically a Total Maximum Daily Load (TMDL). The TMDL specifies the amount of the target pollutant that the waterbody can sustain on a daily or annual basis and is established by amending the water quality control plan. TMDLs are prepared by the RWQCBs and result in amendments to Water Quality Control Plans which must be approved by the U.S. EPA. The 303(d) list is used by the U.S. EPA to prepare the biennial federal CWA Section 305(b) Report on Water Quality.

Although Strawberry Creek is not included in the 2006 303(d) list, the RWQCB has found that San Francisco Bay Area urban creeks do not consistently meet the Basin Plan's narrative water quality objectives pertaining to toxicity. In response, the Basin Plan was amended on November 16, 2005, by Board Resolution R2-2005-0063 to establish a TMDL to reduce diazinon and pesticide-related toxicity in Bay Area urban creeks (Johnson 2005). The TMDL will become effective upon U.S. EPA approval.

National Pollutant Discharge Elimination System

The U.S. EPA has delegated management of California's NPDES program to the State Board and the nine Regional Board offices. The NPDES program was established in 1972 to regulate the quality of effluent discharged from easily detected point sources of pollution such as wastewater treatment plants and industrial discharges. The 1987 amendments to the CWA [Section 402(p)] recognized the need to address nonpoint source stormwater runoff pollution and expanded the NPDES program to operators of municipal separate storm sewer systems (MS4s), construction projects, and industrial facilities.

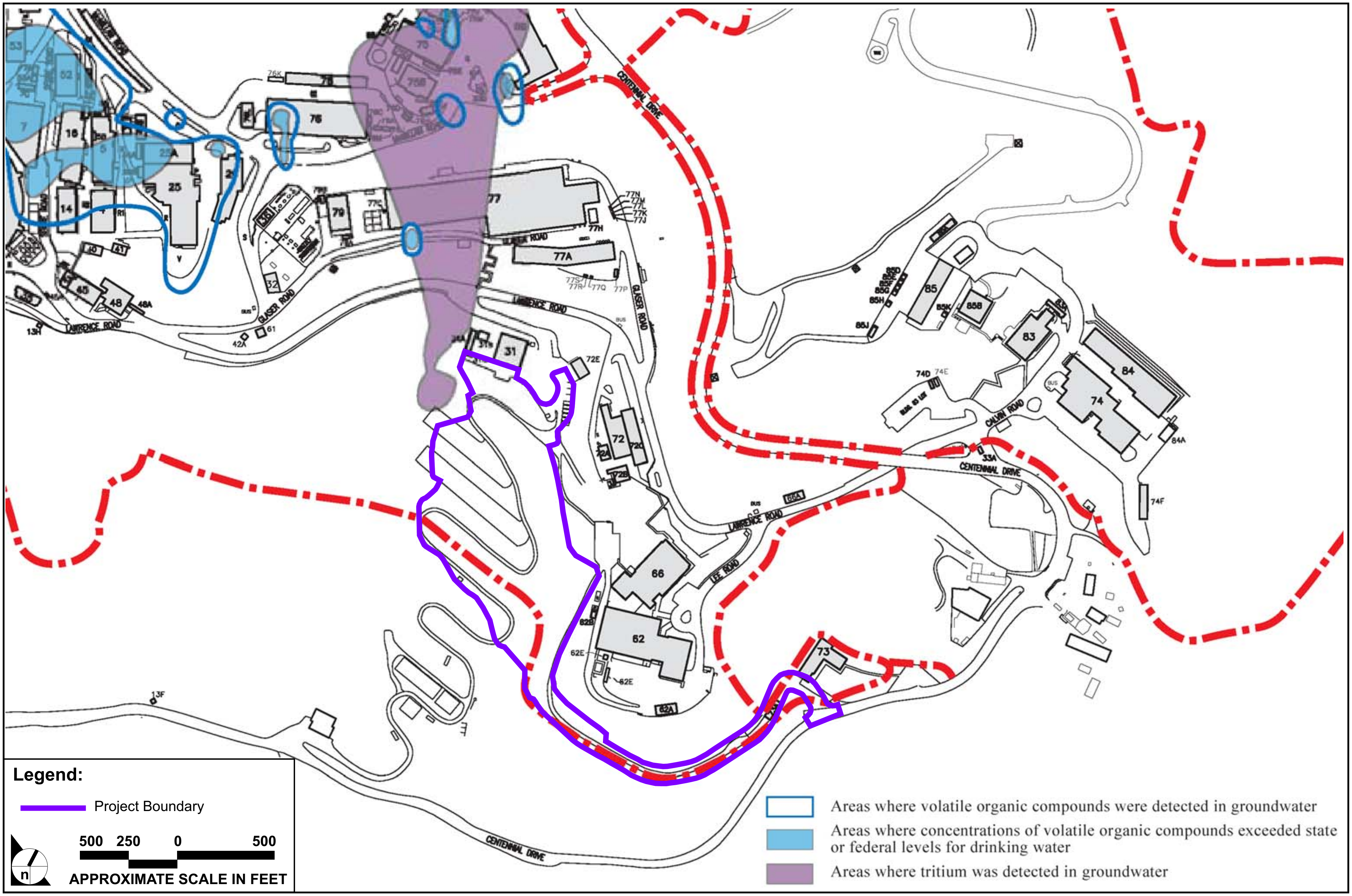
Industrial

Because of metal finishing activities and operation of a hazardous waste treatment facility (Standard Industrial Classification or SIC codes 3499 and 4953), LBNL must be permitted under NPDES industrial regulations. The State Board administers the NPDES General Permit for Discharges of Stormwater Runoff Associated with Industrial Activities (General Industrial Permit). The General Industrial Permit requires the implementation of management measures that will achieve the performance standard of best available technology economically achievable and best conventional pollutant control technology to control pollutants in stormwater runoff from industrial facilities. The General Industrial Permit also requires the development of a Storm Water Pollution Prevention Plan (SWPPP) and a monitoring plan. The SWPPP identifies sources of pollutants and describes the means to manage the sources to reduce stormwater pollution. LBNL filed a Notice of Intent in March 1992 and obtained permit identification number 201S002421.[9] Details of the 4th revision of their SWPPP, dated March 1, 2006, are included later in this section.

Construction

The State Board administers the NPDES General Permit for Discharges of Stormwater Runoff Associated with Construction Activity (General Construction Permit). If projects involving 1 acre or more of construction want to be covered under the General Construction Permit, the facility must submit a Notice of Intent to the State Board prior to the beginning of construction. The General Construction Permit requires that projects develop and implement a SWPPP, identifying potential sources of pollution and specifying runoff controls during construction for the purpose of minimizing the discharge of pollutants in stormwater from the construction area. In addition, the SWPPP needs to identify post-construction control measures and a monitoring plan.

9 The ID has since changed to 201I002421.



SOURCE: LBNL Long Range Development Plan - 2006

FIGURE **4.7-3**

Groundwater Contaminant Plume Map

Municipal

The cities of Oakland and Berkeley are both participating agencies signatory to the Alameda Countywide Clean Water Program (ACCWP) NPDES Municipal Stormwater Permit, which regulates urban runoff discharges from municipalities based on the 1987 amendments to the CWA. Since the first five-year permit was issued by the RWQCB in 1991, the ACCWP has successively implemented a series of comprehensive stormwater management plans for urban runoff management meeting Regional Board standards.

When the permit was renewed in 2003, the RWQCB included new design standards for runoff treatment control measures (Provision C.3) from new development and significant redevelopment. The reissued permit also required development of a Hydrograph Modification Management Plan (HMP) to manage increased peak runoff flows and volumes (hydromodification) and avoid erosion of stream channels and degradation of water quality caused by new and redevelopment projects (Provision C.3.f). LBNL is generally exempt from local regulations (including Provision C.3.f); however, LBNL has included provisions in the 2006 LRDP to control hydromodification (see 'LBNL Stormwater Management' section below).

Local Plans and Policies

Although LBNL is generally exempted from compliance with local land use regulations, LBNL seeks to cooperate with local jurisdictions. LBNL is located in both the city of Berkeley and the city of Oakland. General Plan policies of both cities related to water quality and hydrology are listed below.

2006 LRDP Principles and Strategies[10]

Development strategies provided by the 2006 LRDP are intended to minimize potential environmental impacts that could result from implementation of the 2006 LRDP. Development strategies set forth in the 2006 LRDP that are applicable to hydrology and water quality include the following:

- Protect and enhance the site's natural and visual resources, including native habitats, streams and mature tree stands by focusing future development primarily within the already developed areas of the site;
- Increase development densities within the most developed areas of the site to preserve open space, and enhance operational efficiencies and access;

10 While this Environmental Impact Report presents a "stand alone" impact analysis that does not rely upon tiering from any programmatic CEQA document, Berkeley Lab does actively follow the 2006 LRDP as a planning guide for Lab development. Accordingly, relevant 2006 LRDP principles, strategies, and design guidelines are identified in this section.

- To the extent possible site new projects to replace existing outdated facilities and ensure the best use of limited land resources;
- To the extent possible site new projects adjacent to existing development where existing utility and access infrastructure may be utilized;
- Site and design new facilities in accordance with University of California energy efficiency and sustainability policies to reduce energy, water, and material consumption and provide improved occupant health, comfort, and productivity;
- Reduce the percentage of parking spaces relative to the adjusted daily population;
- Consolidate parking into larger lots and/or parking structures, and locate these facilities near Laboratory entrances to reduce traffic within the main site;
- Remove parking from areas targeted for outdoor social spaces and service areas;
- Consolidate service functions wherever possible in the Corporation Yard;
- Utilize native, drought-tolerant plant materials to reduce water consumption; focus shade trees and ornamental plantings at special outdoor use areas;
- Minimize impervious surfaces to maintain or reduce stormwater run-off and provide landscape elements and planting to stabilize slopes, reduce erosion and sedimentation;
- Maintain a safe and reliable utility infrastructure capable of sustaining the Laboratory's scientific endeavors; and
- Design infrastructure improvements to embody sustainable practices.

LBNL Design Guidelines

The LBNL Design Guidelines were developed in parallel with the 2006 LRDP and provide specific guidelines for site planning, landscape and building design as a means to implement the 2006 LRDP's development principles as each new project is developed. Specific design guidelines are organized by a set of design objectives that essentially correspond to the strategies provided in the 2006 LRDP. The LBNL Design Guidelines provide the following specific planning and design guidance for the hydrologic and water quality aspects of new development to achieve these design objectives.

- Minimize impacts to disturbed slopes;
- Minimize further increases in impermeable surfaces at the Berkeley Lab; and
- Minimize visual and environmental impacts of new parking lots.

The design guidelines would be applied to the proposed project as part of the 2006 LRDP program. As part of the design review and approval process, the proposed project would be evaluated for adherence to the design guidelines and any other relevant plans and policies. Approvals would be subject to satisfactory compliance with these provisions.

LBNL SWPPP

LBNL developed a SWPPP and a Storm Water Monitoring Plan (SWMP) in 1992 to comply with the NPDES General Industrial Permit. The most recent revision of the LBNL SWPPP (LBNL 2006) identifies potential sources of pollution and describes best management practices (BMPs) used to protect stormwater quality. In accordance with LBNL's SWMP, water quality samples are collected during the wet season to demonstrate the effectiveness of the SWPPP and compliance with NPDES requirements.

Potential sources of pollution identified in the LBNL SWPPP include: materials management, vehicles, construction and maintenance activities,[11] and spills and leaks. Three levels of BMPs are considered for each pollutant: source control, management control, and treatment control. Examples of BMPs that have been implemented and are described in the LBNL SWPPP include:

- Safe handling of materials during loading, unloading, and transport to avoid container breakage and spillage (i.e., spill containment, personnel training);
- Proper handling and appropriate storage of materials (i.e., indoor use, proper containers, inspections);
- Control of radionuclide use (i.e., LBNL Radiological Work Authorization Program);
- Washing and servicing of vehicles to prevent leaks and spills to the storm drain system (i.e., off-site repair, discharge of wash station to oil-water separator and sanitary sewer system);
- Parking guidelines to prevent erosion (i.e., routine sweeping of parking lots, pavement inspections and repair);
- BMPs to avoid impact to the storm drain system from soil erosion or construction materials (i.e., cover excavation piles, storm drain inlet protection, concrete washout controls);
- Maintenance of stormwater-related facilities (i.e., inspections and cleaning);
- Prevention of sediment and erosion (i.e., landscaping); and
- Hazardous materials and waste management guidelines (i.e., waste minimization, spill prevention, personnel training).

---

11 Although construction activities are included in LBNL's industrial SWPPP, LBNL will file a Notice of Intent prior to construction of the project to comply with the NPDES General Construction Permit.

LBNL Stormwater Management

LBNL utilizes a variety of engineered stormwater facilities to control surface water flows, which are described below:

- Primary debris interceptors. Structural steel tubes, evenly spaced and embedded in concrete across drainage channels, which remove heavy, floating items such as logs, limbs, stumps, and brush from storm runoff entering the LBNL site from upstream portions of the drainage. Primary debris interceptors prevent blockage of the storm system entrance and potential flooding; as debris collects on the interceptors, these features also function as local seasonal check dams by storing, slowing, and further dissipating energy of larger storm flows;

- Secondary debris interceptors. Heavy vertical grids of rebar spaced more closely together than primary debris interceptors to filter out smaller debris, constructed downstream from primary interceptors to further manage flows originating upstream of the site as they enter LBNL. Fiber rolls and similar instruments are typically placed seasonally at the secondary interceptors to help filter out suspended soil particles from runoff and act as smaller check dams, silting pools, and energy dissipaters;

- Rip-rap. Sharp-edged cobblestone typically placed at all entrances and outfall points in the storm drain system. Rip-rap is frequently cemented together and both dissipates energy and protects slopes and channels;

- Wing walls and head walls. Concrete walls used where open-channel flow enters a piping system to protect embankment and channel walls from erosion. Steel grates on the inlet structure also filter debris which may have bypassed the primary or secondary debris interceptors;

- Concrete v-ditches. Channels used in all earthwork projects along the tops of cut slopes and at intermediate benches on the face of the slope. V-ditches intercept surface runoff to keep the slope face from eroding and channeling;

- Jute mesh. Jute mesh installed on all slopes exposed by construction or grading activities on slopes steeper than 2:1 to prevent erosion until hydroseeding and/or ground cover is well established. Mesh is pinned to the slope with long metal staples and typically reinforces the emerging grasslands for up to seven years. Fiber rolls are staked at regular intervals across the faces of slopes to slow down and filter surface runoff;

- Down drains. Pipes that convey water down the face of slopes from a collection point at the top of the slope to a lower elevation at a stable outfall point to prevent erosion and damage to the slope face; and

- Impervious, semi-pervious and pervious pavements, curbs, berms, and water dispersal systems. Surfaces that convey and control storm runoff to prevent runoff from eroding otherwise unprotected surfaces or from flowing down unprotected slopes.

As part of ongoing efforts to coordinate stormwater management efforts within the Strawberry Creek watershed, as well as in response to public comments received as part of the 2006 LRDP EIR process, LBNL expanded its stormwater management practices to reflect the 'Continuing Best Practices' outlined in UC Berkeley's 2020 LRDP EIR (LBNL 2006 LRDP Final EIR, Appendix A, pp. IV.G-16 and 17). These new measures that help to clarify certain specific goals to control hydrologic and water quality impacts are listed below:

- During the design review process and construction phase, LBNL will verify that the proposed project complies with all applicable requirements and BMPs (reflecting UCB Continuing Best Practice HYD-1-a);
- LBNL will implement an urban runoff management program containing the BMPs included in the Strawberry Creek Management Plan. LBNL will also continue to comply with its NPDES stormwater permitting requirements by implementing appropriate construction and post-construction control measures and BMPs required by project-specific SWPPPs. Stormwater Pollution Prevention Plans would be prepared as required by regulation to prevent discharge of pollutants and to minimize sedimentation and the transport of soils resulting from construction-related activities (reflecting UCB Continuing Best Practice HYD-1-b);
- Landscaped areas of development sites will be designed to absorb runoff from rooftops and walkways where feasible. LBNL will ensure that open or porous paving systems be included in project designs wherever feasible, to minimize impervious surfaces and absorb runoff. "Feasibility" is based on site constraints such as topography, slope steepness and stability, soil type and permeability (reflecting UCB Continuing Best Practice HYD-2-c);
- To accommodate existing runoff, LBNL will continue to maintain and clean its storm drain system (reflecting UCB Continuing Best Practice HYD-4-a);
- Development that encroaches on creek channels and riparian zones will be restricted. Creek channels will be preserved and enhanced, where feasible. An undisturbed buffer zone will be maintained between proposed LRDP projects and creek channels (reflecting UCB Continuing Best Practice HYD-4-c);
- LBNL will manage runoff into storm drain systems such that the aggregate effect of projects implementing the LRDP is to approximate pre-project runoff volumes (reflecting UCB Continuing Best Practice HYD-4-e); and
- Any project proposed with potential to alter drainage patterns will be accompanied by a hydrologic modification analysis. Such an analysis will then incorporate a plan to prevent increases of flow from the newly developed site, preventing downstream flooding and substantial siltation and erosion (reflecting UCB LRDP Mitigation Measure HYD-5).

City of Berkeley General Plan

The City of Berkeley General Plan was adopted on April 23, 2002. The following policies are contained in the General Plan pertaining to hydrology and water quality:

Policy EM-23 Water Quality in Creeks and San Francisco Bay: Take action to improve water quality in creeks and San Francisco Bay.

Actions:

D) Restore a healthy freshwater supply to creeks and the Bay by eliminating conditions that pollute rainwater, and by reducing impervious surfaces and encouraging use of swales, cisterns, and other devices that increase infiltration of water and replenishment of underground water supplies that nourish creeks.

F) Encourage the maintenance and restoration of creeks and wetlands and appropriate planting to cleanse soil, water, and air of toxins;

Policy EM-24 Sewers and Storm Sewers: Protect and improve water quality by improving the citywide sewer system.

E) Ensure that new development pays its fair share of improvements to the storm sewerage system necessary to accommodate increased flows from the development.

F) Coordinate storm sewer improvements with creek restoration projects;

Policy EM-25 Groundwater: Protect local groundwater by promoting enforcement of state water quality laws that ensure non-degradation and beneficial use of groundwater;

Policy EM-27 Creeks and Watershed Management: Whenever feasible, daylight creeks by removing culverts, underground pipes, and obstructions to fish and animal migrations.

Actions:

D) Restrict development on or adjacent to existing open creeks. When creeks are culverted, restrict construction over creeks and encourage design solutions that respect or emphasize the existence of the creek under the site.

F) Work in cooperation with adjoining jurisdictions to jointly undertake creek and wetland restoration projects, to improve water quality and wildlife habitat, to allow people to enjoy creeks as part of urban open space.

G) Regulate new development within 30 feet of an exposed streambed as required by the Creeks Ordinance and minimize impacts on water quality and ensure proper handling of stormwater runoff by requiring a careful review of any public or private development or improvement project proposed in water sensitive areas.

H) Consider amending the Creek Ordinance to restrict parking and driveways on tops of culverts and within 30 feet of creeks; and

Policy S-27 New Development: Use development review to ensure that new development does not contribute to an increase in flood potential.

Actions:

C) Require new development to provide for appropriate levels of on-site retention of stormwater.

D) Regulate development within 30 feet of an exposed streambed as required by the Preservation and Restoration of Natural Watercourses (Creeks) Ordinance.

City of Oakland General Plan

The Oakland General Plan consists of several Elements that were separately adopted. City objectives and policies pertaining to hydrology and water quality are included in the Open Space, Conservation and Recreation Element, adopted in 1996:

Policy OS-8.2 Creek Daylighting: Support programs to restore or "daylight" sections of creek that have been culverted or buried in the storm drain system, provided that the following conditions exist: (1) broad-based community support for the project; (2) availability of financial resources for the project; and (3) no significant health, safety, flooding, or erosion hazards would result from the project. Place priority for daylighting on properties where additional opportunities for recreational access would be created.;

Policy CO-5.2 Improvements to Groundwater Quality: Support efforts to improve groundwater quality, including the use of non-toxic herbicides and fertilizers, the enforcement of anti-litter laws, the clean-up of sites contaminated by toxics, and ongoing monitoring by the Alameda County Flood Control and Water Conservation District;

Policy CO-5.3 Control of Urban Runoff: Employ a broad range of strategies, compatible with the Alameda Countywide Clean Water Program, to: (a) reduce water pollution associated with stormwater runoff; (b) reduce water pollution associated with hazardous spills, runoff from hazardous material areas, improper disposal of household hazardous wastes, illicit dumping, and marina "live-aboards" and (c) improve water quality in Lake Merritt to enhance the lake's aesthetic, recreational, and ecological functions; and

Policy CO-6.1 Creek Management: Protect Oakland's remaining natural creek segments by retaining creek vegetation, maintaining creek setbacks, and controlling bank erosion. Design future flood control projects to preserve the natural character of creeks and incorporate provisions for public access, including trails, where feasible. Strongly discourage projects that bury creeks or divert them into concrete channels.

4.7.4 Impacts and Mitigation Measures

Significance Criteria

The impact of the proposed project on hydrology and water quality would be considered significant if it would exceed the following Standards of Significance, in accordance with Appendix G of the *California Environmental Quality Act (CEQA) Guidelines* and the UC CEQA Handbook:

- 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 (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted);
- 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 which 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 flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map;
- Place within a 100-year flood hazard area structures which would impede or redirect flood flows;
- 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

- Cause inundation by seiche, tsunami, or mudflow.

Issues Not Discussed Further

The Helios project Initial Study found that impacts to groundwater supply would be less than significant, because the project would not 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. Groundwater in the project area is not used for public supply. Furthermore, the project incorporates vegetated swales and other measures to reduce the impacts to infiltration.

LBNL is not located within a 100-year flood hazard zone and therefore structures would not impede or redirect flood flows. The project would not 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 because the project site is not within an area downstream of a dam or levee. Also, because of the elevation and location of the LBNL site, impacts due to seiche or tsunami are less than significant. These issues are not discussed further in this section.

Project Impacts and Mitigation Measures

Helios Impact HYDRO-1: Development of the project site would increase the area of impervious surfaces that would result in increased volume of stormwater runoff that could contribute to erosion and/or siltation in Strawberry Creek. (*Potentially Significant; Less than Significant with Mitigation*)

Construction of impervious surfaces on areas currently occupied primarily by vegetated open space would (without appropriate controls) serve to decrease storm water infiltration at the site and result in increased peak flow and volume of flow in downstream reaches. These increases (often referred to as 'hydromodification') can, in turn, increase the frequency of erosive events in downstream channels. The effects are typically most prominent for the higher frequency, lower magnitude events that occur on a yearly or decadal basis.

The Helios project incorporates several features intended to reduce increases in stormwater runoff. Green roof elements are planned for the top of a portion of the Helios Facility (see Section 3.5.1.6) that would be designed to absorb runoff from rooftop and rooftop terrace areas. Permeable pavement is also being considered for the parking area, pending geotechnical approval, as a means for further reducing stormwater runoff.[12] Additionally, stormwater runoff from much of the site will be directed into

12 Permeable pavement has not yet been incorporated in the project design, and while it remains a possibility, it was not considered as part of the project for the purpose of this EIR. All impervious areas were included in the preliminary planning for the hydromodification basin, and Helios Mitigation Measure HYDRO-1 requires BAHM calculation to be completed again following finalization of the project design.

vegetated swales before emptying to the storm drain system. While not specifically designed for hydromodification control, these swales will serve to absorb (and evapotranspire) some of the excess stormwater volume.

However, even considering the above measures, the proposed project would add approximately 2 acres of new impervious area to the project site, and some increase in stormwater runoff volume is expected. To avoid erosion and sedimentation impacts on downstream drainages from this additional runoff, stormwater runoff from most of the impervious areas of the project site (approximately 1.8 acres) would be directed to a storm drain system (via vegetated swales) that will drain to a hydromodification vault to be constructed beneath the proposed turnaround to the west of the Helios building. The hydromodification vault has been preliminarily sized using the Bay Area Hydrology Model (BAHM), a tool that was developed and calibrated to meet the conditions of the Alameda County NPDES C.3.f (hydromodification) provision. This stormwater vault would provide 'flow duration control'[13] for stormwater runoff from the project site (both peak flow and duration of erosive flows) between 10 percent of the two-year recurrence flow and the 10-year recurrence flow. This would reduce hydromodification impacts to a less than significant level by detaining excess stormwater and/or releasing the water at a rate below the erosion threshold of the receiving stream.[14]

A portion of the proposed access road (approximately 0.2 acre of new impervious area) would drain to the Strawberry Creek mid-canyon detention basin. While the mid-canyon detention basin does provide attenuation of flow peaks, it was not specifically designed to control for hydromodification. A hydromodification vault (or similar hydromodification control feature) has been evaluated for incorporation into the design of the lower portion of the access road so that post-project flow durations (between 10 percent of the two-year recurrence flow and the 10-year flow) match, or are less than, pre-project flow durations. For this reason, excess runoff from the access road would not contribute to increased frequency of erosive flows within the Strawberry Creek watershed.[15] However, if during final design it is determined that a hydromodification vault is not feasible, the flows added by the project could result in a significant impact. To address this potentially significant impact, Helios Mitigation Measure HYDRO-1a is proposed below.

---

13 'Flow duration control' is a method used for mitigating urban hydromodification that controls the cumulative duration of frequent, erosive flows from the project, mimicking pre-project conditions. This method, originally developed for use in Western Washington, has been incorporated into the Alameda County hydromodification management plan (as well as several other HMPs in the Bay area).

14 See Helios Impact HYDRO-2 for discussion of flood control for storm events larger than the 10-year storm.

15 UC Berkeley has a policy of 'no net increase in stormwater runoff' (UCB 2020 LRDP). While the Helios project is not part of the UC Berkeley 2020 LRDP, the access road is partially located on UC Berkeley property. Though the excess runoff from this small additional impervious area is unlikely to induce channel response on its own, it would cumulatively add to hydrologic effects within the watershed as a whole.

Furthermore, to ensure that the proposed hydromodification facilities are appropriately sized, Helios Mitigation Measure HYDRO-1b below is also proposed to address stormwater runoff.

Helios Mitigation Measure HYDRO-1a: Should a hydromodification control facility not be feasible in the lower portion of the Helios Access Road, the primary hydromodification vault (located under the turnaround) shall be over-sized to control and compensate for the additional impervious surfaces not controlled in the lower portion of the access road. This would be done by re-designing the primary hydromodification vault using the BAHM to handle stormwater flow from existing impervious surfaces near the project area (equal to that of the extra access road impervious area) that currently do not contain hydromodification controls.

Helios Mitigation Measure HYDRO-1b: Using the Bay Area Hydrology Model, calculations shall be provided following approval of the final project design to show that the proposed hydromodification vault (or vaults) is (are) sized appropriately to control flows such that 'flow duration control' is provided between 10 percent of the two-year recurrence storm and the 10-year recurrence storm.

Significance after Mitigation: With the implementation of the proposed mitigation measures, the impact related to erosion and sedimentation would be reduced to a less than significant level.

Helios Impact HYDRO-2: Development of the site would alter surface drainage patterns on the site which could result in increased peak flows and induce flooding in downstream reaches. (*Potentially Significant; Less than Significant with Mitigation*)

Potential increases in Strawberry Creek flows below the 10-year design storm would be controlled for both peak flows and flow duration by the hydromodification vault, as described above. However, some increase in stormwater runoff from the site is also expected for higher magnitude storm events (25-, 50- and 100-year storms, for example). Because of the project site's relatively steep hillside location, much of the rainfall during large storm events (when the ground is saturated and infiltration is reduced) runs directly off the site rather than infiltrating into the soils. Therefore, the difference between pre-development and post-development flows for large storms would be small. However, even a small increase could potentially exacerbate flooding in downstream reaches of Strawberry Creek, especially at the Oxford Street culvert at the western end of the UC Berkeley Campus where the existing capacity is limited to approximately a 25-year event (UCB 2005). Therefore, the project's impact related to flooding would be potentially significant. Helios Mitigation Measure HYDRO-2 would mitigate this potential impact to a less than significant level.

In addition to increased stormwater runoff, dewatering of areas around the building site could also add water to the creek system. As described in **Section 3.0, Project Description**, the Helios Facility would be constructed with various levels below the existing grade. The northern portion of the building would be approximately 30 feet below the existing ground surface, while the southern portion of the building would be a maximum of about 45 feet below the existing ground surface. An underground drainage system would likely be included to route groundwater around the underground structure to No Name Creek. Based on water level observations at nearby monitoring wells, it is possible that the building sub-basement structure will encounter groundwater along as much as the lower 10 to 20 feet of the structure. Due to the low permeability of the surrounding substrate and relatively slow movement of groundwater at the project site, the dewatering system at the Helios building is expected to contribute little, if any, flow to No Name Creek. In fact, the dewatering system at the nearby Molecular Foundry building has been completely dry since construction in 2005, and the fill drains currently located on the Helios project site rarely contribute flow to No Name Creek. Furthermore, as discussed under Helios Impact HYDRO-5 and required by Helios Mitigation Measure HYDRO-5, all water from the dewatering system would be collected and transported to an U.S. EPA-approved disposal facility, or re-infiltrated near the top of the tritium plume to increase the residence time of the water and allow the tritium to decay, or discharged to the sanitary sewer system. Therefore the dewatering system discharges would not contribute to flows in Strawberry Creek and would therefore not exacerbate flooding in downstream reaches.

Helios Mitigation Measure HYDRO-2a: The hydromodification vault will be oversized to incorporate control of peak flows for the 25-, 50-, and 100-year events. The excess storage volume will be designed such that the 'hydromodification control' function of the vault (for peaks and flow duration less than the 10-year storm) is not affected. Final design calculations showing no increases in peak runoff for the 25-, 50-, and 100-year events will be provided to and reviewed by LBNL staff upon finalization of the project design.

Helios Mitigation Measure HYDRO-2b: Stormwater detention (such as an oversized pipe system or detention vault) shall be provided for the portion of the project draining to the mid-canyon detention basin to control peak flows for the 25-, 50-, and 100-year storms. Final design calculations showing no increase in peak runoff for the 25-, 50-, and 100-year events will be provided to and reviewed by LBNL staff upon finalization of the project design. If a hydromodification vault is included for this section, it may be adapted to control for larger events (assuming that the 'hydromodification control' function is not affected). Alternatively, should capacity allow, stormwater detention may be provided within the mid-canyon detention basin. In this case, final design calculations shall show that project runoff does not increase peak flows for the 25-, 50-, and 100-year storm events from the mid-canyon detention basin.

Significance after Mitigation: With the implementation of the proposed mitigation measures, the impact related to flooding would be reduced to a less than significant level.

Helios Impact HYDRO-3: Project construction activities would not increase turbidity or decrease water quality in surface waterways. (*Less than Significant*)

LBNL currently employs, and would continue to employ, a wide array of construction-period best management practices to minimize the potential for accidental discharges of fill or other materials into surface waters. Active management of construction-related stormwater flows from development sites is a standard part of contract specifications on all construction projects undertaken by LBNL. Construction projects incorporate control measures and are monitored to manage stormwater flows and potential discharge of pollutants. For example, LBNL's standard construction specifications include requirements for installation of erosion control netting and riprap to protect slopes and minimize adverse effects of runoff; protection of existing plant materials; application and maintenance of hydroseeding (sprayed application of seed and reinforcing fiber on graded slopes); no washout of concrete trucks to the storm drain system; and proper disposal of wastewater resulting from vehicle washing. LBNL also implements spill prevention and response programs to minimize pollutants in runoff. Construction sites are replanted as soon as practicable following construction. In addition, the Berkeley Lab's construction specifications require that contractors properly maintain construction vehicles to minimize fluid leaks and contractors not refuel construction equipment in proximity to waterways. These ongoing programs would reduce the potential for accidental discharge during construction to adversely affect surface and groundwater quality.

In addition to the employment of LBNL best management practices, the impact to surface and groundwater quality would be minimized to below the level of significance through development and implementation of a SWPPP (including a project-specific erosion control plan) as required by the NPDES permit program. The SWPPP would incorporate LBNL's standard stormwater management practices and engineering controls as well as standards outlined in Association of Bay Area Governments' Manual of Standards for Erosion and Sediment Control Measures (ABAG 1995) and the California Stormwater Quality Association's (CASQA) Stormwater Best Management Practice Handbook for Construction (CASQA 2003). Development of a project-specific SWPPP, including appropriate measures for construction activities on hill slopes, has been included in the project for compliance with the California NPDES General Permit for Storm Water Discharges Associated with Construction Activity. The impact related to construction site runoff would be less than significant.

Mitigation Measure: No project-level mitigation measure required.

Helios Impact HYDRO-4: Stormwater runoff from the proposed parking area, access road, and other impervious surfaces could potentially contribute to long-term pollutant discharges to surface waters, including on-site streams and downstream to Strawberry Creek and the Bay. (*Potentially Significant; Less than Significant with Mitigation*)

The proposed project includes the widening of an existing access road, the creation of a new roadway section and turnaround area, and the addition of approximately 50 parking spaces. This would result in an increase in impervious surfaces that typically contribute additional oil, grease, and metal brake dust to stormwater runoff. Stormwater runoff from the proposed parking area and much of the newly established access road (the entire length of roadway except the southerly 650 feet, discussed further below) would be routed through a system of vegetated bioswales prior to entering the stormwater drainage system. Under the current project plans, the swales have been designed at a conceptual level, pending final project designs and feasibility based on geotechnical recommendations. In the event that some of these improvements are found to be infeasible, or cannot be appropriately sized, the proposed project could result in a potentially significant impact on surface water quality. Helios Mitigation Measure HYDRO-4a below is included to guide the final designs so that water quality impacts are reduced to a less than significant level.

As part of the project, approximately 650 feet of an existing gravel access road in the southern portion of the project site would be widened and improved to provide direct access to the Helios Facility from Centennial Drive. The road is currently used as secondary access to Buildings 66 and 62, as well as the Molecular Foundry building. Stormwater runoff from this portion of the project area would drain to a storm drain that follows the axis of the current road alignment, and empties into the Strawberry Creek mid-canyon detention basin at Centennial Drive. Due to the relatively steep grade of the road, as well as the steep slopes present on either side of the road, the use of vegetated bioswales for water quality treatment of the runoff from this area is not feasible. However, the impact of runoff from the roadway on surface water quality would not be significant because of the low traffic volumes associated with this roadway (about 50 automobiles and shuttle buses would use this roadway each day). However, to further reduce this impact, Mitigation Measure HYDRO-4b below is included for the project to install an in-line stormwater pollution prevention device to control sediment and floatables in the runoff from this area.

Helios Mitigation Measure HYDRO-4a: Vegetated swales will be incorporated into the project to maintain water quality of runoff and avoid exceeding water quality objectives prior to discharge to creeks. LBNL shall provide calculations showing that design of the swales meets recognized criteria for design of water quality BMPs. Should it be determined that appropriately sized vegetated swales are not feasible, then alternative RWQCB-approved methods of treating stormwater runoff, such as in-line pollution prevention devices or infiltration galleries, shall be incorporated into the project. All water quality treatment and source controls shall be summarized in the project-specific SWPPP.

Helios Mitigation Measure HYDRO-4b: An in-line pollution prevention device (such as a Continuous Deflective Separation (CDS) unit or Stormceptor) will be installed within the storm drain system along the proposed access road where vegetated bioswales are not feasible.

Significance after Mitigation: With the implementation of the proposed mitigation measures, the impact on storm water quality would be reduced to a less than significant level.

Helios Impact HYDRO-5: Discharge of groundwater pumped or drained as part of construction-phase or post-construction-phase dewatering activities could adversely affect surface water quality. (*Potentially Significant; Less than Significant with Mitigation)*

Due to the project's location on a hillside and given the proposed design of the building, which includes floor levels that are below grade, project construction would involve cuts ranging from about 5 feet to 30 feet below existing grade in the various portions of the project site. As discussed earlier in this section, groundwater in the project vicinity occurs at varying depths; in the monitoring well closest to the northern portion of the project site, groundwater has been observed between 20 and 30 feet of the ground surface. Therefore in areas of the deeper cuts, groundwater may be encountered during project construction, which would require collection and disposal. Once the building is constructed, a groundwater collection system could be required to intercept groundwater in the hillside up-gradient of the building. Depending on the amount of groundwater encountered, this system could be a gravity flow system or could involve pumping. These details would be developed during final design of the proposed project.

The proposed project does not directly overlie any areas of known groundwater contamination, and groundwater dewatering during project construction or operation is not expected to produce contaminated groundwater. However, as shown on **Figure 4.7-3, Groundwater Contaminant Plume Map**, a tritium plume has been identified west of the northern portion of the project site. The edge of the project site in this area would be within 50 feet of the plume. The potential for the project's dewatering operations to draw contaminated groundwater from the tritium plume is discussed below.

LBNL has mapped the extent of groundwater contamination in the tritium plume and continues to monitor the plume under its Environmental Restoration Program. Tritium activities[16] in groundwater are regularly measured at five monitoring wells directly northwest of the project site as well as at 10 temporary groundwater sampling wells.[17] Tritium activities have fallen in almost all monitoring wells over the past several years, although the two temporary wells (SB31-02-2 and SB31-02-1) nearest to the Helios project show an increase in tritium activity since installation.[18] Tritium activities in those two wells and others nearby are well below the maximum contaminant level (MCL) for drinking water (LBNL 2007c).

In addition to groundwater monitoring, LBNL has prepared a conceptual model of groundwater flow in the area affected by the plume (LBNL 2007d). According to this model, tritiated groundwater is limited almost entirely to Orinda Formation sandstone between Chicken Creek and the fault contact with Great Valley Group. Tritium contamination is not present in the thick soil deposits that underlie the northern portion of the Helios project site or in the underlying Great Valley Group bedrock. Tritium has not been detected in monitoring wells screened in the thick soil deposit since development of this conceptual model (LBNL 2007c). The auditorium building (west of the northern portion of the main Helios Facility) resides entirely over these units, approximately 80 feet south of the plume.

The cut for the northeast corner of the Helios building is approximately 200 feet east of the known extent of the tritium plume, while the cut for the cooling tower pad at the northwestern corner of the Helios project would be located approximately 50 feet east of the tritium plume in the margin of the paleolandslide deposit at SB31-02-2. Both of these cuts will likely be entirely within the overlying thick soil deposit somewhat transgradient from the plume. As tritium has not been detected in this generally low-permeability unit, even directly down-gradient of the plume, it is unlikely that tritium plume migration would affect these proposed Helios Facility cuts. Still, there is the potential that project site dewatering during construction and operation could accentuate plume migration towards the facility and potentially capture tritiated groundwater (even though the dewatering flow rate is expected to be very low due to the low permeability of materials encountered). Although tritium activities in the plume are well below the MCL for drinking water, should tritiated groundwater be captured and discharged to

---

16 Tritium concentrations are generally reported in terms of radiometric activity per volume of water.

17 The referenced wells are located between the project site and Lawrence Road. Additional monitoring wells within the tritium tracking program are located north of Lawrence Road. Supplemental sampling points were established in 2002 and 2003 to better track the extent of the tritium plume.

18 In one well the tritium concentration has dropped somewhat since 2005; however, this drop is recent enough that it is difficult to identify a long-term trend. In the other well, the most recent sample (Q2 2007) was the highest recorded tritium concentration for that well over the five-year monitoring period.

surface waters, such discharge could potentially result in a significant impact on surface water quality. To address this potentially significant impact, the following mitigation measure will be implemented.

Helios Mitigation Measure HYDRO-5: Tritium monitoring shall continue at existing temporary monitoring wells SB31-02-2 and SB31-02-1 and shall be included in the long-term tritium monitoring program. In addition, sampling of discharges related to dewatering activities in the northern portion of the project, both during (where encountered in pier and/or test borings or other excavations) and after project construction (via pumping or gravity subdrains), shall be added to and managed under the tritium monitoring portion of the LBNL Environmental Restoration Program. All water from the dewatering system in the northern portion of the project will be collected and transported to an U.S. EPA-approved disposal facility or will be re-infiltrated near the top of the plume to increase the residence time of the water and allow the tritium to decay.

Significance after Mitigation: With the implementation of the proposed mitigation measure, the impact on surface water quality would be reduced to a less than significant level.

4.7.5 REFERENCES

Alt, D., and Hyndman, D.W., 2000, *Roadside Geology of Northern and Central California.* Missoula, Montana: Mountain Press Publishing Company, 369p.

Association of Bay Area Governments (ABAG), 1995, Manual of Standards for Erosion and Sediment Control Measures: 422 p.

California Stormwater Quality Association (CASQA), 2003, Stormwater Best Management Practice Handbook for New Development and Redevelopment, available at http://www. cabmphandbooks.org/, prepared by Camp Dresser & McKee and Larry Walker Associates.

Graymer, R.W., Jones, D.L., and Brabb, E.E., 1996, Preliminary geologic map emphasizing bedrock formations in Alameda County, California: A digital database. U.S. Geological Survey Open-File Report 96-252, 33p + plates.

Johnson, B., 2005, Diazinon and pesticide-related toxicity in Bay Area urban creeks – water quality attainment strategy and TMDL – proposed basin plan amendment and staff report: California Regional Water Quality Control Board San Francisco Bay Region, 132 p. + appendices.

Korbay, S.R., and Lewis, L.E. 1980. Supplemental Geotechnical Exploration, Atomic Resolution Microscope Building, Lawrence Berkeley Laboratory, Berkeley, California. Consulting report prepared by Harding-Lawson Associates for LBNL. 12p.

Lawrence Berkeley National Laboratory (LBNL). 2007a. Site Environmental Report for 2006, LBL-27170 (2007). September.

Lawrence Berkeley National Laboratory (LBNL). 2007b. Quarterly progress report, first quarter fiscal year 2007 (October 1 to December 31, 2006) for the LBNL Hazardous Waste Facility Permit. Monitoring report prepared by the LBNL EH&S and Earth Sciences Divisions, 136p.

Lawrence Berkeley National Laboratory (LBNL). 2007c. Quarterly progress report and annual status summary, fourth quarter fiscal year 2006 (July 1 to September 30, 2006) for the LBNL Hazardous Waste Facility Permit. Monitoring report prepared by the LBNL EH&S and Earth Sciences Divisions, 556p.

Lawrence Berkeley National Laboratory (LBNL), 2007d, Hydrogeology and Tritium Transport in Chicken Creek Canyon, Lawrence Berkeley National Laboratory, Berkeley, California, Lawrence Berkeley National Laboratory Report, *LBNL-63557*, Lawrence Berkeley National Laboratory, prepared by Jordan, P.D. and I. Javandel, 2007. October.

Lawrence Berkeley National Laboratory (LBNL). 2006. Site Environmental Report for 2005, LBL-27170 (2006). July.

Lawrence Berkeley National Laboratory (LBNL). 2006. Storm Water Pollution Prevention Plan, Revision 4, Prepared for the U.S. Department of Energy under Contract No. DE-AC02-05CH11231.

Lewis, L.E. 2003. Geotechnical investigation, Molecular Foundry Building, Lawrence Berkeley National Laboratory, Berkeley, California. Consulting report prepared by Kleinfelder, Inc. for LBNL, dated September 20, 2002, revised October 30, 57p.

University of California Berkeley (UCB). 2005. Strawberry Creek Management Plan. Draft UC Berkeley EH&S working document, by e-mail from Karl Hans, UCB EH&S.

Welch, L. E. 1981. Soil survey of Alameda County, California, Western Part: United States Department of Agriculture, Soil Conservation Service, in cooperation with University of California Agricultural Experiment Station, 103 p. + map plates.