4.9 Air Quality

This section evaluates the quantity of air pollutant emissions that will occur with the Project. *Air pollution* is a general term that refers to one or more chemical substances that degrade the quality of the atmosphere. *Air quality* describes the amount of pollution in the air. Individual air pollutants degrade the atmosphere by reducing visibility, damaging property, reducing the productivity or vigor of crops or natural vegetation, or reducing human or animal health. For more information and references, see the *Honolulu High-Capacity Transit Corridor Project Air Quality and Energy Technical Report* (RTD 2008g).

4.9.1 Background and Methodology

Regulatory Requirements

The Clean Air Act Amendments of 1990 (40 CFR 51) and the Final Transportation Conformity Rule (40 CFR 93) direct the EPA to implement environmental policies and regulations that will ensure acceptable air quality levels.

As required by the Clean Air Act, National Ambient Air Quality Standards (NAAQS) have been established for six major air pollutants. Known as *criteria pollutants*, these are carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), particulate matter (PM_{10} and $PM_{2.5}$), sulfur dioxide (SO_2) and lead (Pb). The State of Hawai'i has also established ambient air quality standards that are either the same or more stringent than the corresponding Federal standards. State and Federal standards are summarized in Table 4-14.

Table 4-14 National and State Ambient Air Quality Standards

Pollutant	Standards	
	Hawai`i State Standard	Federal Primary Standard (Health)
Carbon Monoxide (CO)		
1 hour	9 ppm	35 ppm
8 hour	4.5 ppm	9 ppm
Nitrogen Dioxide (NO_2)		
Annual (arithmetic)	0.04 ppm	0.05 ppm
PM_{10}		
24 hour	150 µg/m^3	150 µg/m^3
Annual (arithmetic)	50 µg/m^3	Revoked
$PM_{2.5}$		
24 hour	No standard	35 µg/m^3
Annual (arithmetic)	No standard	15 µg/m^3
Ozone (O_3)		
8 hour	0.08 ppm	0.08 ppm
Sulfur Dioxide (SO_2)		
3 hour	0.5 ppm	No standard
24 hour	0.14 ppm	0.14 ppm
Annual (arithmetic)	0.03 ppm	0.03 ppm
Lead (Pb)		
3 months (arithmetic)	1.5 µg/m^3	1.5 µg/m^3

µg/m3 = micrograms per cubic meter

ppm = parts per million

Sources: State of Hawai'i, Department of Health, Clean Air Branch—Hawai'i Administrative Rules, Chapter 59 Code of Federal Regulations, Title 40, Part 50, Accessed: December 10, 2007. EPA, National Ambient Air Quality Standards.

In addition to the criteria pollutants addressed in the NAAQS, the EPA regulates air toxics. Toxic air pollutants are those known or suspected to cause cancer or other serious health effects. In 2001, the EPA identified 21 Mobile Source Air Toxics (MSAT) and highlighted 6 as priority MSATs.

In February 2007, the EPA finalized the *Control of Hazardous Air Pollutants from Mobile Sources: Final Rule to Reduce Mobile Source Air Toxics* (EPA 2007). This rule limits gasoline's benzene content and reduces toxic emissions from passenger vehicles and gas cans.

Methodology

Air quality effects predicted to result from the Project's operation are based on the anticipated vehicle miles traveled (VMT) and average network speed. A regional mobile source pollutant burdens analysis was completed. It was based on link-by-link VMT and speed for the Project and compared to the No Build Alternative. VMT and

the associated traffic simulation network speeds were used.

Emissions factors were obtained through the EPA's mobile source emission model, MOBILE6.2, in accordance with Hawai'i Department of Health Clean Air Branch's recommendation. This analysis compares regional pollutant burdens (the total quantity of each pollutant released in the region) for the Project. Changes in regional emission levels were estimated to describe the potential effect the Project may have on regional air quality.

In 2006, the USDOT issued Interim Guidance regarding MSAT analysis in NEPA documentation. This guidance includes a three-tiered approach to determining potential project-induced MSAT impacts, depending on the nature of the project. A qualitative analysis of MSAT effects was completed because the Project has low potential for increasing MSAT emissions.

4.9.2 Affected Environment

Relevant Pollutants

The Project will affect travel patterns within the study corridor, so pollutants that can be traced principally to motor vehicles are relevant in evaluating project consequences. These pollutants include CO, volatile organic compounds (VOC), nitrogen oxides (NO_x), PM_{10} and $PM_{2.5}$, and MSATs.

Air pollutant levels in Hawai'i are monitored by a network of sampling stations operated under the supervision of the State of Hawai'i Department of Health (HDOH) at various locations around O'ahu. The only NAAQS for which pollution levels have been measured greater than the standard since 2004 is $PM_{2.5}$. $PM_{2.5}$ concentrations exceeded the 24-hour standard on four occasions in Pearl City in 2004 as a result of fireworks.

Regional Compliance with Standards

Section 107 of the 1977 Clean Air Act Amendments requires the EPA to publish a list of all geographic areas that are in compliance with the NAAQS and areas that do not attain the NAAQS. Areas not in compliance are called non-attainment areas. Areas for which insufficient data is available to make a determination are unclassified and treated as being in compliance (attainment areas) until proven otherwise. Designation of an area is made on a pollutant-by-pollutant basis.

The entire State of Hawai'i is designated as an attainment area for CO, O_3, PM_{10}, and $PM_{2.5}$. This means that the State is in compliance with the NAAQS for these pollutants.

Projects included in Hawai'i's regional transportation network are found in the Transportation Improvement Plan. The Honolulu High-Capacity Transit Corridor Project is listed in the area's Transportation Improvement Plan and complies with the goals set forth in the Statewide Transportation Plan.

4.9.3 Environmental Consequences and Mitigation

Environmental Consequences

No Build Alternative

The No Build Alternative provides a baseline to which the Project is compared. Under this alternative, the Project would not be built. It is predicted that 6,854 kilograms (kg) of VOCs, 147,464 kg of CO, 4,842 kg of NO_x, 375 kg of PM_{10}, and 174 kg of $PM_{2.5}$ would be generated daily by transportation sources within the study corridor in 2030, including other projects in the ORTP.

Project

Regional Analysis

It is anticipated that the Project will reduce regional pollutant emissions by between 3.9 to 4.6 percent compared to the No Build Alternative (Table 4-15).

Table 4-15 2030 Mobile Source Regional Transportation Pollutant Burdens (kg/day)

Alternative	Emission Burden (kg/day)					Percent Change from No Build				
	VOC	CO	NO_x	PM_{10}	$PM_{2.5}$	VOC	CO	NO_x	PM_{10}	$PM_{2.5}$
No Build	6,874	147,899	4,856	376	175	n/a	n/a	n/a	n/a	n/a
Project	6,561	142,098	4,661	360	167	-4.6%	-3.9%	-4.0%	-4.3%	-4.6%

n/a = not applicable

Table 4-15 shows the results of the analysis of VOC, CO, NO_x, PM_{10}, and $PM_{2.5}$ for the Project compared to the No Build Alternative. If the electricity used to operate the Project is generated by combustion, this may produce additional emissions. However, these emissions will be offset in whole or part by the reductions generated by reduced VMT, as indicated in Table 4-15. Furthermore, power plant emissions may be more easily controlled than emissions from individual automobiles.

The Project is expected to have a small positive effect on MSAT emissions in the study corridor, compared to the No Build Alternative because of the reduction of VMT. MSAT levels could be higher in some locations in the study corridor than others, but current tools and science are not adequate to quantify these levels. However, EPA's vehicle and fuel regulations coupled with fleet turnover will result in lower region-wide MSAT levels from current levels.

The Project is predicted to demonstrate a 4-percent reduction in VMT and no change in overall network speed compared to the No Build Alternative. This will result in predicted pollution reductions ranging from 3.9 to 4.6 percent compared to the No Build Alternative.

Greenhouse Gases

The Project will decrease greenhouse gas emissions from transportation sources on O'ahu. Approximately 70 kg of carbon dioxide is emitted per million British thermal units (BTU) consumed when fuel oil, diesel, or gasoline is combusted (USDOE 2009). As detailed in Section 4.11, total daily transportation energy consumption on O'ahu would be 94,890 million BTUs for the No Build Alternative and will be 92,450 million BTUs for the Project. Assuming all electricity is generated from combustion of oil, the daily 2,440-million-BTU energy savings will result in a daily reduction in greenhouse gas emissions of approximately 171 metric tons of carbon dioxide.

Local Effects

The study corridor is currently in attainment for CO, and monitored CO values are less than 20 percent of the applicable NAAQS. Therefore, no violations of the applicable NAAQS are likely to occur with the Project. As a result, a microscale CO analysis was not conducted.

Mitigation

Because no substantial air quality impacts are anticipated to result from operation of the Project, mitigation will not be required.

4.10 Noise and Vibration

This section describes the Project's effects on environmental noise and vibration levels in the study corridor. For more information and references, see the *Honolulu High-Capacity Transit Corridor Project Noise and Vibration Technical Report* (RTD 2008f) and the *Honolulu High-Capacity Transit Corridor Project Addendum 01 to the Noise and Vibration Technical Report* (RTD 2009a).

4.10.1 Background and Methodology

Background

Environmental noise is composed of many frequencies, each occurring simultaneously at its own sound pressure level. The range of magnitude, from the faintest to the loudest sound the ear can hear, is so large that sound pressure is expressed on a logarithmic scale in units called decibels (dB). The commonly used frequency weighting for environmental noise is A-weighting (dBA), which simulates how an average person hears sound.

A common noise descriptor for environmental noise is the equivalent sound level (Leq). Leq is a measure of total noise—a summation of all sounds during a period of time. Leq measured over a one-hour period is the hourly Leq [Leq(h)]. The day/night noise level (Ldn) is a descriptor of the daily noise environment, which incorporates a penalty for high noise levels at night. Lmax is the maximum noise level during an event. Ldn is used by the EPA and FTA to evaluate noise levels in residential areas.

Noise Terminology

dBA is an A-weighted decibel, a measure that considers how people hear sound

Lmax is the maximum noise level during an event

Leq measures the average sound energy over time

Ldn is the day/night sound level, a 24-hour average with a penalty that makes sounds at night more important

Typical sound levels experienced in urban environments are shown in Figure 4-51.

Noise from rail transit operations is generated from the interaction of wheels on track, motive power, and the operation of traction power substations. The interaction of steel wheels on rails generates the following three different types of noise, depending on track work: (1) noise generated by pass-by trains operating on tangent track sections, (2) noise generated from wheel squeal on tightly curved track, and (3) noise generated on special trackway sections, such as at crossovers or turnouts.

Noise Criteria for the Project

Noise impacts from transit projects are evaluated using criteria established by the FTA, which are based on community reaction to environmental noise exposure (FTA 2006a). The FTA noise impact criteria group noise-sensitive land uses into the categories shown in Table 4-16.

Relative Sound Level	½ as loud		Baseline		Twice as loud		Four times as loud
Typical Sound Environment	Indoor Office		Urban Residential		Urban Commercial		
Lmax of Common Noise Sources		Washing Machine (3 ft)	Auto (50 mph at 50 ft)	Vacuum Cleaner (3 ft)	Garbage Disposal (3 ft)	Delivery Truck (50 mph at 50 ft)	Dump Truck (50 mph at 50 ft) / Blender (3 ft)
Sound Level dBA	60	65	70	75	80	85	90
Lmax at 50 ft of Transit Noise Source			Rail Transit with a Barrier (50 mph)		Rail Transit (50 mph) / City Bus (50 mph)		

Sources: EPA 1971, EPA 1974, FTA 2006

Figure 4-51 Typical Sound Levels

Table 4-16 FTA Transit Project Noise Impact Criteria—Land Use Categories

Category	Metric	Land Use Description
1	Leq(h) (dBA)	Tracts of land where quiet is an essential element in their intended purpose. This category includes lands set aside for serenity and quiet, land uses such as outdoor amphitheaters and concert pavilions, and National Historic Landmarks with substantial outdoor use.
2	Ldn (dBA)	Residences and buildings where people normally sleep. This category includes homes, hospitals, and hotels where a nighttime sensitivity to noise is assumed to be of utmost importance.
3	Leq(h) (dBA)	Institutional land uses with primary daytime and evening use. This category includes schools, libraries, and churches where it is important to consider interference with such activities as speech, meditation, and concentration on reading material. Buildings with interior spaces where quiet is important, such as medical offices, conference rooms, recording studios, and concert halls, fall into this category. It also includes places for meditation or study associated with cemeteries, monuments, and museums. Certain historical sites, parks, and recreational facilities are also included.

Source: Transit Noise and Vibration Impact Assessment, Final Report (FTA 2006a).

The FTA criteria define moderate and severe impacts. The project-generated noise level (project noise exposure) at which an impact will occur depends on the existing noise environment and the category of land use. The noise impact criteria for transit operations are shown on Figure 4-52, with residential noise impacts (measured in Ldn) shown on the left side of the graph and commercial noise impacts (measured in Leq[h]) shown on the right. Reading from the graph, if the existing noise level in a residential area is 60 dBA Ldn, then a project that generates less than 58 dBA Ldn will not have an effect. If it generates between 58 and 63 dBA Ldn, it will cause a moderate impact, and if it generates more than 63 dBA Ldn, it will cause a severe impact. Future noise exposure is the combination of existing noise exposure and the additional noise exposure caused by a project.

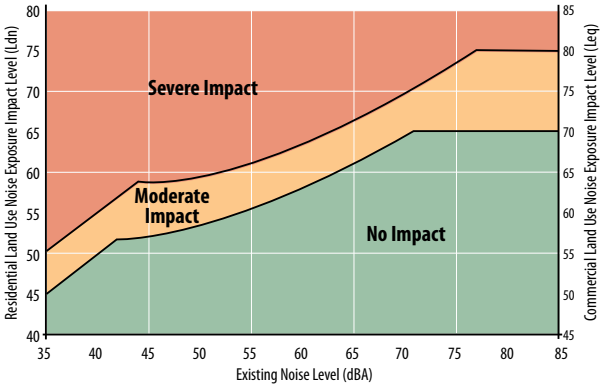

Figure 4-52 FTA Transit Project Noise Exposure Impact Criteria

Severe noise impacts are considered significant within the context of NEPA and HRS 343. Severe noise impacts require the evaluation of alternative locations/alignments to avoid severe impacts altogether. If it is not practical to avoid severe impacts by changing the location of the Project, mitigation measures must be considered and incorporated into the Project unless there are truly extenuating circumstances that prevent it. Moderate noise impacts also require consideration and adoption of mitigation measures when it is reasonable. The mitigation of moderate impacts should consider the predicted increase over existing noise levels, the type and number of noise-sensitive land uses affected, existing outdoor/indoor sound insulation, community views, special protection provided by law, and the cost-effectiveness of mitigating noise to more acceptable levels.

The State of Hawai‘i regulates community noise pollution through HAR 11-46. The regulations are applicable to stationary noise sources, such as traction power substations and the vehicle maintenance and storage facility.

Vibration Criteria for the Project

Vibration effects from transit operations are generated by motions/actions at the wheel/rail interface. The smoothness of these motions/actions are influenced by wheel and rail roughness, transit vehicle suspension, train speed, track construction (including types of fixation and ballast), location of switches and crossovers, and the geologic strata (layers of rock and soil) underlying the track. Vibration from a passing train has the potential to move through the geologic strata, resulting in vibration transferred through the building foundation. The principal concern is annoyance to building occupants.

Ground-borne vibration is usually characterized in terms of vibration velocity. This is because—over the frequency range relevant to ground-borne vibration (about 1 to 200 hertz)—both human and building response tends to be more proportional to velocity than to displacement or acceleration. Vibration velocity is often reported as vibration decibels (VdB) relative to a reference velocity of 10^{-6} inches/second.

The FTA has developed criteria for acceptable levels of ground-borne vibration (FTA 2006a) as shown in Table 4-17.

Noise and Vibration Assessment Methodology

Project-related noise levels were calculated using FTA reference sound levels for rail transit. Potentially noise-sensitive land uses and vibration-sensitive buildings were identified, as well as appropriate locations for noise monitoring.

Ground-level noise levels were measured at locations along the project alignment and near proposed station locations to establish the most sensitive existing environment (i.e., existing baseline noise levels). Noise levels were also measured on the upper floors of residential buildings that have four or more floors. This is done by performing a series of measurements at representative locations. All noise measurements were made in accordance with American National Standards Institute procedures for community noise measurements.

Noise measurements were taken at 46 noise-sensitive locations along the study corridor. Eight of the noise measurements were taken at sites near the Arizona Memorial and Pearl Harbor Naval Base in response to comments received on the Draft EIS. Measurements for 24-hour periods were conducted at 25 sites that include residences and other buildings where people normally sleep (Category 2 sites). These measurement locations were supplemented with short-term 15-minute measurement sites to determine existing noise levels at typical recreational, institutional, and commercial land uses with primarily daytime and evening activity (Category 3 sites). Eight of the 24-hour measurement sites were located on the upper floors of multi-story

Table 4-17 FTA Ground-borne Vibration Impact Criteria

Land Use Category	Ground-borne Vibration Impact Levels (VdB)	
	Frequent Events[1]	Infrequent Events[2]
Category 1: Buildings where low ambient vibration is essential for interior operations	65 VdB[3]	65 VdB[3]
Category 2: Residences and buildings where people normally sleep	72 VdB	80 VdB
Category 3: Institutional land uses with primarily daytime use	75 VdB	83 VdB

Source: Transit Noise and Vibration Impact Assessment, Final Report (FTA 2006a).

[1] *Frequent Events* are defined as over 70 vibration events per day.

[2] *Infrequent Events* are defined as less than 70 vibration events per day. This includes most commuter rail systems.

[3] This criterion is based on levels that are acceptable for most moderately sensitive equipment, such as optical microscopes. Vibration-sensitive manufacturing or research will require detailed evaluation to define acceptable vibration levels. Ensuring lower vibration levels in a building often requires special design of the HVAC system and stiffened floors.

residential buildings with open lanais. Potential noise effects from transit park-and-ride lots and maintenance and storage facility operations were also identified.

Noise effects from the Project were determined by comparing the project-generated noise exposure level at each representative receptor in the corridor to the appropriate FTA criterion, given the land use and existing noise levels. If the project-generated noise is below the level for moderate impact, no impact will occur. If the noise level is between the level for moderate impact and severe impact, a moderate impact will occur. If the project noise level is equal to or above the severe impact level, a severe impact will occur.

Vibration effects from the Project were determined using the detailed vibration assessment information and procedures contained in the FTA's *Transit Noise and Vibration Impact Assessment* (FTA 2006a). FTA reference levels for a transit vehicle and FTA reference data on ground transmission of vibration energy were used to estimate vibration levels at distance from the fixed guideway.

4.10.2 Affected Environment

This section describes the noise survey used to establish baseline conditions. Ambient vibration levels were not measured as part of this study.

Ambient Noise Conditions in the Study Area

The measurement locations and existing sound levels are shown in Figures 4-53 through 4-56. These locations represent noise-sensitive land uses along the corridor.

Ambient Vibration Conditions in the Study Area

Ambient vibration levels were not measured as part of this study but are anticipated to be below perceptible levels.

4.10.3 Environmental Consequences and Mitigation

Environmental Consequences

No Build Alternative

Under the No Build Alternative, the Project would not be built and the only source of future noise levels would be traffic movements on local streets and highways. The Project would not generate any new noise impacts. Similarly, no new vibration sources would occur in the absence of the Project. Although the projects in the ORTP will be built, their environmental impacts will be studied in separate documents.

Project

Noise

The Project will include an integrated parapet wall at the edge of the guideway structure that extends 3 feet above the top of the rail.

Figures 4-53 through 4-56 show the measured existing noise level and future project noise exposure at each site. The data table included in these figures for each site is labeled "no impact" or "moderate impact" for each site. There will be three residential buildings that will experience adverse noise effects. No noise impacts will occur for schools, public parks, or historic resources as a result of the Project. There will be no noise impacts at the three sites located at the Arizona Memorial (Figure 4-55).

The Project will cause no severe noise impacts. Moderate impacts will occur at eight areas (Table 4-18). The moderate impacts to these eight areas will occur at the ground level for 50 residences and between the fifth and eleventh floors of four high-rise buildings.

The greatest noise source from the traction power substations will be air-conditioning equipment, which will not generate substantial noise impacts. Project park-and-ride lots will be located in undeveloped or commercial areas. The closest

Table 4-18 Noise Impacts

Area	Receptor Description	Buildings Affected	Level of Impact
West Loch to Waipahu Transit Center	94-340 Pupumomi Street	One 9-floor building	Moderate impact to 5th floor and above
West Loch to Waipahu Transit Center	Hanewai Circle	20 single-family residential	Moderate impact
Waipahu Transit Center to Leeward Community College	Awaiki Place	18 single-family residential	Moderate impact
Aloha Stadium to Pearl Harbor Naval Base	Betio Place	8 single-family residential	Moderate impact
Aloha Stadium to Pearl Harbor Naval Base	Makalapa Guest House	4 single-family residential	Moderate impact
Downtown to Civic Center	700 Richards Street	One 26-floor building	Moderate impact to 7th through 11th floors
Civic Center to Kaka`ako	860 Halekauwila	One 30-floor building	Moderate impact to 6th floor and above
Kaka`ako to Ala Moana Center	1133 Waimanu	One 28-floor building	Moderate impact to 5th through 9th floors

proximity from a park-and-ride lot to a residential use will be approximately 300 feet to the nearest point and more than 1,000 feet to the center of the park-and-ride site at Pearl Highlands.

Noise sources at the maintenance and storage facility will include trains operating and switching within the facility and maintenance and cleaning activities. These activities will occur over a 24-hour period. The preferred site option for the maintenance and storage facility is a 44-acre vacant site in Waipahu near Leeward Community College. Leeward Community College and Waipahu High School are both approximately 700 feet from the center of the Leeward Community College site. At this distance, the maintenance activities will not generate substantial noise impacts. There are no noise-sensitive uses near the alternative Hoʻopili maintenance site option.

Vibration

Vibration levels at adjacent properties will not exceed 65 VdB for the elevated rail transit. This level is less than the FTA criterion of 72 VdB for residential buildings and other structures where people normally sleep (Category 2). No land use along the alignment is identified as having vibration-sensitive equipment that will require the use of lower vibration impact criteria; therefore, no vibration effects are anticipated. No long-term vibration impacts will occur to historic resources.

Mitigation

Noise

Without mitigation, noise exposure levels at eight locations would exceed the noise impact criteria. Several measures are available to reduce noise levels during operation. Wheel skirts can reduce noise by as much as 10 dBA and track ballast by up to 5 dBA (FTA 2006).

For the Project, wheel skirts will reduce noise generated from the Project by 3 dBA or more. Wheel skirts have been added to the system specifications. As a result, noise exposure levels from the Project will be 3 dBA less than shown in Figures 4-53 through 4-56. Wheel skirts will reduce noise exposure levels to below the impact criteria at five of the eight locations where impacts are predicted (Table 4-19). With wheel skirts, three residential sites still will experience moderate noise impacts on the fifth through eleventh floors. The moderate noise impact that will occur at the high-rise buildings will only be experienced from units above track level on the fifth through ninth floors.

Figure 4-53 Noise Measurement Locations and Results (East Kapolei to Fort Weaver Road)

Figure 4-54 Noise Measurement Locations and Results (Fort Weaver Road to Aloha Stadium)

Figure 4-55 Noise Measurement Locations and Results (Aloha Stadium to Kalihi)

Figure 4-56 Noise Measurement Locations and Results (Kalihi to Ala Moana Center)

Table 4-19 Mitigated Noise Levels

Area	Receptor Description	Impact Criteria	Noise Level without Mitigation	Noise Level with Wheel Skirts	Noise Level with Wheel Skirts and Sound Absorptive Material
West Loch to Waipahu Transit Center	94-340 Pupumomi Street, 5th floor and above	66 dBA Ldn	**71 dBA Ldn**	**68 dBA Ldn**	65 dBA Ldn
West Loch to Waipahu Transit Center	Hanewai Circle	60 dBA Ldn	**60 dBA Ldn**	57 dBA Ldn	n/a
Waipahu Transit Center to Leeward Community College	Awaiki Place	58 dBA Ldn	**59 dBA Ldn**	56 dBA Ldn	n/a
Aloha Stadium to Pearl Harbor Naval Base	Betio Place	59 dBA Ldn	**59 dBA Ldn**	56 dBA Ldn	n/a
Aloha Stadium to Pearl Harbor Naval Base	Makalapa Guest House	59 dBA Ldn	**59 dBA Ldn**	56 dBA Ldn	n/a
Downtown to Civic Center	700 Richards Street, 7th through 11th floors	66 dBA Ldn	**67 dBA Ldn**	64 dBA Ldn	n/a
Civic Center to Kaka`ako	860 Halekauwila, 6th floor and above	66 dBA Ldn	**70 dBA Ldn**	**67 dBA Ldn**	64 dBA Ldn
Kaka`ako to Ala Moana Center	1133 Waimanu, 5th through 9th floors	66 dBA Ldn	**69 dBA Ldn**	**66 dBA Ldn**	63 dBA Ldn

Values in **BOLD** represent a noise impact
n/a – Not applicable, Sound Absorptive Material not proposed in this location.

The use of sound-absorptive materials under the tracks in these three areas will reduce the project noise exposure at upper floors to below the moderate noise impact threshold (Table 4-19). Eight hundred feet of sound-absorptive material will be installed from Pupukahi Street to Pupupuhi Street. For the building at 860 Halekauwila Street, sound-absorptive material will be required from 200 feet ‘Ewa of Kamani Street to 100 feet Koko Head of Kamani Street—a total of 300 feet. The building at 1133 Waimanu will require sound-absortive material to be installed between Kamakee Street and Waimanu Street for a total of 920 feet.

Once the Project is operating, noise measurements will be conducted at representative sites. Should the Project’s noise exposure exceed the FTA noise impact criteria, further mitigation may be conducted on the receivers with the authorization of the property owners.

Vibration

Because no vibration effects are projected, no mitigation is proposed.

4.11 Energy and Electric and Magnetic Fields

This section describes the energy required for operating the Project and analyzes electric and magnetic fields (EMF) as related to the Project’s operation. Energy used during the Project’s operation will include fuel consumed by buses, electricity used to power transit vehicles, and a negligible amount of energy for signals, lighting, and maintenance. For more information and references, see the *Honolulu High-Capacity Transit*

Corridor Project Electric and Magnetic Fields Technical Report (RTD 2008h).

EMFs are a result of the voltage or electric potential of an object. For this Project, the high-capacity transit system will be powered by electricity from a third line located next to the rail tracks. Whenever an electrical current flows, it creates a magnetic field. An analysis of EMFs is included in this Final EIS because of public concern about potential health effects and effects on equipment and machines adjacent to the corridor that may be sensitive to EMFs.

4.11.1 Background and Methodology

Energy

The analysis of operational energy consumption on Oʻahu was based on the transportation analysis prepared for the Project. Changes in overall transportation energy use for vehicles traveling on Oʻahu were assessed using daily VMT and speed values calculated from the transportation demand forecasting model.

The energy consumed by electrically powered transit operations for the high-capacity transit system was also considered. Fixed guideway high-capacity transit systems require energy for propulsion and to account for energy lost during transmission from the energy-generation site to the transit vehicles. The average energy consumption for a rail transit vehicle in the U.S. is 62,700 BTUs per vehicle-mile of service (USDOE 2007).

Electric and Magnetic Fields

EMFs are produced wherever wires distribute electric power and wherever electrical equipment is used. EMFs decrease with the square of distance away from operating equipment or away from current-carrying electric lines. Sensitive equipment that may be affected by changes to the Earth's geomagnetic field caused by operation of the Project may be located at research, manufacturing, medical, and possibly military facilities. Available data on high-voltage power lines, medical and diagnostic facilities, institutional and research facilities, and military operations were assembled. This information was confirmed through field reconnaissance to verify site locations and identify equipment that may be sensitive to the influence of EMFs associated with the Project.

Research into the health effects of EMFs has not established a link between EMFs and any health effects. National Academy of Sciences National Research Center findings "do not support the contention that the use of electricity poses a major unrecognized public-health danger" (NRC 1999). The International Commission on Non-Ionizing Radiation Protection also concluded that data related to cancer do not provide a basis for assessing the health risks of human exposure to power frequency fields (ICNIRP 1998), but it did establish a protective guideline of 830 milligauss magnetic field density for exposure to the general public.

4.11.2 Affected Environment

Energy

In 2006, 291 million gallons of gasoline were consumed on the Island of Oʻahu. Gasoline represents the largest segment of transportation energy consumption, closely followed by aviation fuel, then by diesel.

Transportation modeling results for 2007 show approximately 11.5 million daily VMT on Oʻahu. This results in a daily consumption of approximately 666,000 gallons of fuel with an energy content of 85,600 million BTUs (MBTU).

Electric and Magnetic Fields

Twenty locations were found during a field survey that are within 200 feet of the center line of the project alignment and which could have sensitive electronic equipment that could be affected by operation of the Project. The facility managers were contacted to determine whether sensitive electronic equipment is used, and all but one facility was

eliminated (Table 4-20). Honolulu Community College has an electron microscope that is approximately 200 feet from the alignment.

4.11.3 Environmental Consequences and Mitigation

Environmental Consequences

Energy

No Build Alternative

Transportation energy consumption for the No Build Alternative would include motor vehicle fuel consumption islandwide. This is estimated to be 94,890 MBTUs in 2030 (Table 4-21).

Project

The total transportation energy demand for transit and highway vehicles will be lower than for the No Build Alternative. Table 4-21 summarizes the anticipated average daily transportation demand in 2030 for the Project. The Project is anticipated to reduce daily transportation energy demand by approximately 3 percent compared to the No Build Alternative. The values in Table 4-21 changed since the Draft EIS as a result of revisions to travel demand model results.

The Project will consume approximately 1 to 2 percent of the total projected electricity generated on Oʻahu in 2030. According to HECO, the planned electricity generation capacity on Oʻahu will be sufficient to support the transit system, but the electricity distribution system will require various upgrades to support the system (HECO 2008).

Integration of photo-voltaic cells into stations and other project features could reduce net project electricity demand.

Electric and Magnetic Fields

No Build Alternative

There will be no features generating EMFs.

Project

The magnetic-field disturbance generated by operation of the Project will be low-frequency (0 to 10 hertz) and will occur at intervals determined by passing trains. EMFs produced by the Project will be of such low magnitude that the only potential effects will be to highly sensitive instruments that may be in use within facilities adjacent to the right-of-way. The electron microscope at Honolulu Community College is located approximately 200 feet from the alignment and will not be affected by the Project. A review of the state of the science regarding health effects associated with EMFs found no new evidence

Table 4-20 Location of Potential EMF Receptors within 200 Feet of the Project

Address	Building Name	Equipment	Category
874 Dillingham Boulevard	Honolulu Community College	Electron microscope	Institutional—university/research

Table 4-21 2030 Summary of Average Daily Transportation Energy Demand

Alternative	Roadway and Bus Energy Consumption (MBTUs)	Fixed Guideway Vehicle Energy Consumption (MBTUs)	Total Energy Consumption (MBTUs)	Percent Change from No Build
No Build	94,890	0	94,890	n/a
Project	90,760	1,690	92,450	-3%

MBTUs = million British thermal units

linking these fields to biological issues. Project-generated magnetic fields will be less than the International Commission on Non-Ionizing Radiation Protection guideline limit in areas where the public may be regularly exposed.

Because no negative health effects or effects on equipment related to EMFs will occur, mitigation will not be needed.

4.12 Hazardous Waste and Materials

This section analyzes potential contaminant sources that may be present in the study corridor. It also assesses the potential of encountering hazardous waste and chemically impacted soil and/or groundwater adjacent to the project alignment, as well as the Project's potential use of hazardous materials. For more information and references, see the *Honolulu High-Capacity Transit Corridor Project Hazardous Materials Technical Report* (RTD 2008i).

4.12.1 Background and Methodology

Regulatory Background

Many Federal and State laws regulate hazardous waste and materials. The primary Federal laws are the *Resource Conservation and Recovery Act of 1976* (USC 1976) and the *Comprehensive Environmental Response, Compensation and Liability Act of 1980* (CERCLA) (USC 1980). The *National Priority List* is a listing of the most polluted sites in the nation that are eligible for cleanup funding (Superfund) under CERCLA.

Hazardous waste in the City is primarily regulated by the Solid and Hazardous Waste Branch of HDOH. The Solid and Hazardous Waste Branch is responsible for overseeing the Office of Solid Waste Management, the Underground Storage Tank Program, and the Hazardous Waste Program. The HDOH Office of Hazard Evaluation and Emergency Response is responsible for implementing the *Hawai'i Environmental Response Law* (HRS 128D), the *State Contingency Plan* (HAR 11-451), and *the Hawai'i Emergency Planning and Community Right-to-Know Act* (HRS 128E).

Methodology

An Initial Site Assessment of the study corridor was conducted to identify potential hazardous waste areas. The following steps were performed during this assessment to establish existing conditions, evaluate potential impacts, and determine whether project-related activities have the potential to disturb, generate, use, and/or dispose of hazardous materials:

- Reviewed environmental database records to evaluate potential impacts to the Project. Environmental Database Resources, Inc., prepared a report for the Project on November 2, 2007 (EDR 2007). To generate this report, they conducted a search of all databases relevant to hazardous waste and materials operations in Hawai'i.
- Reviewed previous Honolulu transit project hazardous materials surveys.
- Coordinated with HDOH.
- Reviewed historical land uses using maps and historic aerial photos to identify any past business uses in the immediate project vicinity that could have a negative impact on the Project in terms of hazardous materials and wastes.
- Conducted field reconnaissance to identify land uses that may indicate the presence of hazardous materials or waste. Field reconnaissance was conducted from public access areas and within the study corridor, as feasible.
- Contacted owners of oil and fuel pipelines to establish pipeline locations. Preliminary information was obtained. Coordination with these owners will be ongoing throughout design and construction.

Potential mitigation measures to be employed during further design, planning, and construction

of the Project were developed based on the data collected and evaluations conducted.

4.12.2 Affected Environment

The study corridor is currently dominated by commercial and residential developments, with some areas of military activity and localized industrial activity. Information from the database search, field reconnaissance, and the review of historic maps and aerial photographs indicate a more industrial past for certain areas of the study corridor.

Past and present industrial activities along the study corridor are mostly agricultural, food processing, or warehousing. Contaminants associated with these uses are primarily petroleum hydrocarbons, such as gasoline, diesel, and oil. Other contaminants can include pesticides, herbicides, metals, and solvents, but solvents and metals are generally not used in bulk in agriculture, food processing, and warehousing.

Agricultural Uses

Specific areas of past industrial agricultural activity near the Project include the following:

- Former ʻEwa Sugar Mill
- Former Oʻahu Sugar Mill
- Former ʻAiea Sugar Mill
- Former Dole Pineapple Cannery

These industrial agricultural sites appear in the databases searched. However, these sites all ceased operations in the 1990s and were largely remediated and redeveloped in the late 1990s and early 2000s.

Industrial Uses

In some areas along the project alignment, current and historic land uses indicate a more industrial past than other areas, so they have a higher potential of harboring soil or groundwater contamination. These areas include the following:

- **Waipahu (West Loch)**—this neighborhood is dominated by gas stations and car dealerships along Farrington Highway, with warehouse and automobile repair businesses makai of Farrington Highway.
- **Airport Industrial Area**—this neighborhood is dominated by airport/airline support activities (tank farms and maintenance facilities), car dealerships, rental car agencies, warehouses, and light industrial activities.
- **Kapālama-Iwilei**—this area was dominated by the Dole Cannery and supporting businesses in the past but is increasingly becoming commercial. The former Kapālama Incinerator was located in the area along with a number of warehouse and light manufacturing businesses. Warehousing continues along Kapālama Canal.
- **Kakaʻako**—this neighborhood was once dominated by automobile dealerships and repair shops, warehouses, and light industry. However, it is becoming increasingly commercial and residential in character.

Military Uses

Military activities are also present within the study corridor and tend to have a broader array of associated pollutants. Pollutants included in the Pearl Harbor Naval Complex Superfund Record of Decision include petroleum, solvents (perchloroethylene and others), polychlorinated biphenyls, metals (mercury and chromium), and pesticides. Military bases and activities near the Project include the following:

- **Former Naval Air Station Barbers Point**—portions of which are still under the jurisdiction of the Navy, while other portions are now under the Hawaiʻi Community Development Agency's jurisdiction
- **Pearl Harbor Naval Complex**—an active Navy base on the National Priority List (Superfund); the complex formerly included the Navy Drum Site
- **Hickam Air Force Base**—an active Air Force base, but uses near the Project are primarily housing

- **Fort Shafter Flats**—an active military base, but the area near the Project is a relatively undeveloped floodplain

Petroleum Contaminants

Petroleum handling and transportation facilities are frequently associated with releases of oil or hazardous materials to the environment through leaks, spills, maintenance, and other activities. These facilities include gas stations, tank farms, large maintenance base yards, and pipelines and are considered potential sites of contaminants wherever they appear along the project right-of-way. Petroleum contaminants (e.g., gasoline and diesel fuels) have been shown to migrate less than 300 feet from their source once released into a subsurface environment similar to that found in the study corridor. Therefore, only petroleum releases approximately 300 feet from the Project are considered a concern.

A recent utility survey identified a number of petroleum pipelines in the study corridor. These pipelines are owned by a variety of firms, including the military, HECO, Chevron, and Tesoro. Pipeline locations include the following:

- Under Kapolei Parkway
- Along the Oʻahu Railway & Land Company (OR&L) right-of-way in Kapolei, Pearl City, Waimalu, and ʻAiea
- On the mauka side of Farrington Highway through Waipahu
- Under Kamehameha Highway from Pearl City to the airport
- Throughout the airport area, primarily on the makai side of Aolele Road
- Under Nimitz Highway to the HECO's downtown power plant

The fixed guideway will cross or run parallel to these pipelines in many areas of the study corridor. These pipelines have been in place for many years, and releases from them are possible.

Sites of Concern

Individual sites of concern were first identified during environmental database review, and their presence was verified and additional sites were identified during field reconnaissance. Sites of concern were ranked "1" or "2." A "1" ranking means there is a high probability that releases at the site have affected soil or groundwater beneath the Project. A "2" ranking means there is a low probability that releases at the site have impacted soil or groundwater beneath the Project, but further evaluation is needed based on proximity to the Project. The sites ranked "1" or "2" are summarized in Table 4-22. Sites that have been remediated or will not be of concern if the Project were built are identified in the Hazardous Materials Technical Report (RTD 2008i).

Examples of sites ranked "1" include the following:

- Pearl Harbor Naval Complex (a Superfund site)
- Leaking underground storage tank sites that have not been remediated and are within 300 feet of the project alignment

Examples of sites ranked "2" include the following:

- Sites adjacent to the Project that have been remediated (e.g., Pacific Machinery in Waipahu)
- Sites with large releases that are somewhat distant or downgradient from the Project (e.g., BHP Gas Company in Iwilei)
- Sites with institutional controls (e.g., where excavation is restricted due to the presence of contaminants) that are near the Project (e.g., Chuei Shokoh in Kakaʻako, a former dry cleaner)
- Sites observed to have limited hazardous materials issues (e.g., improper waste storage at Hi-Pace Racing in Kakaʻako)

The ground beneath any portion of the Project could be contaminated, most likely by petroleum products. Contamination is most likely to be

Table 4-22 Sites of Concern near the Project that Could Be Contaminated (continued on next page)

Site Name	TMK	Reason for Listing	Rank	Property Acquisition?
East Kapolei to Fort Weaver Road				
East Kapolei pesticide mixing and loading	91017088	Database	2	No
East Kapolei property	91017071, 91017088	Database	1	No
Fort Weaver Road to Leeward Community College				
Pacific Machinery	94048019	Database	2	No
Cutter Mitsubishi Dodge	94048068	Database	2	No
O`ahu Sugar Company Ltd.	94161005 & others	Database	2	No
Waipahu Auto Company	94019050	Database	2	Yes
Leeward Community College to Aloha Stadium				
Pearl Harbor Naval Station (PHNS)	94008010, 96003044, & others	Database	1	Yes
RHS Lee Baseyard (Banana Patch)	96004006	Field observations	1	Yes
Mid Pac Petroleum/ConocoPhillips	97031021	Database	1	No
HECO—Waiau Power Plant	98004003	Database	2	No
Steven's Super Service, Inc.	98018024	Database	1	No
Pearl Auto Service & Supply, Inc.	98010009	Database	1	No
Sears	98016029	Database	2	No
PHNS `Aiea Military Reservation	98019002, 99004004	Database	2	No
PHNS U.S. Navy Exchange `Aiea Laundry	99005005	Database	1	No
Aloha Stadium to Middle Street				
Pearl Harbor Naval Station (PHNS)	99001008	Database	1	No
PHNS Navy PWC—Makalapa Compound	11010011	Database	1	No
Honolulu International Airport	11003001	Database	1	Yes
Chevron USA Honolulu Airport Terminal	11003011	Database	1	Yes
Honolulu Fueling Corp.	11003010	Database and field observations	1	No
Delta Airlines	11003038	Database	1	No
Hawaiian Telecom Base Yard	11014018	Database	1	No
ALSCO-American Linen/Young Laundry & Drycleaning	11016025	Database	1	No
Middle Street to Nu`uanu Stream				
Middle Street Intermodal Center	12018009	Database	1	Yes
Foremost Dairies	12013006	Database	1	Yes
BHP Gasco	15012006	Database	2	No
Costco warehouse	15012017	Database	2	No
Costco gas station	15015002	Database	2	No
Sprint lot	15015013	Database	1	Yes
Cutter Dodge Auto Service Center	15015001	Database	1	Yes

Table 4-22 Sites of Concern near the Project that Could Be Contaminated (continued from previous page)

Site Name	TMK	Reason for Listing	Rank	Property Acquisition?
Honolulu Gas Products Ltd.	15007016	Database	1	Yes
G. Von Hamm Textiles	15007050	Database	1	No
Ka`aahi Site	15007031	Field observations	2	No
Iwilei Project Site	15007001	Database	1	Yes
Nu`uanu Stream to Ala Moana Center				
Pier 15	21001044	Field observations	2	No
Pier 13/14	21001047	Field observations	2	No
Aloha Tower Development	21001001	Database	2	No
Hawaiian Electric Company	21014006	Database	1	Yes
Melim Building	21026014	Database	1	No
Motor Imports Service Center	21031030	Field observations	2	Yes
Hi-Pace Racing	23007054	Field observations	2	Yes
Chuei Shokoh (former Young's Laundry)	21049065	Database	2	No
420 Ward (Pacific Home)	21050061	Database	2	No
Hakuyosha Hawai`i Inc.	23014011	Database	2	No
Cutter Chevrolet-Geo-Pontiac	23039011	Database	1	No

present in the historically more industrial neighborhoods and near individual sites ranked "1" or "2." In addition, the geology and hydrogeology of the Airport Industrial Area, Māpunapuna, Kapālama-Iwilei, and Kakaʻako areas make them particularly likely to harbor residual pollutants. In these areas there will be a greater likelihood that spilled chemicals will remain in the area and not readily migrate or degrade. Therefore, soil and groundwater in these neighborhoods is frequently found to be degraded by petroleum and other contaminants. The potential for contamination has been confirmed by other projects in the industrial areas.

The Navy Drum site, inactive since the early 1970s, is the preferred location for the maintenance and storage facility near Leeward Community College. In 1971, vandals started a fuel pump, which resulted in the release of motor gasoline to the ground surface. A remedial investigation was completed at the Navy Drum property by the Department of Navy in 2000 (Navy 2000). The investigation concluded that contaminants from the property have not and will not migrate to the deep freshwater aquifer or the artesian well water supply for the watercress ponds. There are no adverse human health or ecological effects that have, or will, result from the 1971 motor gasoline release. The U.S. Department of Health & Human Services and HDOH reviewed the study, concur with the findings, and consider the case closed. (DHHS 2005).

4.12.3 Environmental Consequences and Mitigation

Environmental Consequences

No Build Alternative

Under the No Build Alternative, the Project would not be built, and there would be no impacts associated with hazardous materials. It is assumed that the projects defined in the ORTP will be built,

and environmental impacts associated with those projects will be studied in separate documents.

Project

In some locations, large or specialized hazardous wastes or materials sites may be acquired for needed right-of-way for the Project. Large or specialized hazardous wastes and materials include underground and above-ground storage tanks (UST and AST), fuel islands, and engineered storage facilities.

In a few cases, the Project may displace hazardous materials operations. This includes relocating gas station fuel islands and USTs and ASTs. Table 4-23 lists sites from which right-of-way will be acquired where the Project will result in potential impacts to ongoing hazardous materials operations.

The operation and maintenance of a fixed guideway transit system will require using some hazardous materials and may generate hazardous waste. Likely hazardous materials include the following:

- Lubricants (both grease and oils) of various weights and viscosities
- Hydraulic fluid for transit vehicles and servicing equipment
- Cleaning products for maintaining equipment, cleaning electronic components and vehicles, and removing graffiti—cleaning solutions can range from acids to alkaline to petroleum-based solvents

Wastes (beyond standard office-type) that will require disposal or recycling could include the following:

- Used oil (not hazardous)
- Cleaning product waste (typically recycled through closed systems)
- Vehicle components that wear out or break, including fluorescent light tubes
- Sediment from vehicle washing

Most of these materials and wastes will be used or generated at the maintenance and storage facility. However, limited use of hazardous materials will be necessary to maintain the guideway, stations, and traction power substations.

Releases at sites ranked "1" or "2" (summarized in Table 4-22), petroleum pipelines, and in industrial areas may have resulted in contaminated soil and/or groundwater beneath the Project. The presence of contaminants will affect project construction. Effects during construction and related mitigation are discussed in Section 4.18.7.

Table 4-23 Sites Where Hazardous Materials Are Used or Stored that Will Be Acquired

Site #	Site Name	Tax Map Key	Address	Type of Right-of-Way Acquisition	Potential Long-term Consequences
1	7-11/Aloha Petroleum	97022006	897 Kamehameha Highway	Partial acquisition	Fuel island is very close to street and may need to be relocated
2	Fuji's Chevron Gas Station	98014012	98-121 Kamehameha Highway	Partial acquisition	One fuel island and USTs are close to street and may need to be relocated
3	7-11/Aloha Petroleum	12010068	1900 Dillingham Boulevard	Full acquisition	Fuel island and USTs affected
4	Motor Imports Service Center	21031030	607 South Street	Partial acquisition	Auto maintenance building and oil AST in acquisition area
5	Hi-Pace Racing	23007054	500 Pi`ikoi Place	Full acquisition	Full acquisition, including drum storage area

Mitigation

Some properties that will be acquired to obtain required right-of-way for the Project received a rank of "1" or "2" during the Initial Site Assessment (Table 4-22) and, therefore, may be polluted. Either a partial or complete Phase I Environmental Site Assessment (ESA) will be performed by the City prior to acquiring portions of these properties. to lessen the chance that the City will acquire a degraded piece of real estate or that workers will be exposed to contaminants during construction. ESAs will also be performed for those sites listed in Table 4-23. ESAs will be conducted per the ASTM International's *Standard Practice for Environmental Site Assessments—Phase I Environmental Site Assessments Process (E1527-05)* (ASTM 2005). Depending on the outcome of the Phase I ESAs, a Phase II assessment (including collecting and analyzing samples) may be appropriate. The City will decide whether a partial or complete Phase I ESA is necessary for each property prior to acquisition. If contaminated materials are identified, the property will be remediated in accordance with Federal, State, and Local regulations. Responsibility for the hazardous material clean up and disposal rests with the responsible party with the title claim. The City will coordinate with the HDOT Hazard Evaluation and Environmental Response Office regarding work within HDOT rights-of-way.

The use of hazardous materials for the fixed guideway system's operation and maintenance will be unavoidable. However, the volume of materials used and extent of worker exposure will be limited in the following ways:

- Comply with State and Federal health and safety regulations
- Use non-hazardous alternatives where possible
- Use closed systems designed to limit exposure
- Train employees in the safe use and management of hazardous materials
- Institute waste minimization programs to limit the volume and type of materials used and resulting wastes
- Provide appropriate waste storage locations and receptacles
- Periodically evaluate wastes to establish whether they are hazardous
- Recycle wastes to the maximum extent practicable

4.13 Ecosystems

This section describes vegetation and wildlife within the study corridor. The assessment of vegetation and wildlife was made by reviewing existing studies, consulting with resource agencies, and conducting field surveys. Emphasis was placed on the potential presence of Federal- and/or State-protected species and sensitive habitats. For more information and references, see the *Honolulu High-Capacity Transit Corridor Project Ecosystems and Natural Resources Technical Report* (RTD 2008j).

4.13.1 Background and Methodology

Regulatory Context

Threatened and Endangered Species Regulations

Section 7 of the Endangered Species Act of 1973, as amended (7 USC 136; 16 USC 1531 et seq.), requires Federal agencies to consider impacts on endangered or threatened species and these species' critical habitat. It requires that Federal agencies consult with USFWS and/or the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA/NMFS), depending on whether terrestrial or marine species may be affected. If effects on protected species are identified, a Biological Assessment (BA) will be required to address a project's effects on a listed or candidate species or on the destruction or adverse modification of designated critical habitat. Subsequently, the USFWS will issue a Biological Opinion (40 CFR 402).

The State of Hawai'i's counterpart law is HRS 195D, under which species are similarly protected under state law. HRS 195D stipulates that where there may be an incidental take of a listed species, a Habitat Conservation Plan (HCP) must be "designed to result in an overall net gain in the recovery of Hawai'i's threatened and endangered species."

Migratory Bird Treaty Act

The Federal Migratory Bird Treaty Act (MBTA) (16 USC 703-711) protects migratory birds listed in the MBTA by prohibiting the taking of any listed bird, or any part, nest, or egg of any such bird. *Take* is defined as an attempt to "pursue, hunt, shoot, capture, collect, or kill." This act applies to all persons and organizations in the U.S., including Federal and State agencies. The USFWS administers the MBTA, and protection of listed migratory birds is delegated to USFWS staff handling Endangered Species Act Section 7. Regulation of unlisted migratory birds is delegated to the USFWS Migratory Bird Division.

Marine Mammal Protection Act

The Marine Mammal Protection Act of 1972 (MMPA) (16 USC 1361-1407) protects marine mammals listed in the act by prohibiting the taking of them in waters of the U.S. and by U.S. citizens on the high seas, as well as importing marine mammals and marine mammal products into the U.S. *Take,* as defined by Congress, is "to harass, hunt, capture, or kill or attempt to harass, hunt, capture, or kill any marine mammal."

Coordination with State and Federal Agencies

Early correspondence with regulatory agencies is included in the Ecosystems and Natural Resources Technical Report (RTD 2008j). Correspondence letters and USFWS species list are included in Appendix F of this Final EIS.

Agencies consulted have indicated no designated critical habitats exist on or within one-third mile of the project alignment. However, the agencies did mention that the species listed in Table 4-24 may be present in the study corridor. Since the publication of the Draft EIS, the City and FTA have continued to consult with USFWS. A meeting was held with the USFWS, the DLNR, and the Division of Forestry and Wildlife on January 8, 2009. At the meeting, the USFWS indicated that the Project would have no effect on federally listed species or critical habitat areas. Subsequent to that meeting, USFWS indicated no further consultation is required. FTA requested further concurrence from USFWS that the Project will have "no effect" on listed species or critical habitat (Appendix F).

Methodology

Literature Review

Previous studies, pertinent literature, and USFWS Critical Habitat maps for O'ahu within the study corridor were reviewed prior to undertaking the field surveys. Topographic maps and aerial photographs were examined to assess terrain and habitat characteristics, access, boundaries, and reference points. The Hawai'i Biodiversity and Mapping Program (HBMP) also provided a database of Federal- and State-protected species (plants and animals) previously observed within one-quarter mile of the project alignment.

The review affirmed that field surveys should focus on assessing the likely presence of the species listed by the agencies (Table 4-24).

Field Surveys

Field surveys were performed for flora in the undeveloped 'Ewa Plain as well as for birds along the entire project alignment. A field survey was not performed for marine mammals and marine turtles because the Project will not approach or directly affect a marine habitat. Surveys of other aquatic environments (estuaries, streams, wetlands, and canals) were undertaken as part of the effort to define impacts on aquatic resources in Section 4.14.

Table 4-24 Threatened, Endangered, and Protected Species Evaluated along the Study Corridor

Common Name	Scientific Name	Status	Identified by	Observed during Survey
Endangered Flora				
Ko`oloa`ula or red `ilima	*Abutilon menziesii*	Endangered (S,F)	USFWS and DLNR-DOFAW	No
`Ewa hinahina	*Achyranthes splendens spp. rotundata*	Endangered (S,F)	DLNR-DOFAW	No
Skottsberg's broomspurge	*Chamaesyce skottsbergii*	Endangered (S,F)	DLNR-DOFAW	No
`Awīwī	*Centaurium sebaeoides*	Endangered (S,F)	HBMP, Bishop Museum website	No
`Ihi`ihi	*Marsilea villosa*	Endangered (S,F)	The *Recovery Plan for Marsilea Villosa* (USFWS 1996)	No
Endangered Terrestrial Fauna				
`Ōpe`ape`a or Hawaiian hoary bat	*Lasiurus cinereus semotus*	Endangered (S,F)	USFWS	No
O`ahu `elepaio	*Chasiempis sandwichensis ibidis*	Endangered (S,F)	Vanderwerf 2001; and others	No
Hawaiian common moorhen or `alae`ula	*Gallinula chloropus sandvicensis*	Endangered (S,F)	USFWS	No
Hawaiian coot or `alae ke`oke`o	*Fulica americana alai*	Endangered (S,F)	*Draft Revised Recovery Plan for Hawaiian Waterbirds, Second Draft of Second Revision* (USFWS 2005b); and others	No
Hawaiian duck or koloa maoli	*Anas wyvilliana*	Endangered (S,F)	*Draft Revised Recovery Plan for Hawaiian Waterbirds, Second Draft of Second Revision* (USFWS 2005b); and others	No
Hawaiian stilt or ae`o	*Himantopus mexicanus*	Endangered (S,F)	*Draft Revised Recovery Plan for Hawaiian Waterbirds, Second Draft of Second Revision* (USFWS 2005b); and others	Yes
Protected Migratory Waterbirds				
Pacific golden-plover	*Pluvialis fulva*	MBTA Protected	*Draft Revised Recovery Plan for Hawaiian Waterbirds* (USFWS 2005a); and others	Yes
Black-crowned night heron	*Nycticorax nycticorax hoactii*	MBTA Protected	*Draft Revised Recovery Plan for Hawaiian Waterbirds* (USFWS 2005a); and others	Yes
Ruddy turnstone	*Arenaria interpres*	MBTA Protected	*Draft Revised Recovery Plan for Hawaiian Waterbirds* (USFWS 2005a); and others	Yes
Wandering tattler	*Heteroscelus incanus*	MBTA Protected	*Draft Revised Recovery Plan for Hawaiian Waterbirds* (USFWS 2005a); and others	Yes
State Threatened and Endangered Terrestrial Fauna				
Pueo	*Asio flammeus sandwichensis*	Endangered (S)	Various	No
Newell's shearwater	*Puffinus auricularis newelli*	Threatened (S)	Various	No
White tern	*Gygis alba*	Threatened (S)	Miles 1986; Vanderwerf 2003	Yes

F = Federal; S = State

MBTA = Migratory Bird Treaty Act

Flora Survey of Undeveloped 'Ewa Plain

Field surveys of the flora and vegetation present in the undeveloped 'Ewa Plain portion of the project alignment were completed in September 2007 and January 2008. In areas along the study corridor where rare or endangered species were previously reported, an intensive survey was conducted to establish whether these species populations still remained. Encountered populations were photographed and mapped.

Wildlife Survey along the Alignment

Wildlife field surveys and observations along the project alignment were conducted in September 2007, and bird point counts were conducted from December 2007 to January 2008. The point count involved identifying and recording the number of birds seen and heard at all distances from the point-count stations for a period of eight minutes. The Ecosystems and Natural Resources Technical Report (RTD 2008j) documents the results of this survey. Point counts were performed at locations approximately 1 mile apart along the project alignment, except from Kalihi to UH Mānoa and Waikīkī, where point count stations were spaced every one-half mile to improve the possibility of detecting the State-listed white tern. Counts were also performed at the following locations:

- The makai perimeter of the proposed maintenance and storage facility adjacent to Leeward Community College—this bird point-count site was selected because of the proximity of the site to waterbird habitat in and near Pearl Harbor.
- A stand of ironwoods *(Causaurina equisetefolia)* along the southern edge of Kapiʻolani Park—this bird point-count site was selected because it historically has been an area of known concentrations of white terns in Waikīkī and could be used as a reference site to gauge the level of nesting activity in the population on Oʻahu.

4.13.2 Affected Environment

A distinctive feature of Oʻahu's geomorphology is the broad coastal plain that extends from 'Ewa and Kalaeloa across Pearl Harbor to Diamond Head. It is composed of raised coralline limestone and has natural harbors, a dry leeward climate, and abundant freshwater streams with headwaters in the Koʻolau and Waiʻanae Mountain Ranges. Upland perennial streams are sustained by groundwater from high-level aquifers and, on the coastal plain, perennial flow may be supplemented by springs. Where groundwater is not contributing in a drainage basin, streams exhibit intermittent flow, responding to rainfall and runoff; this pattern is particularly prevalent in the 'Ewa and Kapolei areas. Freshwater streams that enter the marine coastal waters create estuaries at stream mouths and in embayments, such as Pearl Harbor, where nutrients carried by the stream stimulate productivity.

The past century of urbanization on Oʻahu, especially within the areas along much of the project alignment, has resulted in a highly altered environment, and this is reflected in the present state of the vegetation. No intact native vegetation communities remain within the study corridor, and few native plant species are extant near the alignment. The 'Ewa Plain is an area where relatively undeveloped land is present in the study corridor, and vegetation in this area was found to consist of the following:

- Ruderal (weedy) patches in undeveloped areas or abandoned properties
- Plants in abandoned agricultural areas, such as the area makai of the H-1 Freeway near Kapolei
- Plantings in areas reserved for cultivation and diversified agriculture

Beyond the open agriculture (and abandoned agriculture) fields of the 'Ewa Plain, a few relatively undeveloped properties exist where the vegetation present is non-maintained landscaping or ruderal

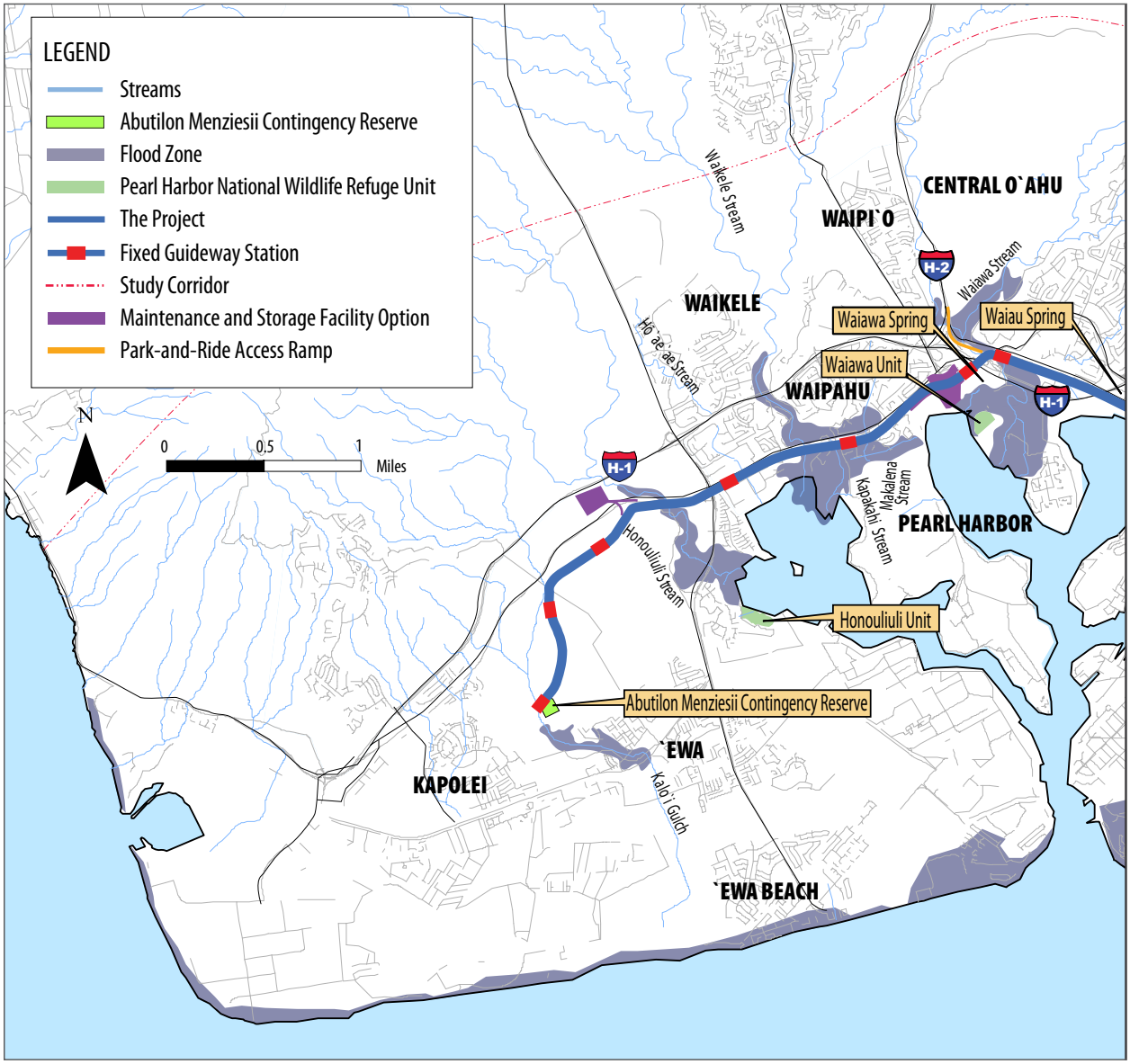

Figure 4-57 Natural Resources (East Kapolei to Aloha Stadium)

weeds growing on highly disturbed sites. Street trees, the most common ecological element of the maintained urban landscape, are discussed in Section 4.15. The less developed areas are illustrated on Figures 4-57 and 4-58 and include the following:

- Pearl Harbor National Wildlife Refuge, Waiawa and Honouliuli Units
- Waiawa Stream in the area of the Project's Pearl Highlands Station
- Waiau Springs, which is currently used for subsistence farming and gardening
- Kalauao Springs, which is occupied by the Sumida Watercress Farm

Table 4-24 lists threatened, endangered, and protected species and indicates whether the species were observed during surveys performed for this Project.

Endangered Flora

Koʻoloaʻula *(Abutilon menziesii)* (Figure 4-59), an endemic plant species, was not observed during the field surveys; however, the Project is known to

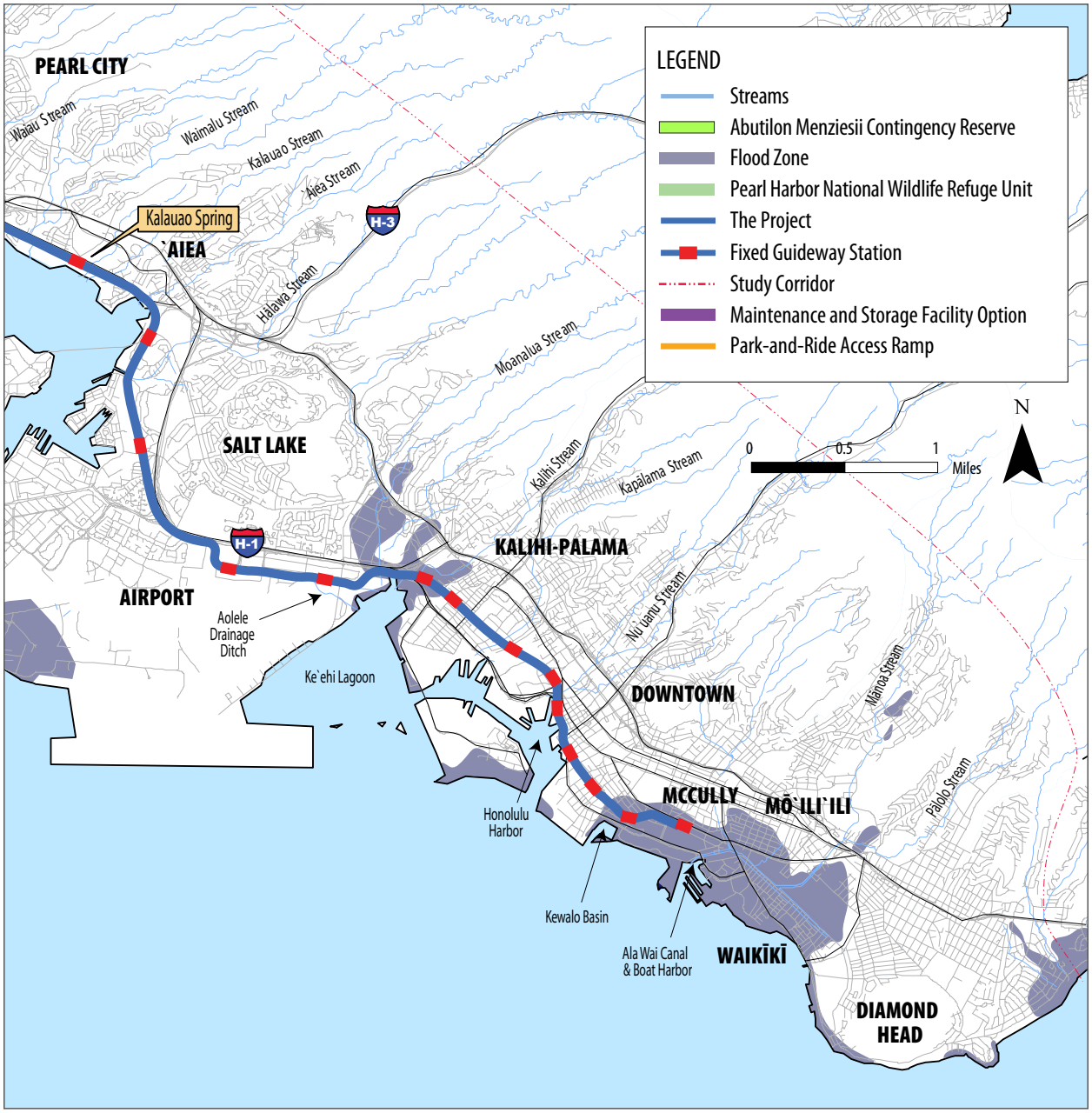

Figure 4-58 Natural Resources (Aloha Stadium to Ala Moana Center)

be in close proximity to extant plant clusters and within approximately 200 feet of the northern edge of an established contingency reserve (Figure 4-57). Koʻoloaʻula is an endangered Hawaiian hibiscus that grows in dryland forests. An HCP that addresses potential effects on the Koʻoloaʻula population near the corner of North-South Road and Kapolei Parkway is already in place (HDOT 2004). This HCP is being incrementally phased in over a 20-year period. The HCP describes impacts that assume the population will be incrementally taken as development along North-South Road is implemented.

The ʻEwa hinahina, Skottsberg's spurge, ʻawīwī, and ʻihiʻihi are plants that grow in dryland areas and could be present in the study corridor. They have been reported from the ʻEwa Plain in the past, but

Figure 4-59 Ko`oloa`ula

were not observed near the project alignment. There are no HCPs related to any of these species.

- The ʻEwa hinahina *(Achyranthes splendens spp. rotundata)*, a small shrub, is typically found on talus or rocky slopes and on coralline plains with numerous sinkholes. The project alignment generally traverses farmed or relatively developed areas rather than talus or rocky slopes and is further inland than known populations of this plant on the ʻEwa Plain.
- Skottsberg's spurge or ʻakoko *(Chamaesyce skottsbergii)*, a small shrub, is generally found closer to the coast in drier and sandier areas than the project alignment.
- ʻAwīwī *(Centaurium sebaeoides)*, a small herb, is thought to be extinct on Oʻahu. It is generally found on rocky slopes near the coast.
- ʻIhiʻihi *(Marsilea villosa),* a small fern resembling a four-leaf clover, requires periodic flooding for spore release and fertilization, followed by a decrease in water levels for the young plants to establish. It typically occurs in shallow depressions in clay soil or lithified sand dunes overlaid with alluvial clay. This plant is known to occur in areas of Kalaeloa that meet these criteria; however, it does not occur in the more developed portion of Kalaeloa where the project alignment is planned.

Endangered Terrestrial Fauna

A number of endangered terrestrial fauna species are potentially present in the study corridor (birds and fresh/brackish water dwellers). Following is a discussion of these species:

- ʻŌpeʻapeʻa, or the Hawaiian hoary bat (*Lasiurus cinereus semotus),* was not observed during the project survey. Bats have been observed on Oʻahu according to the HBMP; however, the USFWS indicated that those reported sightings were "likely incidental occurrences of transient individuals." The *Recovery Plan for the Hawaiian Hoary Bat* (USFWS 1998) indicates that the species is a medium-sized, nocturnal, insectivorous bat most often observed in open areas and river mouths near wet forests on the Islands of Kauaʻi and Hawaiʻi.
- Oʻahu ʻelepaio *(Chasiempis sandwichensis ibidis)* is a monarch flycatcher endemic to the forests on Oʻahu and was not observed during the Project's biological survey. Recovery of the Oʻahu ʻelepaio is provided for in the *Revised Recovery Plan for Hawaiian Forest Birds* (USFWS 2006), which indicates there are approximately 2,000 individuals of this species in the wild. The recovery area illustrated in the plan for the Oʻahu ʻelepaio is located well mauka of the project alignment.
- Four waterbirds are listed as endangered—the Hawaiian common moorhen, the Hawaiian coot, the Hawaiian duck, and the Hawaiian stilt. These four species are generally restricted to wetlands (and stream and estuarine areas in some cases) but will visit temporarily flooded areas. Environments in the study corridor where some or all of these species have been observed previously include Pearl Harbor National Wildlife Refuge, Waiau Springs, and Kalauao Springs (Sumida Watercress Farm). The *Draft Revised Recovery Plan for Hawaiian Waterbirds* (USFWS 2005a) provides for these four species and indicates that the only core habitat on the southern coast of Oʻahu is the Pearl Harbor National Wildlife Refuge. The plan lists no supporting habitat on the southern coast of Oʻahu. Observations of these endangered waterbirds

during the project survey were limited to the following:

- A pair of ducks was observed at a distance flying over agricultural fields along North-South Road. Since wild ducks on Oʻahu are either mallards or mallard/koloa hybrids, these were not the endangered species *Anas wyvilliana.*
- Five Hawaiian stilts *(Himantopus mexicanus)* were observed at Kalauao Springs (Sumida Watercress Farm) during the survey.

Protected Migratory Waterbirds

Four protected "migratory" waterbirds were observed during the project survey. The MBTA protects these species, although they are not listed as threatened or endangered. The four species are as follows:

- The Pacific golden-plover *(Pluvialis fulva)* breeds on the Arctic tundra in the summer and spends the winter primarily in South Asia and Australia with a few in California and Hawaiʻi. Twenty-seven Pacific golden-plovers were observed in count stations during the survey.
- Black-crowned night heron *(Nycticorax nycticorax hoactii)* is an indigenous species common throughout the world. Individuals were observed during the project survey at the Kalauao Springs (Sumida Watercress Farm), Moanalua Stream, and the drainage channel along Aolele Street. Local colonies are known to roost and nest in mangrove trees within Pearl Harbor and Keʻehi Lagoon; however, nests have not been observed in the mangroves along the east bank of Moanalua Stream.
- Ruddy turnstone *(Arenaria interpres)* is a sandpiper that breeds in the northern parts of Eurasia and North America during the summer and winters on coastlines almost worldwide, including Hawaiʻi. Six individuals were observed at Kalauao Springs (Sumida Watercress Farm) during the survey.
- Wandering tattler *(Heteroscelus incanus)* spend summer and breed in Alaska and northwestern Canada; in winter they are found on rocky islands in the Southwest Pacific, including Hawaiʻi, and on rocky Pacific coasts from California to South America and as far as Australia. They feed on aquatic invertebrates. One wandering tattler was observed at Kalauao Springs (Sumida Watercress Farm) during the survey.

State Threatened and Endangered Terrestrial Fauna

The following three species may be present in the study corridor that are designated as threatened or endangered by the State of Hawaiʻi:

- Pueo *(Asio flammeus sandwichensis)* is a subspecies of short-eared owl endemic to Hawaiʻi that nests on the ground. Its habitat includes wet and dry forests on all the Hawaiian Islands. The Pueo has been observed on the ʻEwa Plain, but it is in decline due to habitat loss and was not observed during the survey. There are no recovery plans or designated critical habitat for the Pueo.
- Newell's shearwater *(Puffinus auricularis newelli)* is endemic to the Hawaiian Islands and nests in burrows dug in forested uplands. It is listed as threatened by USFWS. No nesting colonies have been found on Oʻahu (Ainley 1997). Small numbers of fledgling Newell's shearwater have been recovered on Oʻahu following downing incidents and were probably individuals that were attracted to shore from elsewhere by coastal lights (Ainley 1997). No Newell's shearwater were observed during the survey.
- White tern *(Gygis alba)* (Figure 4-60), also known as fairy tern, could only be observed with regularity in the Northwestern Hawaiian Islands prior to the 1960s. Their establishment on Oʻahu may be a result of crowded conditions elsewhere, which

have forced the birds to search for other roosting and nesting locations (Miles 1986; Vanderwerf 2003). The white tern is Honolulu's official bird and is currently found only along the southeastern coast of Oʻahu, where they breed and roost exclusively in large trees. White terns lay their eggs on bare branches in a small fork or depression, without a nest. The peak nesting period is from February through July. Nine white terns were observed during the project survey, all between Middle Street and UH Mānoa.

Threatened, Endangered, and Protected Marine Fauna

With the exception of an outfall to Pearl Harbor from the maintenance and storage facility, the nearest marine environment is approximately one-quarter mile from the Project, which is beyond the area that will be affected by the Project.

Figure 4-60 White Tern

4.13.3 Environmental Consequences and Mitigation

Environmental Consequences

No Build Alternative

Under the No Build Alternative, the Project would not be constructed and would not have any impacts to natural ecosystems. Although it is assumed that the projects in the ORTP will be built, their environmental impacts will be studied and documented in separate environmental documents.

The Project

The Project will result in fewer VMT; therefore, the overall pollutant load in stormwater will be lower than it will be under the No Build Alternative and there will be less threat of surface and marine water contamination. The Project will rely on electric propulsion, which will generate minimal pollutants on the guideway compared to pollutants generated by roadway traffic. This improvement in water quality could benefit downstream environments, including nearby wetlands, streams, and the Pacific Ocean.

As summarized in Table 4-25, the Project will have no effect on any threatened, endangered, or protected species as described in the following sections.

Endangered Flora

The Project will have no effect on endangered flora. The only endangered plant known in the study corridor is koʻoloaʻula *(Abutilon menziesii)*. The presence of this species has previously been documented, and HDOT addressed potential effects on the koʻoloaʻula in the study corridor in an

Table 4-25 Summary of the Project's Effects on Threatened, Endangered, and Protected Species

Endangered Flora	Endangered Terrestrial Fauna	Protected Migratory Waterbirds	State Threatened and Endangered Terrestrial Fauna	Threatened, Endangered, and Protected Marine Fauna
No effect, with mitigation for ko`oloa`ula	No effect	No effect	No effect	No effect

HCP prepared for the North-South Road Project in 2004. Mitigation measures are specified in the HCP related to the construction of a variety of developments in the area. Therefore, the Project will not have an impact on the koʻoloaʻula.

Endangered Terrestrial Fauna

The Project will have no effects on endangered terrestrial fauna. The Project will not affect the hoary bat or the Oʻahu ʻelepaio because neither of these species occur in the study corridor.

The Project will not impact any designated critical, core, or supporting habitat for any listed terrestrial fauna species. The nearest such habitat is the Pearl Harbor National Wildlife Refuge Waiawa Unit (Figure 4-57), which is designated as core habitat for the four endangered waterbirds. The Waiawa Unit is more than 1,000 feet southeast of the preferred maintenance and storage facility option location. As stated in Section 4.14, the Project will not affect other wetlands where the listed waterbirds have been observed, such as Waiau Stream and Kalauao Springs (Sumida Watercress Farm).

Based on the information provided to FTA by USFWS, coordination with USFWS staff, and field observations, there will be "no effect" to threatened and endangered species or designated critical habitat related to this Project. While some of the listed waterbirds have been observed adjacent to the study corridor, over time, the waterbirds will adjust to new structures built for the Project since the wetlands will not be impacted. These waterbirds have continued to occupy the wetlands despite the construction of nearby buildings and overhead utilities and the construction or widening of adjacent roads and highways. For example, water birds continue to use Sumida Watercress Farm although the wetland is now surrounded by Pearlridge Center.

Protected Migratory Waterbirds

The Project will not result in the taking of any protected migratory birds. The black-crowned night heron is known to nest in mangrove stands in Pearl Harbor and Keʻehi Lagoon, which are generally remote from the study corridor. Mangrove stands in these areas are being removed because the mangrove is regarded as an invasive plant species.

State Threatened and Endangered Terrestrial Fauna

The Project will have no effect on state threatened or endangered terrestrial fauna. The only state threatened or endangered species that is present in the study corridor is the white tern, and none of the species have critical habitat in the area. As explained in Section 4.15, some large street trees along the project alignment will require pruning or removal. White terns select the largest high canopy trees for roosting and nesting. The pruning and removal of these trees are not expected to affect the white tern population because there are numerous other large canopy trees in the urban area of Honolulu that will not be affected by the Project and that could be used by the white terns.

Mitigation

Although the Project will have no effect on threatened, endangered, and protected species, mitigation will be implemented for the koʻoloaʻula.

A State Incidental Take License for koʻoloaʻula was issued on March 18, 2005, to the HDOT. The City will secure a Certificate of Inclusion from the State for the Project. Mitigation measures have already been specified in an HCP for this population of koʻoloaʻula, including the establishment of an 18-acre contingency reserve for the plants. Specific measures to protect and offset losses of the koʻoloaʻula have been established by the USFWS in the existing HCP. If an HCP is needed, or if the existing HCP needs to be amended, the City will implement the measures outlined by the USFWS in the new or amended HCP. This will offset impacts

to the plant, and there will be no unavoidable adverse environmental effect to the koʻoloaʻula.

4.14 Water

This section identifies water resources in the study corridor, including surface waters, wetland resources, marine waters, flood zones, stormwater, groundwater, and coastal zone management (CZM) areas. It addresses the potential effects of implementing the Project on these resources and presents mitigation measures that will be incorporated into the Project. For more information and references, see the *Honolulu High-Capacity Transit Corridor Project Water Resources Technical Report* (RTD 2008k), the *Honolulu High-Capacity Transit Corridor Project Wetland and Waters of the U.S. Study* (RTD 2009b), and the *Honolulu High-Capacity Transit Corridor Project Ecosystem Function and Values of Wetland Waters of the U.S.* (RTD 2009h).

4.14.1 Background and Methodology

A number of water resources are located in the study corridor. They are regulated by a variety of Federal and State programs summarized below.

Regulatory Context

Surface Waters

The USACE is authorized to regulate certain activities in the Nation's waters pursuant to Section 404 of the Clean Water Act (CWA) (USC 1972b) and Section 10 of the Rivers and Harbors Act of 1899 (USC 1899). Section 404 of the CWA regulates the discharge of dredged or fill material into waters of the U.S., including:

- Traditional navigable waters (TNW) and their adjacent wetlands
- Relatively permanent non-navigable tributaries of traditional navigable waters (RPW) and wetlands with a continuous surface connection with such tributaries
- Intermittent or non-permanent wetlands and tributaries of waters of the U.S. that can materially impact downstream (biological, chemical, or physical) ecology.

A "traditional navigable water" includes all of the navigable waters of the United States, defined in 33 CFR 329, and by numerous decisions of the Federal courts, plus all other waters that are navigable-in-fact. Section 502(7) of the CWA defines the term *navigable waters* as "the waters of the United States, including the territorial seas."

Section 10 of the Rivers and Harbors Act of 1899 requires authorization for the construction of any structure in or over a navigable water of the U.S. Structures or work that occurs outside the defined limits for navigable waters of the U.S. require a Section 10 permit if the structure or work affects the water body's course, location, or condition.

Waters subject to tidal influence and non-tidal streams that carry commercial traffic are generally defined as navigable by the U.S. Coast Guard. The Coast Guard's authority comes from Section 9 of the Rivers and Harbors Act of 1899 (USC 1899), the Act of March 23, 1906 (USC 1906), and the General Bridge Act of 1946 (USC 1946). New bridges or causeways, and the reconstruction or modification of existing bridges and causeways, require a Coast Guard bridge permit to protect the right of navigation. Project structures that will cross navigable waterways have been identified, and consultation with the Coast Guard was undertaken.

Under Section 401 of the CWA, the need for a Section 404 permit from the USACE triggers the need for a Section 401 Water Quality Certification. The objective of Section 401 is to ensure that CWA, Section 404, and all other federally permitted activities will not adversely impact existing uses, designated uses, and applicable water quality criteria of the receiving waters. In Hawaiʻi, the

Clean Water Branch of HDOH issues the Water Quality Certification.

The State of Hawai'i's general policy is to maintain or improve existing water quality in all State waters. Streams that are not expected to meet State water quality standards, even after application of technology-based effluent limitations, are included in the 303(d) List of Impaired Waters (HDOH 2008). HDOH has completed or is in the process of developing waste load allocations and total maximum daily loads (TMDL) for these waters.

Coastal areas and embayments can be listed by the HDOH as "Water Quality-Limited Segments," as required by the CWA Section 305(b) and defined by 40 CFR 130.8. These segments are water bodies with pollutants in excess of established water quality standards, such that they cannot reasonably be expected to attain or maintain State water quality standards without additional action to control sources of pollution.

Alterations to stream channels are regulated by the State of Hawai'i Commission on Water Resource Management (Water Commission) through a Stream Channel Alteration Permit.

Wetlands

Under Section 404 of the CWA, the discharge of dredged or fill materials into "waters of the U.S.," as defined by 33 CFR 328, triggers the need for a permit from the USACE. Wetlands, as defined by the USACE's *Wetlands Delineation Manual* (USACE 1987), are considered waters of the U.S.

If mitigation is required for fill placed in wetlands, the Project must comply with *Compensatory Mitigation for Losses of Aquatic Resources Final Rule*.

Clean Water Act Section 404(b)(1)

Section 404(b)(1) requires a demonstration that there is no practicable alternative to the proposed discharge that would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences. This analysis must include consideration of activities that do not involve the discharge of dredged or fill material into waters of the U.S., discharges at alternative locations, and other geographic project locations. For this Project, the proposed modal options, transit technologies, and alignments that exhibit the least overall adverse environmental harm must be examined in the context of "practicability" prior to elimination from further consideration. An alternative with fewer impacts to aquatic resources than the Preferred Alternative may only be eliminated by demonstrating it has other overriding significant environmental impacts or is not practicable. Practicable is defined as "available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes." Alternatives evaluation under CWA Section 404(b)(1) is sometimes referred to as the Least Environmentally Damaging Practicable Alternative analysis.

Flood Zones

Protection of floodplains and floodways is required by Presidential Executive Order 11988 (USEO 1977); USDOT Order 5650.2 (USDOT 1979); the F*ederal Aid Highway Program Manual* (FHWA 1992b); and 23 CFR 650 (CFR 1999). These regulations place special importance on floodplains and floodways and require Federal agencies to avoid conducting, allowing, or supporting actions on a floodplain or within a floodway. If a project is located within a floodplain or floodway, results from sufficient analysis must be included in the project's Final EIS, as specified in USDOT Order 5650.2.

Stormwater

The City is permitted by HDOH to discharge stormwater into State waters around O'ahu through National Pollutant Discharge Elimination

System (NPDES) permit No. HI S000002. The City controls the discharge of stormwater in compliance with this permit through ROH Chapter 14, Article 12 and Article 13. The NPDES permit requires the City to develop, implement, and enforce a Storm Water Management Plan (SWMP) designed to address the requirements of the NPDES permit. HDOH has an approved SWMP from the City, which includes the *Best Management Practices Manual* for construction activities in Honolulu.

Groundwater

The EPA has designated the Southern Oʻahu Basal Aquifer as the sole or principal source of drinking water for southern Oʻahu. Section 1424(e) of the Safe Drinking Water Act, in accordance with the 1984 Sole Source Aquifer Memorandum of Understanding between the EPA and the USDOT, requires projects potentially affecting a sole-source aquifer to coordinate with EPA to evaluate potential impacts.

Coastal Zone Management Program

The Hawaiʻi CZM program was authorized by passage of HRS Chapter 205A in 1977. The program is administered by the DBEDT Office of Planning. Pursuant to 15 CFR 930.32, federally permitted, licensed, or assisted activities undertaken in or affecting Hawaii's coastal zone must be consistent with the CZM objectives and policies. The Hawaiʻi CZM area encompasses the entire state, including all marine waters. Other important elements of the Hawaiʻi CZM program include a permit system to control development within the Special Management Area (SMA), a relatively narrow zone along the coastline, and within the shoreline setback area. The SMA permit is administered by the counties of Hawaiʻi.

The Hawaiʻi CZM program has the following goals:

- Protect valuable resources
- Preserve management options
- Ensure public access to beaches, recreational areas, and natural reserves

A full assessment will be reviewed by the DBEDT Office of Planning, the agency administering the State's CZM program. When the City applies for Federal permits to allow construction, an additional review by the Office of Planning will occur.

Methodology

Field investigations for waters of the U.S. were conducted along the project alignment from December 2007 through January 2008 and from January 2009 through July 2009. The study area was defined as a 500-foot-wide buffer centered along the corridor. Thirty-one sites were studied that were either streams or areas where there was the potential for wetlands. The results of this study are documented in the Wetland and Waters of the U.S. Study (RTD 2009b).

At each stream crossing, information was collected to determine whether the stream, at the location crossed, was considered "jurisdictional" (a water of the U.S.), since some types of water features are not regulated by the USACE. Data collected included watershed characteristics; tide information; elevation of ordinary high-water mark (OHWM) and stream cross-sections; some physical, biological, and chemical characteristics; and other information.

The methods used to evaluate potential wetlands along the project alignment followed the *Wetlands Delineation Manual* (USACE 1987). To establish the extent of wetlands, an initial assessment was made based upon the prevalence of wetland plants and obvious hydrology at a site. Soil pits were then dug to establish the presence or absence of hydric soils. If all three wetland indicators (wetland vegetation, hydric soil, and hydrology) occurred, a delineation was undertaken to establish the wetland boundary facing the Project. The routine wetland determination procedures outlined in the *Wetlands Delineation Manual* (USACE 1987) were followed.

The sites surveyed (RTD 2009b) were grouped principally on the nature of the impact of the Project on water resources at each site. Five categories (I through V), ranging from lowest potential impact to greatest potential impact, were defined as follows:

- Category I—no waters of the U.S. present; therefore, no impact on water resources (4 sites).
- Categories II through IV—different types of waters of the U.S. were present, but no structural elements of the Project will be placed in those waters. Categories II through IV represent increasing potential for impacts due to increasing sensitivity of the aquatic environments present at the sites (e.g., wetlands are Category IV and are regarded as more sensitive as adjacent environments than concrete-lined culverts) (18 sites).
- Category V—waters of the U.S. are present, and project elements will require fill in these waters (9 sites)

USACE guidance permits the use of a preliminary jurisdictional determination (JD) approach to satisfy NEPA requirements. The "preliminary JD" approach is being followed for this Project. Under this approach, areas that are potentially waters of the U.S. are considered to be waters of the U.S. For the purposes of this document, all waters (including intermittent and ephemeral streams) are considered waters of the U.S. if they fit the definitions of tidal, wetland, RPW, or non-RPW waters, unless otherwise stated. The Wetland and Waters of the U.S. Study (RTD 2009b) provides additional information on areas being covered under preliminary JDs.

A "functional assessment" was also performed for each location where the Project is adjacent to or crosses a waters of the U.S., as identified in the Wetland and Waters of the U.S. Study (RTD 2009b). Once constructed, the Project will permanently encroach upon 0.02 acre of waters of the U.S. from the linear transportation project. These impacts are from placing structural elements for the guideway in Waiawa Stream and Springs, Moanalua Stream, Kapālama Canal Stream, and Nuʻuanu Stream. As discussed in Section 4.18, during construction of the linear transportation features of the Project, it is anticipated that there will also be a temporary effect of up to 0.13 acre of waters of the U.S.

At the Pearl Highlands Station, the existing stormwater culvert at Waiawa Springs will be improved and extended to reduce ponding at the outfall and avoid erosion around the guideway columns. The culvert improvements will result in 0.06 acre of permanent impacts in waters of the U.S. and no additional temporary impact during construction in waters of the U.S.

Although Kaloʻi Gulch is not under the jurisdiction of the USACE and is not listed in the tables summarizing impacts to waters of the U.S in Sections 4.14.3 and 4.18.10, it was considered in the impacts to waters of the U.S. with the use of the preliminary JD approach. There will be approximately 0.004 acre of permanent impact from placing structural elements of the guideway in Kaloʻi Gulch and 0.07 acre of temporary impact during construction. There will be 0.39 acre of permanent impact from construction of a park and-ride lot, a non-linear feature, at Lower Kaloʻi Gulch, with an additional 0.86 acre of temporary impact during construction.

For all project elements, the Project will permanently encroach upon 0.08 acre of waters of the U.S. and temporarily upon 0.13 acre in waters of the U.S. during construction. Given this level of impact to water resources within Honolulu's urban core, the intent of the functional assessment was to analyze impacts of the aquatic ecosystem to develop mitigation concepts for those waters of the U.S. where impacts could not be avoided and

only after impacts were minimized to the extent feasible.

Each site where the Project is adjacent to or crosses a water of the U.S. was visited and rated on a three-point scale for each of 24 function or value categories as suggested by de Groot et al. (2002), modified for this project site. The NRCS rapid assessment method used in Hawai'i was also undertaken, as was a Hawai'i Stream Visual Assessment Protocol (HSVAP). This NRCS method was developed for Hawaiian streams (NRCS 2001) and uses 10 scored elements—including water clarity, plant growth, channel conditions, native species habitats, and riparian conditions—to arrive at a composite score. This method was deemed applicable for two reasons:

1. Impacts of the Project are relatively minor, calling for a straightforward approach.
2. Methods developed for less urbanized streams in Hawai'i and elsewhere are not readily applicable to the urbanized hardened estuarine reaches where project impacts are occurring.

For stream sites where an actual impact is anticipated based upon the design plans, the method and form developed by the Little Rock District of the USACE (USACE 2008b) for stream assessment was completed. The basis of selection of this method is discussed more fully in the Ecosystem Function and Values of Wetland Waters of the U.S. (RTD 2009h).

Shadow impacts on wetlands were assessed using the Sun Shadow Applet by J. Giesen obtained from the website at http://www.jgiesen.de/sunshadow/.

Existing floodways and floodplain limits within the study corridor were identified using Federal Emergency Management Agency Flood Insurance Rate Maps and other existing data. The State National Flood Insurance Program staff was also consulted. Hydraulic assessments for specific locations where the Project crosses flood zones were performed.

In accordance with the 1984 Sole Source Aquifer Memorandum of Understanding between the EPA and the Federal Highway Administration, a Ground Water Impact Assessment was prepared to meet the coordination requirements of Section 1424(e) of the Safe Drinking Water Act. The thickness of surficial sediments above the basalt aquifer was compared to the predicted depth of deep foundations needed to support the Project. The consequences of various construction techniques were evaluated where the foundations might penetrate the basalt. The hydraulic gradient was considered and location of drinking water wells was compared to the project alignment. The location of the HDOH's Underground Injection Control Line, an indication of the boundary between non-drinking water aquifers and underground sources of drinking water, was compared to the project alignment. best management practices (BMPs), required permits, and other controls that affect groundwater recharge and quality were evaluated, and potential mitigation measures to protect the basalt aquifer were proposed.

Agency Coordination

Coordination with Federal, State, and Local agencies with water-resource expertise and responsibilities has been ongoing to provide input and guidance on the resources, design, and construction of the Project. Coordination will continue as appropriate with regulatory agencies throughout final design and construction. Since publication of the Draft EIS, several meetings have been held. On December 9, 2008, the USACE, HDOH, Hawai'i's CZM Program, Hawai'i Commission on Water Resource Management, and EPA met with project staff to clarify water resource requirements for the Project. As materials were completed to support this section for the Final EIS, follow-up meetings with the EPA were held on March 10, 2009, and July 10, 2009. Meetings were held with the USACE

on January 15, February 25, May 13, July 3, and August 10, 2009. Additional coordination between technical staff and the USACE has occurred. A meeting was also held with the USCG on December 11, 2008. Input from these agencies has directed the analysis included in this Final EIS.

Coordination will continue with Federal, State, and Local agencies to obtain the necessary permits, approvals, and agreements listed in Section 4.21.

4.14.2 Affected Environment

Surface Waters

Surface waters in the study corridor include intermittent and perennial streams, tidal estuaries, and freshwater and tidal wetlands. Descriptions of the surface water environments are discussed in general terms under the Streams, Wetlands, and Marine Waters subsections. Individual sites for which an impact has been identified are discussed in more detail under the appropriate subsection.

Streams

Streams within the study corridor are listed in Table 4-26 and their locations are illustrated on Figure 4-61. Table 4-26 describes, in general terms, attributes associated with each of these streams. Twenty streams or conveyance channels are to be crossed by the guideway or other project structures. In 18 cases, where the Project crosses them, these stream channels have been modified within the study corridor, having either a realigned channel of "natural" material or a channel lined with concrete (in many cases including the bed). Natural channels occur only at Honouliuli Stream, Waiawa Stream, and Pānakauahi Gulch (Sites 4, 12, 13, and 31). Because the guideway follows existing major roadways, the point at which it crosses a stream coincides with an existing bridge where concrete sidewalls are already in place. More importantly, the guideway traverses urban areas where streams have been realigned and otherwise modified for flood control purposes. General water quality in these urban streams tends to be poor, and many are included on the State 303(d) List of Impaired Waters (HDOH 2008).

Table 4-27 summarizes two aspects of the stream environment at each site: (1) typical vegetation in the channel and on or immediately above the banks and (2) the nature of the aquatic fauna present. The watersheds for each stream are identified and illustrated on Figure 4-67. Because these mostly modified channels are subject to maintenance activities, in-channel and riparian vegetation tends to be grasses and shrubs with a ruderal character (meaning plants adapted to disturbed sites). In some cases of tidally influenced channels, mangroves occur along the margins of the bed. Only in the case of Waiawa Stream (Sites 12 and 13) is the vegetation typical of a lowland Oʻahu stream with a true riparian zone. At Honouliuli Stream (Site 4), the stream is intermittent and deeply incised with concrete sidewalls at the crossing point. Upstream, water flow is temporally insufficient to influence much riparian growth. Downstream, the normally dry channel widens through landscaped grounds of Kāhi Mōhala.

Consideration of the kinds of aquatic fauna present at each site (see final column in Table 4-26) can be divided into waters that do not support aquatic animals (intermittent channels, natural or concrete-lined), streams that are perennial and typically harbor introduced fishes and crustaceans (either limited or diverse depending upon habitat complexity among other factors), waters that are tidal (estuarine), and waters that connect the ocean and upland aquatic habitats that support native, amphidromous species. Amphidromous species deserve special consideration because they constitute the native stream macrofauna and require a connection through the lowlands to maintain a viable population in the upper reaches of the stream. These are species that reside as adults in suitable stream habitats but have a larval stage that lives in the ocean. The juveniles develop in the sea and then migrate to a suitable stream habitat to

Table 4-26 Streams Crossed by the Project

Stream	Site No.[1]	Type of Water[2]	Tidally Influenced?	US Coast Guard Navigable Waters?[3]	303(d) Impaired?[4]
Kalo`i Gulch	1, 2	Non-RPW	No	No	No
Honouliuli Stream	4	RPW	No	No	Yes
Hō`ae`ae Stream	6	Non-RPW	No	No	No
Waikele Stream	7	RPW	Yes	Yes[3]	Yes
Kapakahi Stream	9	RPW	No	No	Yes
Waipahu Canal Stream	10	RPW/TNW	Yes	Yes[3]	No
Pānakauahi Gulch	31	Non-RPW	No	No	No
Waiawa Stream and Springs	12, 13	RPW	No	No	Yes
Pearl City Stream	14	Non-RPW	No	No	No
Waiau Springs	15	RPW	No	No	No
Waimalu Stream	16	RPW	Yes	Yes[3]	Yes
Kalauao Springs	17	RPW	No	No	Yes
Kalauao Stream	18	RPW	No	No	Yes
`Aiea Stream	19	RPW	Yes	No	Yes
Hālawa Stream	22	TNW	No	No	Yes
Aolele Ditch	25	Non-RPW	No	No	No
Moanalua Stream	27	RPW	Yes	Yes[3]	Yes
Kalihi Stream	28	TNW	Yes	Yes[3]	Yes
Kapālama Canal Stream	29	TNW	Yes	Yes[3]	Yes
Nu`uanu Stream	30	TNW	Yes	Yes[3]	Yes

[1] The site numbers refer to sites studied in the *Honolulu High-Capacity Transit Corridor Project Wetland and Waters of the U.S. Study* (RTD 2009b)

[2] RPW = relatively permanent water; TNW = traditional navigable water

[3] Advanced approval received from U.S. Coast Guard, December 23, 2008

[4] 303(d) Impaired Waterway as defined by HDOH (2008)

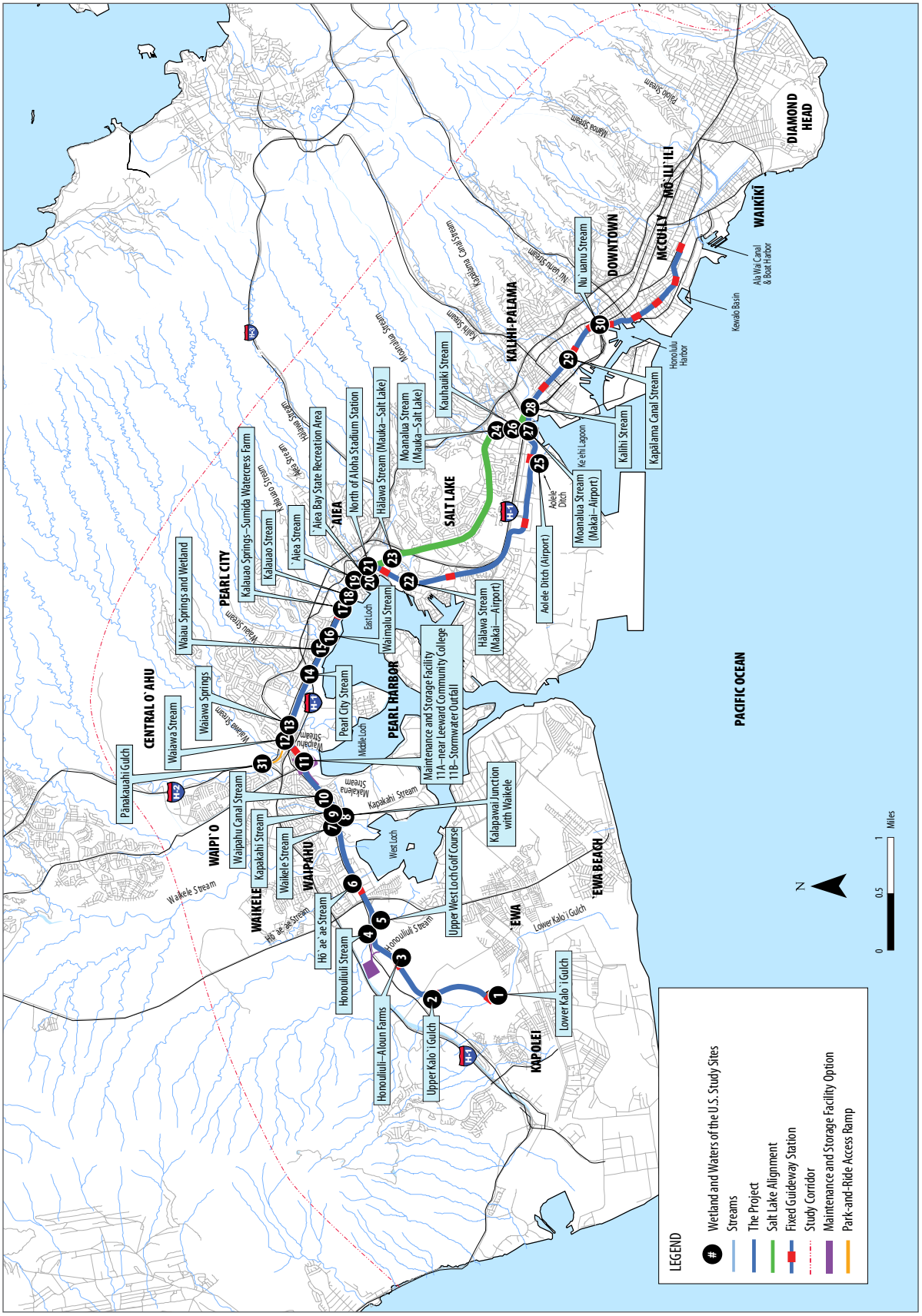

Figure 4-61 Wetland and Waters of the U.S. Study Sites

complete their life cycle. In some cases, it is possible to have a dry stream at a site that nonetheless supports an upstream amphidromous fauna where the stream has one or more perennial reaches. Such streams are classified as interrupted because flow in the lowlands occurs only when sufficient runoff feeds the system (as in the wet season). Thus, an activity that interferes with the migration pattern could have an adverse impact on an otherwise healthy upstream population. Concrete-lined channels can have an adverse impact on the migration pattern, although where the channel is tidal (estuarine; for example, Hālawa Stream at Site 22) water depth is typically sufficient and constant so as not to constitute a barrier. In Table 4-27, streams that are known to have a perennial freshwater reach are characterized under Aquatic Fauna as "native amphidromous," although this declaration by no means claims that the stream does in fact support any native macrofauna (only that upstream habitat is potentially present). In all cases, no permanent (or temporary construction) structures are proposed that would interfere with migration by an amphidromous species through the project area. Kaloʻi Gulch and Waiawa Stream are discussed in greater detail below because they are both natural streams at the project location, and project-related impacts are anticipated.

Navigability determinations for each affected waterway have been made by the USCG in their letter on December 23, 2008 (Appendix F). The USCG classified these channels as Advanced Approval Waterways because they are only navigated by rowboats, canoes, and small motorboats (Table 4-26). Recreational use of many of the navigable streams in the study corridor is minimal because they are located in urban areas and lined with concrete. Access into concrete-lined non-RPW (intermittently flowing) channels is discouraged, as these are, in essence, storm drains. However, a number of the larger channels are used for fishing and crabbing from shore or from pedestrian accessways on bridges. Recreational and subsistence fishing and crabbing are particularly evident in the larger estuarine waters crossed by the Project. The biological resource value for each stream is largely a factor of the water type. RPW and tidal waters (TNW and tidal), even though confined to a modified channel, may support aquatic life (and therefore have the potential for recreational fishing) and may serve as a conduit through which native amphidromous fauna migrates between the ocean and suitable habitat in upland stream reaches.

Kalo`i Gulch

Kaloʻi Gulch is an intermittently flowing stream that historically discharged onto the ʻEwa Plain, lacking an outlet to the ocean owing to the permeability of the ancient reef formation forming the Plain. Water flow occurs only during significant rainfall in this normally dry area. In the project area, the flow has long been directed into man-made channels through former agricultural lands (AECOS 1992, 2005). With the advent of anticipated rapid urbanization of the area, much of the flow from Kaloʻi Gulch will soon be directed into the Kaloʻi Drainage Channel that parallels North-South Road (under construction; Site 2). A portion of the old channel of lower Kaloʻi Gulch will continue to carry runoff from a smaller, tributary gulch named Hunehune (Site 1). USACE has determined that Kaloʻi Gulch is not subject to its jurisdiction.

Waiawa Stream and Springs

Waiawa Stream flows within a natural bed and banks within the study corridor, through an area located between Kamehameha and Farrington Highways in Pearl City (Site 12; Figure 4-62). The floodplain in this area has been altered, but the stream remains in a natural state, as does most of Waiawa Stream and its tributaries with only about 5 percent of the channel modified (Timbol 1978). Waiawa Stream is classified as an interrupted perennial stream, meaning the stream and tributaries are continuously flowing in the uplands, but

Table 4-27 Attributes of Streams Crossed by the Project

Stream	Site No.	Watershed	Channel Characteristics [1]	Bank Vegetation	Aquatic Biota
Kalo`i Gulch	1, 2	Kalo`i	Modified	Grasses	None
Honouliuli Stream	4	Honouliuli	Unmodified	Grasses	None
Hō`ae`ae Stream	6	Waikele	Concrete-lined	None	None
Waikele Stream	7	Waikele	Concrete-lined	None	Diverse FW, amphidromous
Kapakahi Stream	9	Kapakahi	Modified	Ruderal and wetland herbs	Limited non-native
Waipahu Canal Stream	10	Kapakahi	Concrete-lined	None	Estuarine
Pānakauahi Gulch	31	Waiawa	Unmodified	Grasses and trees	None
Waiawa Stream and Springs	12, 13	Waiawa	Unmodified	Mature tree canopy with understory	Diverse FW, native amphidromous
Pearl City Stream	14	Waimalu	Concrete-lined	None	None
Waiau Springs	15	Waimalu	Concrete-lined/modified	Trees, shrubs, understory	Diverse FW
Waimalu Stream	16	Waimalu	Concrete-lined/ modified	Mangrove	Estuarine, native amphidromous
Kalauao Springs	17	Kalauao	Concrete-lined	Maintained, grasses	Diverse FW
Kalauao Stream	18	Kalauao	Modified	Trees and ruderal herbs	Diverse FW
`Aiea Stream	19	`Aiea	Concrete-lined	None	Estuarine, native amphidromous
Hālawa Stream	22	Hālawa	Modified	Some mangrove, other trees	Estuarine, native amphidromous
Aolele Ditch	25	Manuwai	Concrete-lined/modified	Maintained grasses and ruderal herbs	None
Moanalua Stream	27	Moanalua	Concrete-lined	Mangrove	Estuarine, native amphidromous
Kalihi Stream	28	Kalihi	Modified	Shrubs	Estuarine, native amphidromous
Kapālama Canal Stream	29	Kapālama	Modified	Shrubs, ruderal herbs	Diverse FW
Nu`uanu Stream	30	Nu`uanu	Concrete-lined	None	Estuarine. native amphidromous

[1] Channel characteristic at study site where Project crosses stream
FW = fresh water

stream flow is absent in a lowland segment during the dry season (HCPSU 1990). Waiawa Stream is perennially flowing in the project area, fed by local springs (AECOS 1991).

A 36-inch storm drain culvert daylights at the base of the Kamehameha Highway fill bank at a point directly under the proposed Pearl Highlands Station along the guideway (Site 13). This storm drain appears to be discharging a perennial flow that may be spring water captured from the mauka side of the highway, although the source of the apparently continuous flow has not been verified. This spring is assumed to be a waters of the U.S. and is referred to as Waiawa Springs.

Wetlands

Wetlands near the project alignment are associated with riverine, tidal, and spring-fed water systems. Land development has altered or destroyed many

of the historically identified wetlands in the study corridor, leaving only scattered remnants today. In the categorization of waters and impacts developed in the Wetland and Waters of the U.S. Study (RTD 2009b), wetlands adjacent to the Project constitute Category IV. Three sites are freshwater (palustrine) wetlands (Category IVA; Sites 15, 17, and 25) adjacent to the Project (within 250 feet of the alignment or other facilities of the Project). Four sites are littoral or mangrove wetlands (Category IVB; Sites 11B, 16, 20, and 22). No wetlands will be directly affected by structural elements of the Project beyond shading effects. In the cases of Sites 16 (Waimalu Stream) and 22 (Hālawa Stream), the adjacent wetland consists only of a growth of mangrove along the margins of the estuary where the guideway crosses.

Maintenance and Storage Facility Stormwater Outfall

The maintenance and storage facility near Leeward Community College (Site 11A; Figure 4-63) is categorized as a Category I site, having no streams or wetlands present. However, a large detention basin is proposed for this location and the detention basin will overflow via a new 60-inch drain to the shore of Pearl Harbor at Middle Loch. This latter area is Site 11B, assigned to Category IVB because nearshore waters supported, until recently, a mangrove forest. The OHWM (taken herein as the mean reach of the higher high tides) at the shore constitutes the upper limit of waters of the U.S., and the outlet structure and riprap will be placed above (inland of) this line. The stormwater discharges to Middle Loch in an area that was a mangrove wetland and is being recolonized by juvenile mangrove plants.

Waiau Wetland

The Project is located along the median of Kamehameha Highway makai of Waiau Springs wetland. The boundary of this freshwater wetland was defined based upon a combination of wetland vegetation, hydric soil characteristics, and the presence of water. The southern border (closest to the Project) of the wetland lies along the base of the fill slope from Kamehameha Highway (Figure 4-64).

Land surrounding the wetland is being used by residents for subsistence vegetable gardening and, in some areas of the wetland, pondfield culture of kalo *(Colocasia esculenta)* and ung-choi *(Ipomoea aquatica)* is carried out at a subsistence level. Waiau Springs stream and wetland supports fish species such as mollies, guppies, koi, and cichlids (including tilapia). A homeowner adjacent to the wetland raises fish, including channel catfish, Asian catfish, koi, and goldfish, in tanks and cages within the wetland. Although no waterfowl were observed during site inspections, the wetland might be conducive as habitat for Hawaiian coot and Hawaiian moorhen, both of which are federally listed species. Black-crowned night heron, a protected species, are likely to visit this wetland.

Sumida Watercress Farm Wetland

Sumida Watercress Farm at Pearlridge is a historic pondfield farm operating within a wetland fed by Kalauao Springs (Figure 4-65). This wetland is extensively developed into rectangular pondfields used for the commercial production of watercress *(Nasturtium officinale)*. The closest approach of the Project to the farm is the guideway along the median of Kamehameha Highway, the mauka edge of the highway roadbed slope, which forms a dike along the discharge channel at the lower end of the wetland. The discharge channel feeds a set of pumps used to spray the fields as a preventive against insect damage to the crop and drains via a culvert to a concrete-lined drainage channel through Pearlridge Center, discharging south into the East Loch of Pearl Harbor.

`Aiea Bay State Recreation Area Wetland

The Project guideway is approximately 200 feet mauka of the tidal wetland (formally a dense mangal forest) fringing ʻAiea Bay (Figure 4-66). ʻAiea Stream has formed a depositional delta off the shore here, on which supports the growth of

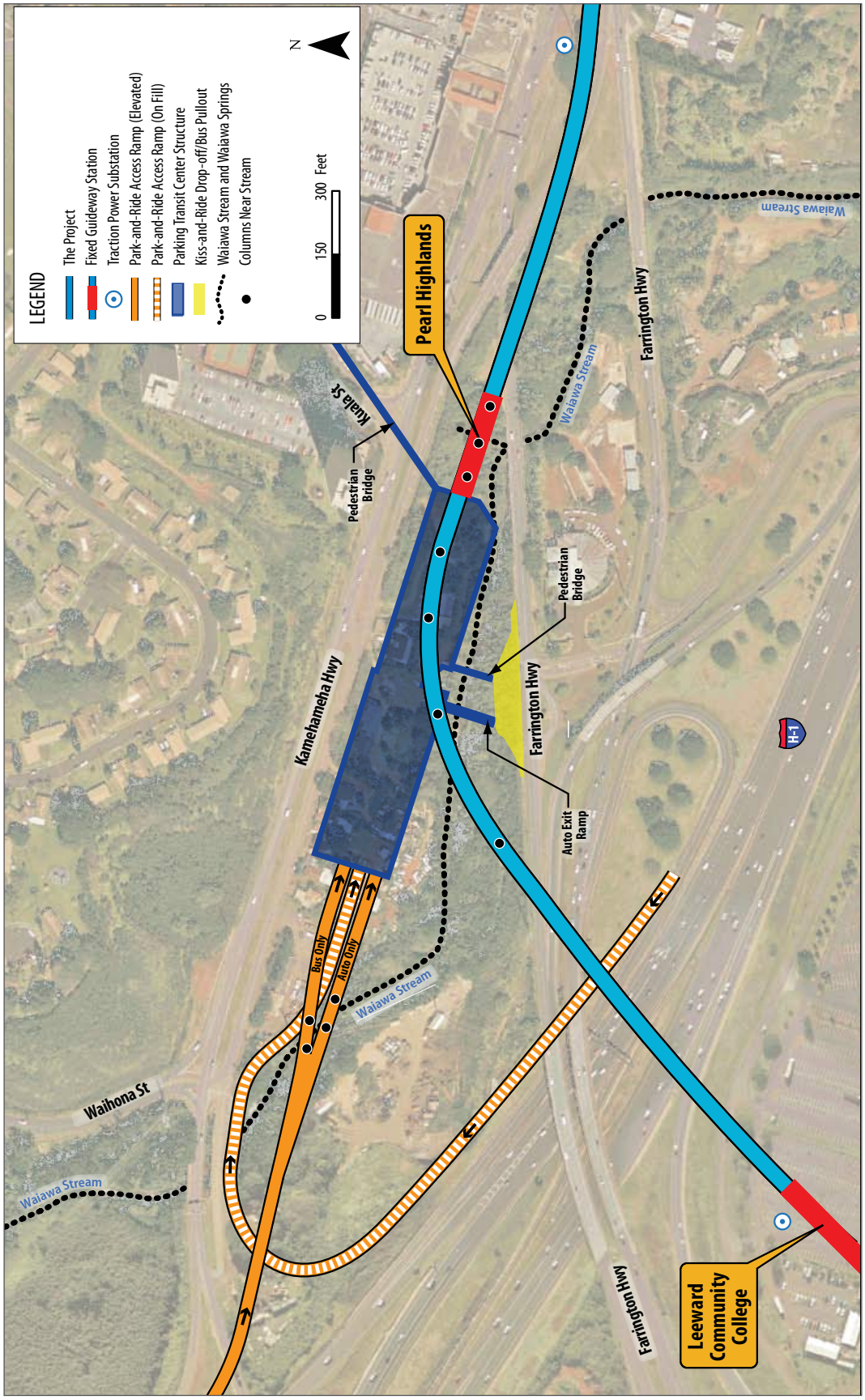

Figure 4-62 Waiawa Stream and Springs

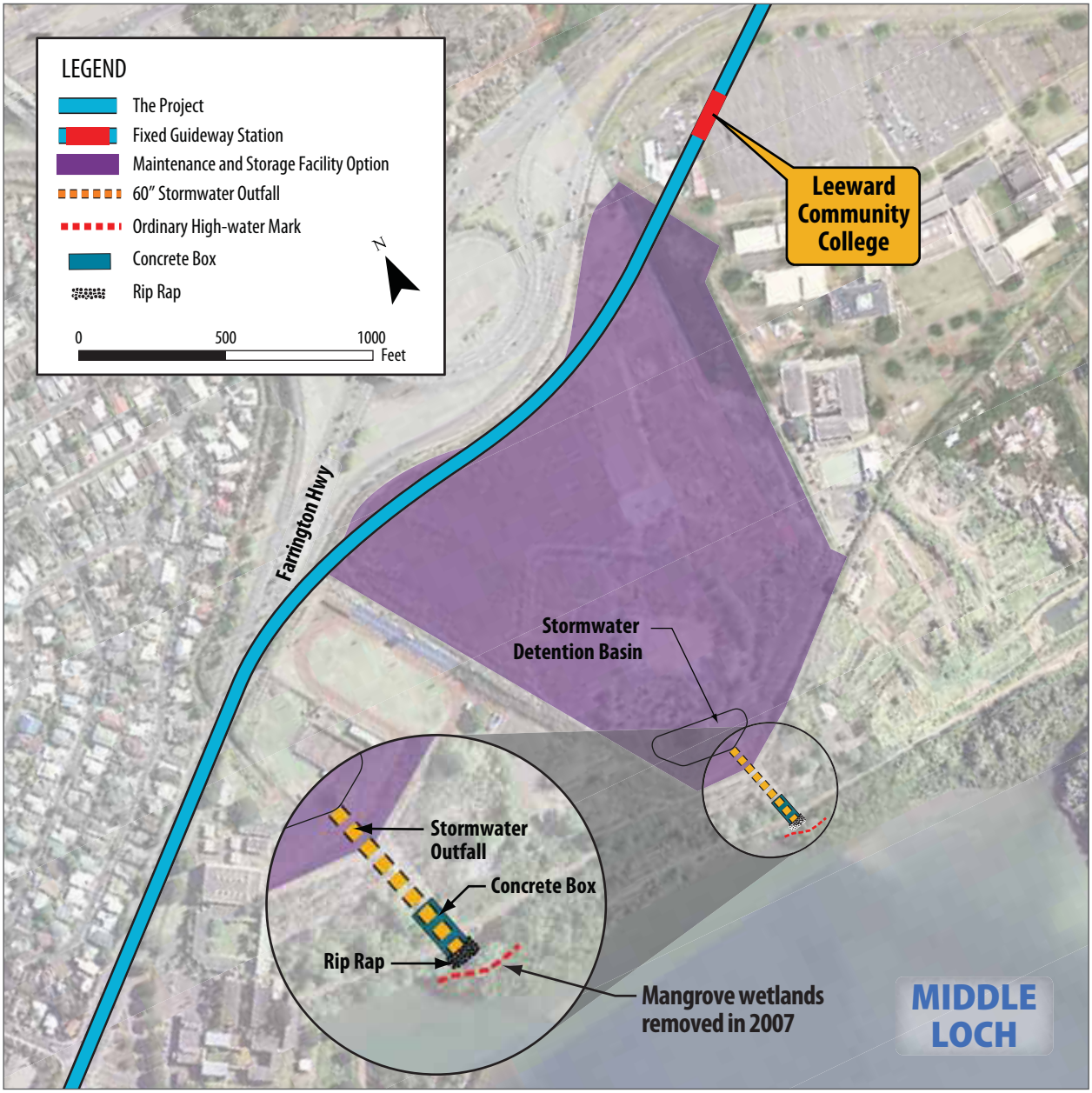

Figure 4-63 Stormwater Outfall

salt-tolerant plants (mangrove and pickleweed). The sediment is anaerobic. Mud flats in Pearl Harbor, such as this one, are relatively stable, whereas the narrow riparian mudflats along streams are subject to hydraulic scouring. Recovery of the mangrove removed in 2007 is well underway as juvenile mangrove plants colonize the tidal flat.

Aolele Ditch

Aolele Ditch is a man-made drainage feature constructed to drain stormwater to Keʻehi Lagoon from the northeastern portion of Honolulu International Airport and an adjacent light industrial area. The lower end of the ditch is tidal. However, the part of the ditch crossed by the guideway is an intermittently flowing (non-RPW), unlined, open ditch fed by several small drains from the

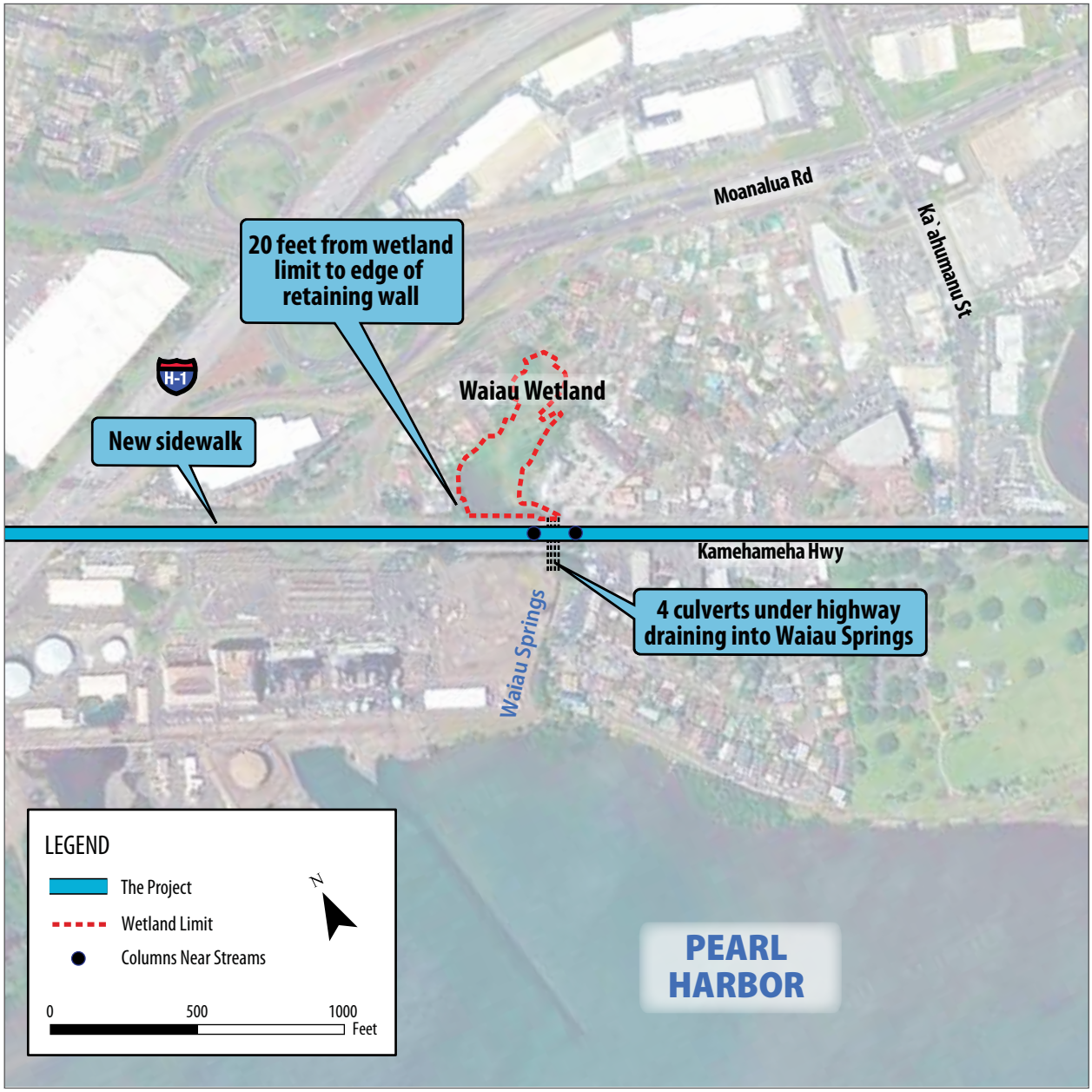

Figure 4-64 Waiau Springs and Wetland

light industrial area mauka. These drains provide sufficient freshwater to establish three small semi-permanent wet areas along the bottom of the ditch (one under the guideway). These "wetland" features support a variety of wetland plants and aquatic insects, such as dragonflies. The most downstream of the three wetlands connects to the tidal reach of Aolele Ditch and harbors top minnows (poeciliids) and American crayfish, suggesting a permanent fresh or slightly brackish wetland that has developed on a thin layer of sediment over the concrete channel bed in this segment.

Marine Waters

The large coastal surface water bodies within or adjacent to the study corridor are listed in Table 4-28 and illustrated in Figure 4-61. These water bodies are all highly urbanized and/or

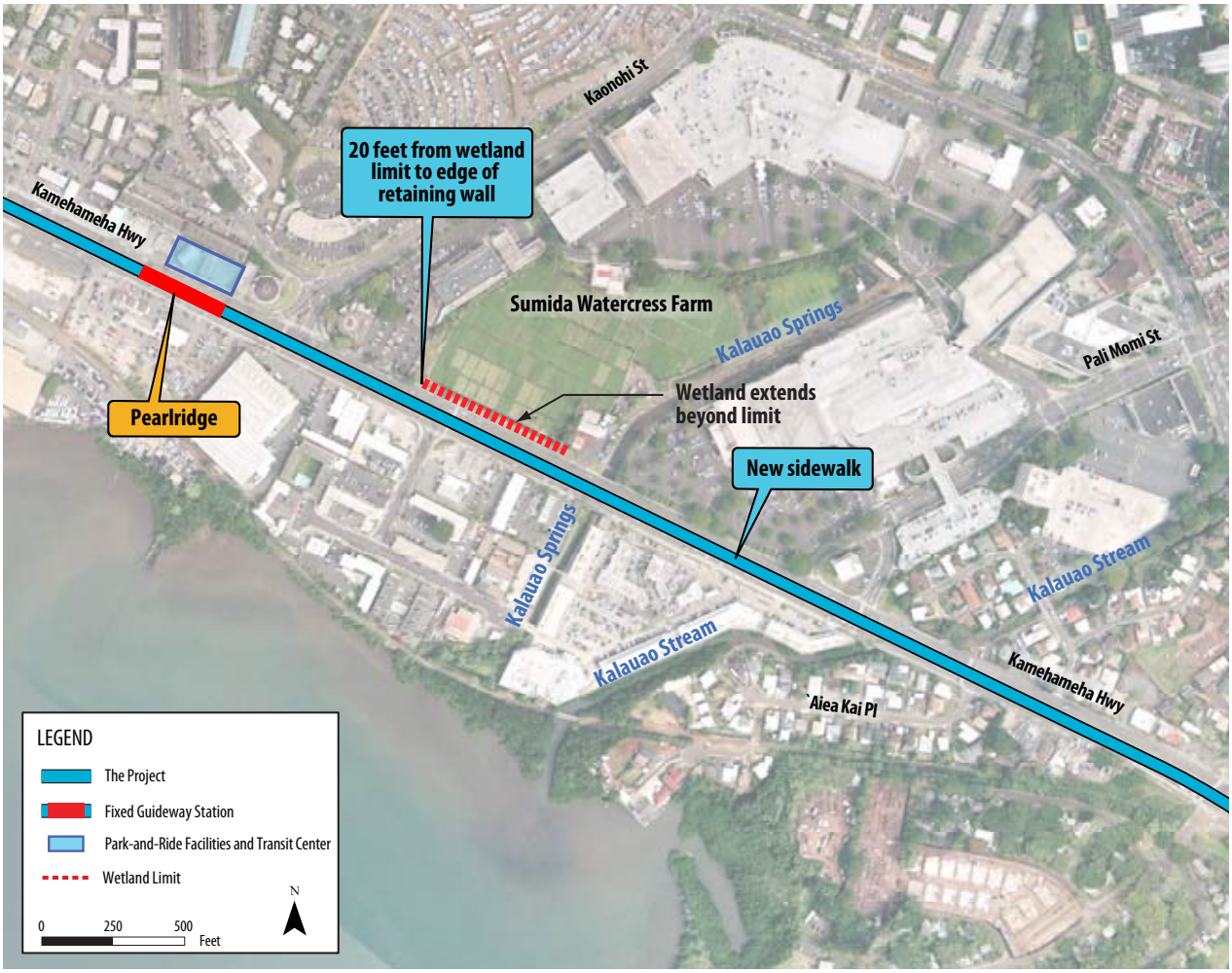

Figure 4-65 Sumida Watercress Farm

altered from their natural state. Marine areas near the Project include the Middle and East Lochs of Pearl Harbor (technically an estuarine bay), Keʻehi Lagoon (an open embayment), and Honolulu Harbor.

Flood Zones

Flood Insurance Rate Maps show that the project alignment will cross several floodplains and two floodways associated with Waiau and Waiawa Streams (Figures 4-57 and 4-58). Floodplains along the project alignment mostly recharge groundwater levels, convey stormwater toward the ocean, and help moderate floods when they occur (Figure 4-67). These areas also support plants and wildlife within urbanized areas, while maintaining areas for outdoor recreation and enjoyment and preserving the land's natural beauty. The flood zones and their associated waters are listed in Table 4-29.

Stormwater

The existing drainage conditions encountered along the guideway alignment consist of the following: undeveloped or unpaved areas, areas adjacent to paved roadways, landscaped median areas of paved roadways, or a combination of these conditions. Drainage conditions for the Project area west of Hoʻopili Station (west Site 4) is generally undeveloped or unpaved. The drainage conditions for the Project within the City of Waipahu are landscaped median areas of paved

Figure 4-66 `Aiea Bay State Recreation Area

roadway. The drainage conditions for the majority of the project alignment are areas adjacent to paved roadways or a combination of various conditions. The existing drainage system consists of drainage pipes/culverts, structures, swales, and outfalls to tributaries adjacent to Pearl Harbor and Honolulu Harbor.

Groundwater

The entire Project overlies the Southern O'ahu Basal Aquifer and includes two aquifer sectors. The Pearl Harbor Aquifer Sector contains the 'Ewa, Waipahu, Waiawa, and Waimalu Aquifer Systems, and the Honolulu Aquifer Sector contains the Moanalua, Kalihi, and Nu'uanu Aquifer Systems.

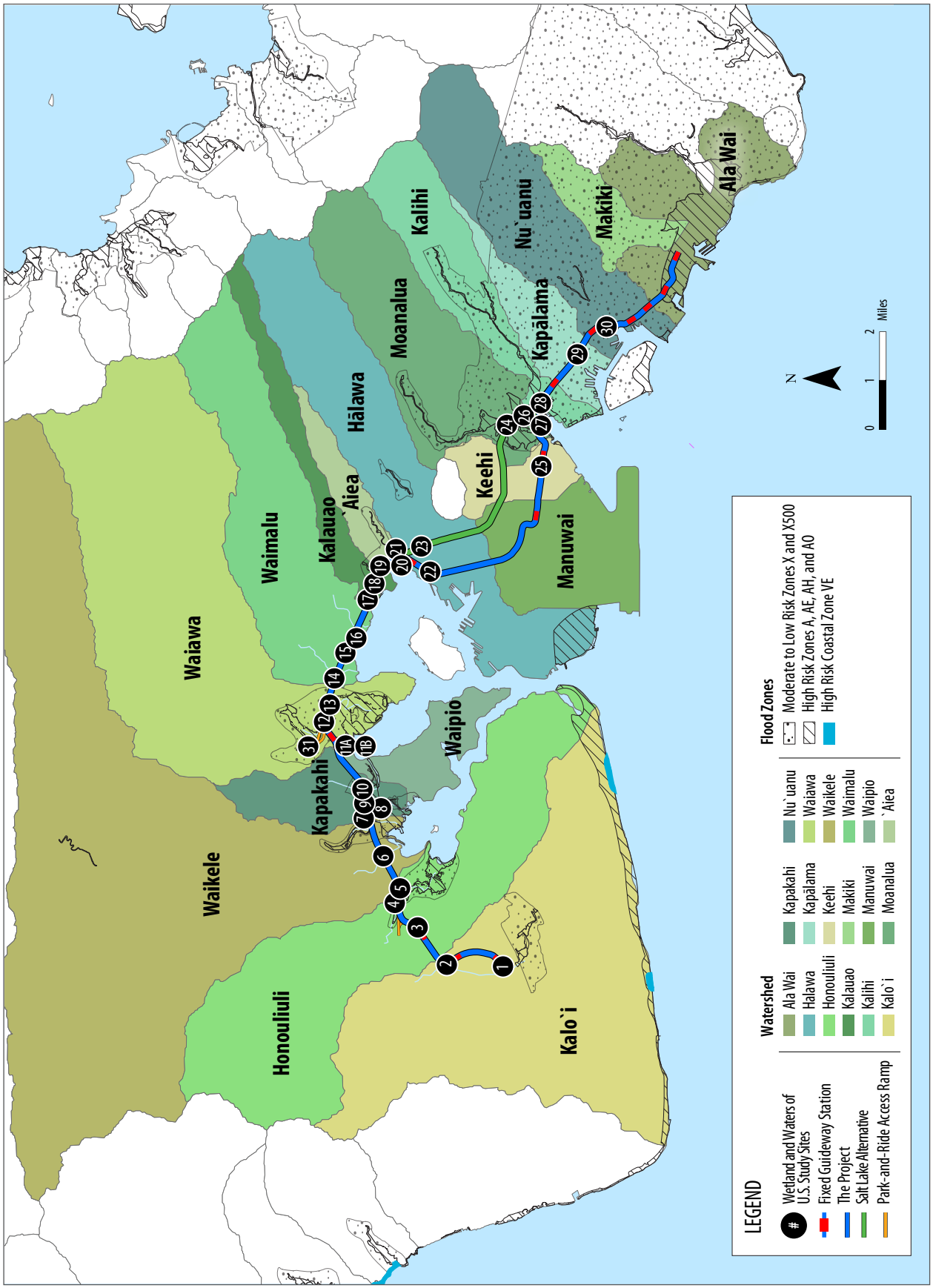

Figure 4-67 Watershed and Flood Zones

Table 4-28 Marine Waters

Water Body	Class	Associated Inlets	303(d) Impaired[2]
Pearl Harbor[1]	2—Inland water/estuary	Point-source discharges; streams	Yes
Ke`ehi Lagoon	A—Marine embayment	Storm drains; streams	Yes
Honolulu Harbor	A—Marine embayment	Storm drains; streams	Yes

[1] Pearl Harbor includes West Loch, Middle Loch, and East Loch

[2] 303(d) Impaired Waterway as defined by State of Hawai`i Department of Health (2008).

Coastal Zone Management Areas

The CZM area in Hawaiʻi encompasses the entire State and the areas of concern, such as historic resources, public participation, ecosystems, visual resources, coastal hazards, and development, are discussed in other sections of this Final EIS.

4.14.3 Environmental Consequences and Mitigation

Environmental Consequences

No Build Alternative

Under the No Build Alternative, the Project would not be built and would not have any impacts to water resources. The projects in the ORTP are assumed to be built, and the consequences of those projects will be studied and documented in separate environmental documents.

Project

The following sections discuss possible effects to surface and marine waters, wetlands, flood zones, stormwater, and groundwater and present coordination activities and mitigation that will occur to address possible effects. Effects during construction are discussed in Section 4.18.

Surface Waters

Project encroachment into waters of the U.S. is summarized in Tables 4-30 and 4-31. The Project will, once constructed, permanently encroach upon 0.08 acre of waters of the U.S. (0.02 acre as listed on Table 4-30 and 0.06 acre as listed on Table 4-31). These impacts are from placing piers in Waiawa Springs, Moanalua Stream, Kapālama Canal Stream, and Nuʻuanu Stream and improving a culvert in Waiawa Springs. Although Kaloʻi Gulch is not under the jurisdiction of the USACE and not included in Tables 4-30 or 4-31, it was considered in the impact quantities with the use of the preliminary JD approach. The Project at Kaloʻi Gulch will add 0.009 acre of permanent impact from the guideway support columns, with 27 cubic yards of impact below OHWM and above the mudline and 1,234 cubic yards below the mudline (linear transportation features). The Project will also add 0.39 acre of permanent impact from a park-and-ride lot, with 953 cubic yards below OHWM and above the mudline and 744 cubic yards below the mudline..

As discussed in Section 4.18, during construction of the fixed guideway (linear transportation project features), it is anticipated that there will be a temporary effect of up to 0.13 acre of waters of the U.S. Although Kaloʻi Gulch is not under the jurisdiction of the USACE and the impacts are not listed in the tables, temporary impacts include 0.07 acre of impact from the guideway support columns with 948 cubic yards of impact below OHWM and above the mudline. An additional 0.86 acre of temporary impact will result from construction of a park-and-ride lot at Lower Kaloʻi Gulch with an additional 1,238 cubic yards below OHWM and above the mudline.

Of the 20 streams in the study corridor, most will not be directly affected because the Project's elevated guideway will clear-span these streams and there will be no pier or column construction or other construction-related activities within the

Table 4-29 Streams Having FEMA Mapped Flood Zones

Associated Water Body	Developed	Major Functions	Flood Zone(s) Traversed by Fixed Guideway
Kalo`i Gulch	Yes	Groundwater recharge; stormwater conveyance	AE
Honouliuli Stream	No	Groundwater recharge; stormwater conveyance	A
Waikele Stream	Yes	Stormwater conveyance	AEF, AE
Kapakahi Stream	Yes	Stormwater conveyance	AEF, AE
Waiawa Stream	Yes	Stormwater conveyance	AEF, AE
Kalauao Stream	Yes	Stormwater conveyance	AEF
Moanalua Stream	Yes	Stormwater conveyance	AEF, AE, AO
Kalihi Stream	Yes	Stormwater conveyance	AEF, AE, AO

Zone A = the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base flood elevations or depths are shown within this zone.

Zone AE = the flood insurance rate zones that correspond to the 100-year floodplains that are determined in the Flood Insurance Study by detailed methods. In most instances, base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AEF = the area within Zone "AE" reserved to pass the base flood.

Zone AO = the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. The depth should be averaged along the cross-section and then along the direction of flow to determine the extent of the zone. Average flood depths derived from the detailed hydraulic analyses are shown within this zone. In addition, alluvial fan flood hazards are shown as Zone AO on the Flood Insurance Rate Map.

stream channel below OHWM. In general, the project alignment parallels other bridge crossings of the streams and, in many cases, crosses along the median between bridges carrying opposing lanes of traffic. In these cases (Categories II through IV as outlined in Section 4.14.2), the only potential direct effect of the Project is one of shading of the stream or wetland. Because the guideway is elevated relative to the surrounding roadway crossings, the guideway will only impart minimal, additional shading onto the water as compared to the bridges already present in each location. Shading impacts are addressed in more detail for Sumida Watercress Farm, below.

The streams affected by structural elements of the Project are described below and in Tables 4-30 and 4-31. These are the Category V sites discussed above, most of which are estuarine and confined to highly modified channels with little to no riparian values. An acreage approach to quantifying impacts has been followed since functional assessment methods are typically calibrated to non-urban, non-hardened areas. There are no secondary or derivative adverse impacts resulting from the Project that would be overlooked by focusing on acreage or that don't scale to acreage. Kaloʻi Gulch is not under the jurisdiction of the USACE and is, therefore, not listed in Tables 4-30 or 4-31. However, it was considered in the impact quantities with the use of the preliminary JD approach.

Kalo`i Gulch

The lower end of Kaloʻi Gulch on the ʻEwa Plain will be impacted by structural elements of the Project in two respects—a park-and-ride lot is proposed for a parcel crossed by the man-made drainage channel (Site 1); and support columns for the guideway will be located on the banks of the Kaloʻi Drainage Channel (Site 2). Although how the drainage channel at the park-and-ride lot will be designed has yet to be determined, the most likely solution will be to replace the existing man-made ditch with a buried box culvert. Another option would be to redirect the channel

Table 4-30 Permanent Impacts to Waters of the U.S. (Linear Transportation Features)

Total Impact	Waiawa Stream & Spring (Sites 12 & 13)	Moanalua Stream (Site 27)	Kapālama Canal Stream (Site 29)	Nu`uanu Stream (Site 30)	Total Impact of Project
Area (acres)	0.003	0.004	0.01	0.004	0.02
Volume (cubic yards) (below OHWM & above mudline)	10	8	61	27	105
Volume (cubic yards) (below mudline)	873	1,454	60	1,164	3,551

Table 4-31 Permanent Impacts to Waters of the U.S. (Other Project Features)

Total Impact	Waiawa Spring (Existing Stormwater Culvert Extension)
Area (acres)	0.06
Volume (cubic yards) (below OHWM & above mudline)	185
Volume (cubic yards) (below mudline)	0

elsewhere, for example via a ditch or culvert more directly to the Kalo‘i Drainage Canal nearby to the east. No aquatic resources are associated with this channel, which is normally dry and cut-off from most of its drainage basin by redirection of upper Kalo‘i Gulch into the Kalo‘i Drainage Canal. Future urban development will likely establish runoff conveyances throughout this area. As noted, the Kalo‘i Drainage Canal will take over much of the stormwater runoff contributed by Kalo‘i Gulch. This approximately 160-foot wide channel is presently under construction paralleling North-South Road. Neither this channel nor the existing narrow Kalo‘i Gulch (Site 2) have aquatic resource value. The guideway crosses the “new” channel at a shallow angle on a turn, and the span at this point cannot avoid placing several columns within the banks of the channel. Two columns (approximately 36 square feet constructed on 10-foot drilled shafts) are located near the bottom of the banks (within the 100-year floodway).

Waiawa Stream and Springs

The Project and associated features will have one guideway support column and two station piers below OHWM. There will be some impacts to riparian areas. Moving the station location, parking structure, bus transit center, and other features is the only option to avoid impacts to this area. The Pearl Highlands Station is projected to have the second-highest passenger volume of all stations in the system and will serve as the transfer point for all users in Central O‘ahu, whether they drive to the station or transfer from TheBus. This transit center and park-and-ride facility are designed to provide easy access to the fixed guideway transit system from the H-1 and H-2 Freeways, Kamehameha Highway, and Farrington Highway. This station location provides the most convenient access to the system for residents of Central O‘ahu (i.e., locations mauka and ‘Ewa of the station). Therefore, elimination of the station and associated park-and-ride structure does not satisfy the Project’s Purpose and Need.

Alternative locations for the Pearl Highlands Station and park-and-ride lot were identified at Leeward Community College and the Hawai'i Laborers Training Program site. Both of these sites were evaluated in Section 5.4.2 of the Draft EIS that addressed avoidance alternatives to potential impacts to the historic Solmirin House (since publication of the Draft EIS, the Solmirin House has been determined to be not eligible for designation as a historic resource). Locating the park-and-ride facilities at either of the two avoidance alternative sites would cost substantially more and provide less efficient transportation circulation, as access would be less direct. For these reasons, these avoidance alternatives are not considered feasible.

The construction of the high occupancy vehicle (HOV) ramp that will connect inbound H-2 Freeway vehicles with the park-and-ride structure adjacent to the Pearl Highlands Station will result in four columns being constructed close to Waiawa Stream, all above OHWM. These columns were moved away from the stream to avoid impacts. Waiawa Stream in this area flows in a natural bed and banks, although there are multiple existing piers in the stream associated with Farrington Highway and Kamehameha Highway bridges.

The guideway will clear-span this stream makai of the Pearl Highlands Station. The Pearl Highlands parking and transit center will be constructed on circular columns close to Waiawa Stream. In this area, the park-and-ride structure roughly parallels Waiawa Stream (Figure 4-62). This structure will require approximately six support columns (approximately 25 square feet each) to be located in the riparian area outside the OHWM but below the top-of-bank (TOB) line.

Construction of the elevated guideway at Pearl Highlands Station will result in one guideway support column (approximately 36 square feet constructed on a 10-foot drilled shaft foundation) and two station piers (approximately 25 square feet total) being placed close to the OHWM of Waiawa Springs located beneath the station structure. The impact area and fill for these columns are included in Table 4-30 because of their proximity to the springs. The location of the Pearl Highlands Station is designed to be in close proximity to the proposed park-and-ride lot as well as surrounding businesses. The piers near the Pearl Highlands Station cannot be relocated because they are supporting the guideway as it enters the station, as well as supporting a concourse, stairs, and escalators.

The springs (Site 13) in this case is at the end of a street drain passing under Kamehameha Highway. It would best be modified by constructing an extension of the existing pipe culvert to a point beyond the elevated station footprint. This new "outlet" would be located closer to Waiawa Stream where the TOB line and OHWM closely coincide along an erosion face created by the piers of the Farrington Highway bridge forcing the stream flow to the right (thus eroding the left bank). Extending the drain's outlet would have no consequences on spring-water contribution to Waiawa Stream and would reduce potential stream contamination in an area that would be too shaded by the station structure to support plant growth. A cut in the high bank already exists where the spring flow joins Waiawa Stream.

Approximately 5 acres near Waiawa Stream between Kamehameha Highway and Farrington Highway will be shaded by structures (a park-and-ride parking structure, bus transit center, station and guideway, and various pedestrian and vehicle access ramps), roughly one-third of the area (Sites 12 and 13). Direct impacts on the stream (including shading) would be minimal; most of the structures are on the north side of the stream. Waiawa Stream supports some native amphidromous fauna, and no part of the Project is anticipated to interfere with the local population of goby observed or migration through the site required by native macrofauna that may breed upstream.

To maintain floodway hydrology, it will be necessary to remove fill material from along Waiawa Stream in this area. Approximately 100 feet of the small tributary issuing from an existing drain (Site 13) will be confined within an extension of that drain pipe.

Moanalua Stream

To avoid impacts below OHWM in Moanalua Stream (300 feet wide) substantially different bridge types would be needed to clear span this stream. This stream is beyond the practical length limit for precast concrete girders (150 feet). Long spans could add $5 million to total project costs. For this reason, avoiding impacts below OHWM in these streams is not considered feasible.

Because of the 300-foot width of the channel where the guideway crosses Moanalua Stream, two guideway columns (approximately 36 square feet each on 5-foot drilled shaft foundations) will need to be constructed in the estuary (Figure 4-68). This location (Site 27) is makai of the H-1 Freeway ramp to Nimitz Highway. In this area, there exists multiple bridge crossings of Moanalua Stream, including Kamehameha Highway, the H-1 Freeway, Nimitz Highway ramps, and two pedestrian bridges makai of the project guideway crossing. The guideway columns will be aligned with the upstream viaduct piers, as feasible, to minimize obstruction of stream flow. This area is tidal and near the stream mouth at Keʻehi Lagoon. Placement of the piers is not expected to have any consequences on the Moanalua Stream estuarine environment or its fauna beyond a loss of 0.004 acre of sandy mud bottom. Because the guideway lies immediately south of the existing viaducts and will be elevated 50 feet above the water, shading on the estuary will be minimal.

Kapālama Canal Stream

The existing Dillingham Boulevard bridge over Kapālama Canal Stream will be widened makai. This will allow for construction of a new median in line with the guideway to maintain two through lanes and one dedicated left-turn lane for both directions of traffic. This will improve safety and enhance traffic flow. There will be impacts to Kapālama Canal Stream to extend the existing piers and abutments.

A design option was evaluated at this stream crossing to avoid impacts below OHWM that considered construction of the guideway on straddle bents located on each bank of the stream. The straddle bents would have been approximately 100 feet long to completely straddle Dillingham Boulevard. This option was not considered feasible for the following reasons:

- Construction of massive straddle bents would be difficult in this congested corridor
- The large straddle bents would require large and expensive drilled shaft foundations
- Overhead power lines would complicate construction
- The size of the straddle bents would have a considerable visual impact in this area

The Project crosses Kapālama Canal Stream at the Dillingham Boulevard Bridge with the guideway in the median of the Boulevard (Site 29; Figure 4-69). Although the guideway support columns will be located outside of Kapālama Canal behind the existing bridge abutments, the Dillingham Boulevard Bridge will need to be widened approximately 20 feet makai to accommodate a new median. In-water work will involve extending the four existing bridge piers and the two existing bridge abutments makai. Pier extensions will require eight additional piles placed in the stream (approximately 1.36 square feet each). The abutment and retaining walls will require approximately 30 cubic yards of fill on each site at the stream. The widening will allow Dillingham Boulevard Bridge to carry two through lanes, one left turn lane, and full-size sidewalks in both directions. Placement of the piers and fill is not expected to have any consequences on the Kapālama Canal Stream

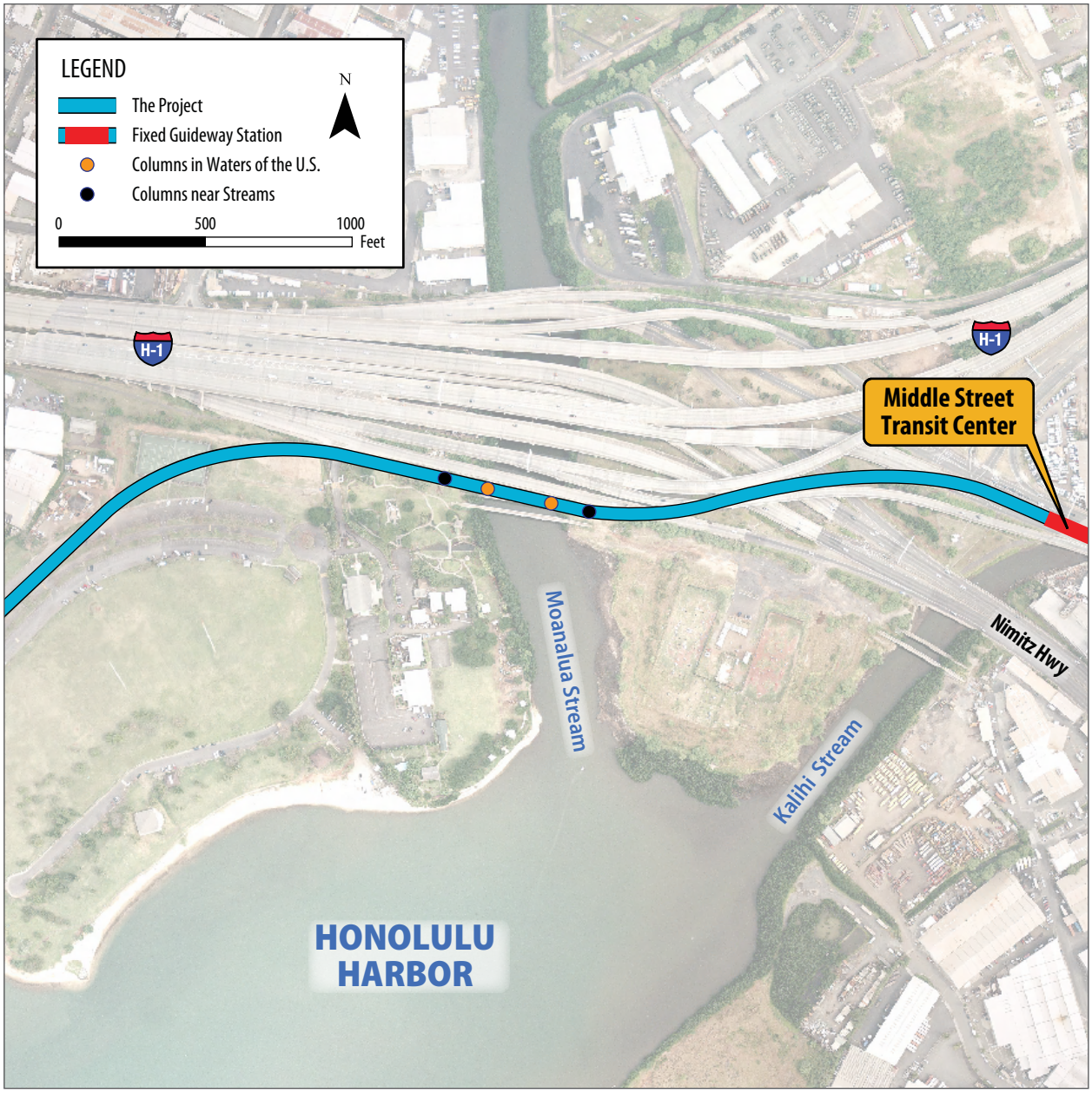

Figure 4-68 Moanalua Stream

estuarine environment or its fauna beyond the loss of 0.01 acre of silty sand bottom. Because the guideway is located over an existing solid bridge surface, shading effects will be minimal, although widening of the bridge makai will increase shading on this part of the canal.

Nu`uanu Stream

The Project will cross the mouth of Nu‘uanu Stream on the ‘Ewa side of the Chinatown Station between the inbound and outbound bridges of Nimitz Highway (Site 30; Figure 4-70). Two guideway support columns (approximately 36 square feet each on 10-foot drilled shaft foundations) will be constructed in the estuary. Columns are needed in this location to span the stream. In Nu‘uanu Stream, because of the presence of the Nimitz Highway lanes and ramps and the sewage treatment plant ‘Ewa of Nu‘uanu Stream, the location of guideway columns has

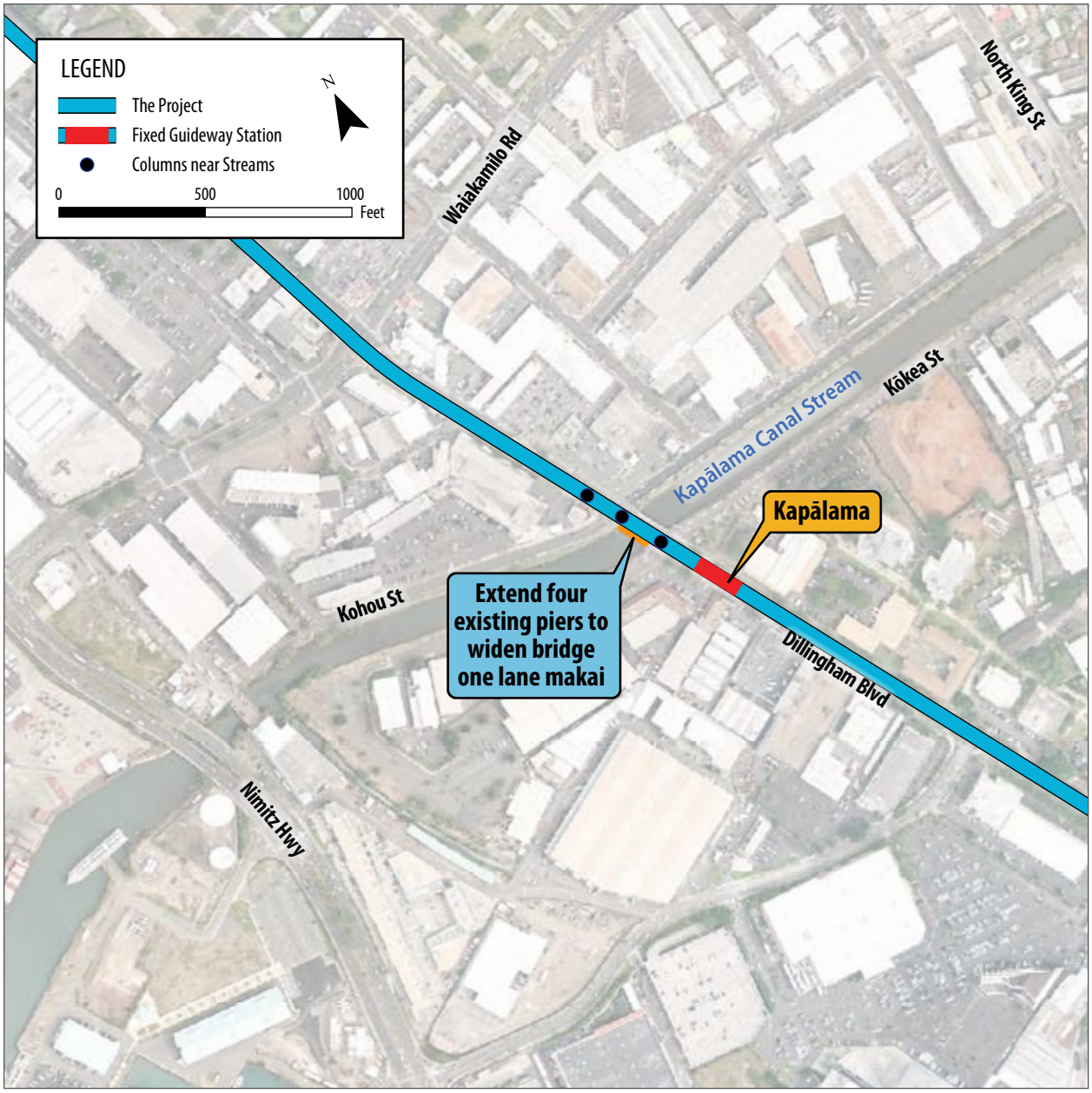

Figure 4-69 Kapālama Canal Stream

already been optimized to avoid the existing roads and facilities in this area while still accommodating a Chinatown Station on the Koko Head side of Nuʻuanu Stream. The columns will be designed to be in line with existing bridge piers in the stream, if feasible. Placement of the piers and fill is not expected to have any consequences on the Nuʻuanu Stream estuarine environment or its fauna beyond a loss of approximately 0.004 acre of silty sand bottom. Because the guideway is located between two existing bridges, shading effects will be minimal as the guideway shadow will be on one or the other of the bridges most of the time.

Wetlands

The project guideway will be built in the middle of Kamehameha Highway and will not place any structural elements in either Waiau Springs wetland (Site 15) or nearby Sumida Watercress Farm wetland (Site 17). The edge of the deck of

Figure 4-70 Nu`uanu Stream

the guideway will be approximately 50 to 60 feet from the makai edge of both of these wetlands. The edge of the roadway is approximately 20 feet from these wetlands. The guideway near ʻAiea Bay State Recreation Area (Sites 19 and 20) is approximately 200 feet from the tidal wetland there. The Project will have no impact on this wetland (Figure 4-66).

Maintenance and Storage Facility Stormwater Outfall

An outfall designed to handle overflow that exceeds the capacity of the stormwater detention basin from the preferred maintenance and storage facility site (Site 11A) will drain into Middle Loch of Pearl Harbor at Site 11B. To meet avoidance and minimization requirements, structural elements of the drain will not be placed in waters of the U.S. The system will have a permanent oil/water/sand separator prior to the outfall, and any discharge

entering Pearl Harbor will meet water quality requirements for the estuary (Figure 4-63). Impacts will be limited to infrequent flows generated by large storms. These treated flows will contribute fresh water to the Loch. However, Pearl Harbor is considered to be an estuary because of the restricted exchange with the Pacific Ocean through a narrow mouth and the substantial freshwater flows from a number of contributing springs and streams draining southern O'ahu.

Waiawa Wetland

As noted, there will be no physical impacts on this small wetland from the nearby guideway beyond shading. Because the shading effect will be similar for both wetlands, the discussion of this impact is deferred to the Sumida Watercress Farm Wetland.

Sumida Watercress Farm Wetland

As noted, there will be no physical impacts on this small wetland from the nearby guideway beyond shading. Although equations (and computer programs) exist to quantify shading from structures, the results are not easily simplified for discussion. A primary reason for the complexity is that the shadow created by the guideway in this or any other location will be slightly different each hour of the day and each day of the year. Furthermore, unlike a building or wall of comparable dimensions, the elevated guideway is open underneath. Nonetheless, a general description of the shadow path across the Sumida Wetland site can be offered and assessed on a daily and seasonal basis.

The guideway will be elevated approximately 30 feet above the highway and extend upward roughly another 10 feet. It will be this "wall" at between 30 and 40 feet above Kamehameha Highway that will cast the major shadow on surrounding areas. The horizontal distance from the guideway to the nearest Sumida Watercress pondfield is about 70 feet. Since the guideway will be a continuous structure oriented WNW-ESE, its shadow will be a band across the ground, the size and location of which is a function of the angle of the sun.

This shadow will change throughout the day—a low sun angle in the early morning and late afternoon will generate a broad shadow band distant from the guideway in a direction opposite from the sun's position in the sky. In the summer, the sun angle at all times will generate a shadow either to the south (away from the wetland) or more or less parallel with the guideway. Only in the several months before and after the winter solstice will a shadow be cast to the north, potentially falling on some pondfields. The longest shadows will be cast in the morning and afternoons because at those times the sun is low on the horizon. The longest noon shadow will occur on the winter solstice (December 21); on that date the guideway shadow band will lie between 69 and 92 feet north from the guideway, or just reaching into the nearest pondfield 70 feet distant. Of course, on that date (as on all others), the structure's shortest shadow will occur when the sun is highest in the sky around noon, so perhaps the clearest way to quantify the shadow's extent relative to the watercress growing areas is to consider the time of day that the shadow leaves (in the morning as the sun rises) and enters (in the afternoon as the sun sets) the pondfields closest to the guideway.

Note first that between early March and mid-October of every year, the shadow does not reach the watercress growing areas (except perhaps briefly right after sunrise and just before sunset). From mid-October through late December, the shadow will move back from the pondfields progressively later in the morning and appear progressively earlier in the afternoon, a trend that will reverse after December 21. The impact of shadowing will be greatest during the months of December and January when some pondfields will remain in shadow up to about 9 a.m. and will be in shadow after 4 p.m. For the months of November

and February, shadowing should end after about 8:30 a.m. and return around 4:30 p.m.

Consideration of whether such a shadow will measurably reduce primary productivity in plants subjected to shadow complicates the assessment further. A shadow does not represent an area of no light (as is the case at night in the earth's shadow), but an area of reduced light similar to a cloudy day because sunlight is scattered by the atmosphere.

Further the movement of the sun will keep the shadow moving throughout the daylight hours, so no single location or plant will experience continuous shading over an extended period (as would be the case underneath elevated building platforms at Sites 12 and 13). When the shadows from the guideway are longest (at lowest sun angles), the nearest pond fields will receive light coming under the guideway

Flood Zones

As a linear feature, the guideway will cross several floodplains in Waipahu and Pearl Highlands. However, the Project will not cause significant floodplain encroachment as defined by USDOT Order 5650.2. The guideway and many stations will be elevated above the floodplain by piers, but some facilities, such as stairs, elevators, and traction power substations, will have to be built at ground level. These features could have minor effects on floodplains, depending on how and where they are placed within a floodplain (Figures 4-67). However, any such changes caused by the Project will be mitigated through design to comply with current flood zone regulations.

The fixed guideway will provide a safe alternative to surface transportation during storms. No likely future damage associated with floodplain encroachment is anticipated that could be substantial in cost or extent.

There will be no notable adverse impacts on natural and beneficial floodplain values. The major beneficial functions for the floodplains analyzed in the study corridor are the recharge of groundwater and drainage conveyance. There will be no impact to water levels in flood zones.

Stormwater

Pollution prevention BMPs, such as regular inspection and cleaning of the drainage system, will need to be a part of the stormwater management plan that will be developed during Final Design. Permanent BMPs will be needed for the maintenance and storage facility and the park-and-ride facilities. Permanent BMPs will also be installed for stormwater that drains from the guideway at all crossings of waterbodies.

In some instances, the discharge of stormwater may increase stormwater inflow to some waters as a result of rainfall collecting on impervious surfaces where infiltration currently occurs. However, because stormwater quality is not expected to be adversely affected, no streams or downstream marine waters are expected to experience negative effects.

Stormwater runoff will be filtered through landscaped median areas and sedimentation collars where possible. Stormwater will be filtered through specially designed bioinfiltration units near water bodies on the HDOH 303(d) list of water quality-limited segments (specifically Sites 4, 12, 18, and 19). In locations where space does not allow for their use, downspout filters will be installed on drains near impaired waters (Sites 7 and 30).

Permanent BMPs will be installed as part of the Project to address stormwater quality before the water is discharged to streams or existing storm drain systems. The BMPs will promote a natural, low-maintenance, sustainable approach to managing and increasing stormwater quality. At a minimum, all stormwater downspouts from

the guideway will include erosion control BMPs and energy dissipation devices to prevent any scour of landscaped medians. An integral part of the permanent BMPs will be an inspection and maintenance plan to ensure that the BMPs operate as designed.

Permanent BMPs will be used to reduce typical pollutants associated with runoff from the park-and-ride and the maintenance and storage facilities before it enters State waters to the maximum extent practicable. The permanent storm water BMPs will be designed, installed, and maintained in accordance with the criteria and guidelines described in the respective authority having jurisdiction of the storm water management plan. Types and sizes of permanent storm water BMPs will depend upon the runoff quality and water quality requirements of each receiving water body.

Permanent BMPs, such as bioretention areas, vegetated buffer strips, dry swales, water quality basin, and structural BMPs with oil/water separators, will be considered, as needed, during the park-and-ride site and the maintenance and storage facility design process. Selection of permanent BMPs will be site-specific and may be modified as a result of geotechnical data collection during final design. Proper training, maintenance, and reporting of the permanent BMPs will also be needed for the long-term success of the stormwater pollution reduction efforts.

Groundwater

The Project meets the coordination requirements of Section 1424(e) of the Safe Drinking Water Act, in accordance with the 1984 Sole Source Aquifer Memorandum of Understanding between the EPA and the USDOT. A Water Quality Impact Assessment was reviewed by EPA, and EPA concurred that contamination of the Southern O'ahu Basal Aquifer will not occur (letter dated March 27, 2009, located in Appendix F). The construction methods and BMPs employed and the presence of an upward hydraulic gradient in much of the study corridor will protect the groundwater, and there will be no adverse effect to groundwater quality.

The Project will increase impermeable surfaces at the maintenance and storage facility and park-and-ride lots and redirect runoff. By installing permanent BMPs, most of the runoff will be directed back into the ground to recharge the groundwater system, resulting in little change in the amount of infiltration. In this way, although runoff from surrounding surfaces may enter the groundwater system along a different path than previously, the groundwater recharge needed to sustain the aquifer system will continue. Therefore, the Project will not result in any long-term changes to groundwater levels. Runoff from the guideway itself is expected to be relatively free of pollutants and will not threaten groundwater quality. Permanent BMPs, such as oil-water separators, will be used in areas where contamination is present to protect groundwater quality. If artesian conditions are encountered during construction, mitigation will be provided to prevent contamination of the aquifer (Section 4.18).

Coastal Zone Management Area

The Project is consistent with the objectives and policies of the State's CZM program, as described in the following text.

Recreational Resources

The Project will improve access to existing and future park and recreational facilities along the alignment (see Section 4.5 and Chapter 5 of this Final EIS for more information).

Historic Resources

No historic resources that are completely coastal in origin (lighthouses, shipyards, etc.) will be affected by the Project. For a full discussion of historic resources, see Section 4.16 and Chapter 5 of this Final EIS.

Scenic and Open Space Resources

Scenic impacts associated with the Project include potential removal or relocation of Exceptional Trees, a change in the setting of a historic resource or cultural site, alteration of ʻEwa-Koko Head and mauka-makai views, and the introduction of project components that are out of scale or character with their setting. The guideway will be visible from some coastal areas and affect views. However, areas where one can clearly see the guideway from the shoreline are already urbanized. Section 4.8 of this Final EIS describes visual impacts.

Coastal Ecosystems

Portions of the Project are in the SMA. An SMA permit will be obtained from DLNR. The only project element in the Shoreline Setback Area will be an emergency stormwater overflow outfall from the Leeward Community College maintenance and storage facility site that will drain into Pearl Harbor. The outfall is being designed with a permanent oil/water/sand separator, and any discharge entering Pearl Harbor will meet water quality requirements for the estuary. Construction impacts that could affect coastal water quality will be mitigated, as described in Section 4.18 of this Final EIS.

Economic Uses

To accomplish the economic development objectives for Oʻahu's urban corridor, suitable infrastructure must be developed, as described in Section 4.3. The Project will result in improved infrastructure and long-term benefits to residents, businesses, and commuters. The Project will not adversely affect coastal-dependent economic activities.

Coastal Hazards

The Project is not located in a tsunami evacuation zone and will not affect coastal hazards (RTD 2008m).

Managing Development

The Project will require State and City permits and approvals that include provisions for public participation and ensure protection of coastal resources (see Section 4.21). The Project will also provide necessary infrastructure to accommodate existing and planned future travel demand, as described in Chapter 3.

Public Participation

Agencies, non-governmental groups, and the public have been engaged throughout the Project's planning process, as required by Federal and State law. For more details on public participation opportunities, see Chapter 8, Comments and Coordination.

Beach Protection

The Project will not affect coastal erosion or Oʻahu's beaches.

Marine Resources

The Project is not adjacent to or abutting a shoreline and will not affect marine resources. The only structure near a beach is a stormwater outfall at the maintenance and storage facility site near Leeward Community College, located at the Middle Loch of Pearl Harbor.

Mitigation

Surface and Marine Waters

Water resource mitigation is being proposed to compensate for the 0.02-acre permanent encroachment into waters of the U.S from the linear transportation features of the Project and 0.06 acre of impact from other Project elements (culvert improvement at Waiawa Springs). Construction phase mitigation measures are discussed in Section 4.18. The mitigation measures presented here satisfy the requirements established by 33 CFR 325 and 332, and 40 CFR 230 (Subpart J: Compensatory Mitigation for Losses of Aquatic Resources). These mitigation measures are presented only after measures to fully avoid the water feature have

failed and only after all measures have been taken to minimize encroachment.

Permanent mitigation features are proposed at Waiawa Stream, within the Pearl Highlands Station (Figure 4-62). This 11-acre site provides sufficient space for mitigation since only approximately 5 acres will be required for the station, leaving the remainder of the site available for mitigation. Regulations suggest, but do not require, mitigation within the same watershed. Impacts from the Project amount to several small impacts in different watersheds. Individually these would be difficult to mitigate separately (i.e., keep within the same watershed as the impact) to achieve lasting compensation. Impacted watersheds could be more broadly defined on the basis of the nearby receiving waterbody for the impacted estuary; these are Pearl and Honolulu Harbors and Keʻehi Lagoon. Of the three, Pearl Harbor has the greatest potential for benefit from a mitigation effort directed at improving function within a contributing stream system. This is because it is the largest of the estuarine environments (i.e., of a type closer to the environments impacted) and is the most enclosed. As a result, it is more sensitive to land impacts than Keʻehi Lagoon or Honolulu Harbor. The proposal is to consolidate mitigation to a single site (Site 12) on Waiawa Stream.

Waiawa Stream has been selected over an estuary location because of the availability of land that is part of the Project where enhancement of the stream and potential establishment of a riverine wetland are possible with a high degree of long-term success. The mitigation area would become part of the Project. Although the Project will have minimal effect on the stream at Site 12, it will have a considerable effect on the riparian area at that location. Further, if the "spring" located here (Site 13) is jurisdictional and Kaloʻi Gulch is not, the impact area of constructing a culvert to direct spring flow away from beneath the Pearl Highlands Station comprises about 30 percent of the acreage of the permanent project impacts. Mitigation can also be used as a design element to enhance the natural setting of the station.

Mitigation proposed for the Waiawa Stream mitigation site includes the following:

- Enhancement of the stream to restore and/or improve ecological and aquatic function
- Establishment of wetlands
- Enhancement of floodway capacity conveyance to achieve zero rise in flood zone by removal of fill and an increase in stream area
- Relocation of Waiawa Stream to its original location
- Extension of existing culvert to Waiawa Stream to correct existing ponding situation
- Ecological restoration with native Hawaiian plantings and use of non-invasive species

Details will be developed during the permitting phase.

Where the Project crosses an estuary reach and placement of support columns below the OHWM cannot be avoided, the columns will align with existing columns, where feasible. As these columns are not anticipated to adversely affect flood flow, fish passage, or long-term water quality, no mitigation is planned (see Section 4.18 for mitigation during construction).

In one instance (Waiawa Stream, Site 12), a relatively natural riparian zone still exists and may be affected by the Project. These impacts include shading from five bridge structures, permanent removal of vegetation underneath raised structures, and the placement of support columns in the riparian area outside the stream channel. These impacts could reduce vegetative cover and lead to increased bank erosion in some areas. Mitigation for these impacts will include restoration of portions of the stream bank and riparian zone where previous land tenants have placed fill material, as well as natural

landscaping of riparian areas along the entire stream affected by the Project.

Stormwater

Permanent BMPs will be installed on all stormwater outfall structures associated with the Project and incorporated into the design, as discussed in this section and Section 4.17.2 for the maintenance and storage facility. Temporary BMPs for the management of stormwater during construction are discussed in Section 4.18.

Wetlands

Since there are no significant impacts to wetlands, no mitigation is required (see Section 4.18 for mitigation during construction). Although some shading impacts to wetlands are anticipated, these are minimal and limited to increased duration of early morning and late afternoon shadows during several mid-winter months (in the case of Sites 15 and 17).

Flood Zones

Since the Project will be designed to meet these requirements when constructed in a floodplain, no mitigation will be required.

Groundwater

Because no impacts to groundwater, artesian resources, or the Southern Oʻahu Basal Aquifer are expected, no mitigation other than the BMPs discussed above and in Section 4.18 will be required.

Approach to USACE Permitting

In consideration of the level of impacts described above, the use of Nationwide Permits is proposed. Water resource impacts are small enough that this permit approach may be suitable to the level of impact requiring regulation. Current Nationwide Permits expire in 2012, so permitted work requiring construction after 2012 will either require coverage under renewed Nationwide Permits or under an individual permit to be obtained at that time. Should future discussions with the USACE indicate that an Individual Permit should be pursued, USACE requirements will be followed.

The City and County will obtain USACE permits for all phases of construction as presented in the Final EIS. Should a contractor propose work beyond the scope of those existing City and County permits, the work will only be allowed after approval from the City and County. If the City and County approves, the contractor will be required to prepare the necessary permit modifications. The City will be responsible for implementing all mitigation measures resulting from this permit modification process.

USACE permits contain legally enforceable conditions. The Record of Decision to be issued that indicates acceptance of the Final EIS also establishes a legally enforceable mechanism to ensure that committed mitigation measures are implemented. Means are available to regulate contractor-proposed changes to issued permits.

4.14.4 404(b)(1) Analysis

The regulatory requirements of the Section 404(b)(1) analysis are stated in Section 4.14.1. For this Project, the proposed modal options, transit technologies, and alignments that exhibit the least overall adverse environmental harm must be examined in the context of "practicability" prior to elimination from further consideration. Practicable is defined as "available and capable of being done after taking into consideration cost, existing technology and logistics in light of overall project purposes."

Chapter 2 discusses a wide range of alternatives and documents the basis of those modal options, transit technologies, and alignments that were eliminated from consideration. Many alternatives were eliminated from consideration prior to entering the Alternatives Analysis. Of those alternatives that entered the Alternatives Analysis, neither the Managed Lane Alternative nor the Transportation

System Management Alternative would have met the Project's Purpose and Need. As a result, these two alternatives would not have been practicable per Section 404(b)(1) requirements. During this process, aquatic resources were considered qualitatively as there is no substantial difference between alternatives, which all would cross waters of the U.S. throughout the corridor. In addition, their comparative severity of impact to waters of the U.S. was not a differentiating factor among them. The Alternatives Analysis concludes that the Fixed Guideway Alternative meets the Project's Purpose and Need (Chapter 2) and is, therefore, the sole remaining practicable alternative.

Subsequent to the Alternatives Analysis, the differing transit technologies were evaluated on the basis of performance, cost, and reliability (Chapter 2). Steel wheel on steel rail was selected as the Preferred Alternative because it is mature, proven, safe, reliable, economical, and non-proprietary. For these reasons, the other technologies are not considered practicable per the Section 404(b)(1) requirements.

Following the screening of technologies, only four alternatives were evaluated in the Draft EIS, all using steel wheel on steel rail technology. The encroachment into waters of the U.S. of each alternative is summarized below:

- No Build Alternative—no encroachment from the Project
- Fixed Guideway via Salt Lake Boulevard—encroachment during construction: 0.18 acre; permanent encroachment: 0.03 acre
- Fixed Guideway via the Airport—encroachment during construction: 0.13 acre; permanent encroachment: 0.02 acre
- Fixed Guideway via the Airport & Salt Lake—encroachment during construction: 0.19 acre; permanent encroachment: 0.03 acre

The Airport Alternative has been identified as the Preferred Alternative (Chapter 2). Of the three fixed guideway alternatives addressed in the Draft EIS, the Airport Alternative encroaches the least into waters of the U.S. during both construction and operation (0.06 acre less and 0.01 acre less than both of the other alternatives, respectively). Consequently, the Airport Alternative is the LEDPA under the Section 404(b)(1) analysis.

Further discussion of the differences between the Airport Alternative and the Salt Lake Alternative with respect to impacts on water resources is provided below.

Each alternative would cross a total of 20 streams, 19 of them the same (although two are at different locations on Hālawa and Moanalua Streams). Seventeen of the 19 streams would be crossed in approximately the same manner with regard to clear-span versus piers below OHWM. The Salt Lake Alternative would have crossed Kahauiki Stream, and the Airport Alternative will cross Aolele Ditch.

Both alignments would require guideway columns in Moanalua Stream. The Airport Alternative's span over Moanalua Stream (Site 27) will be near the mouth of the stream on the downstream side of the H-1 Freeway ramp to Nimitz Highway. It will require two piers be placed in the stream. As much as feasible, these columns will be aligned with the supports for the many other viaducts supporting the H-1 Freeway and its access ramps to avoid impacts to stream flow. The Salt Lake Alternative would have crossed Moanalua Stream farther inland (Site 24), approximately 500 feet downstream of where Kikowaena Street crosses. No columns would be located in the stream. The guideway would also cross over the tributary Kahauiki Stream (Site 26), spanning it without columns in the channel.

Both alternatives would span Hālawa Stream but at different locations. The Project will cross Hālawa Stream between the Kamehameha Highway

bridges (Site 22). The Salt Lake Alternative would cross at Salt Lake Boulevard (Site 23) over a concrete-lined channel. The Project site crossing at Kamehameha Highway spans a tidally influenced waterway.

Aolele Ditch will be spanned by the Project. Aolele Ditch is a man-made trapezoidal flood-control canal that parallels Aolele Road flowing Koko Head under Lagoon Drive into Keʻehi Lagoon. It receives drainage from the commercial district up to Nimitz Highway, as well as runoff conveyed in storm drains from portions of the airport.