

Natural Resources Technical Report Honolulu High-Capacity Transit Corridor Project

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Acronyms Used in this Document

| | |
|--------|--|
| AA | Alternatives Analysis |
| AASHTO | American Association of State Highway and Transportation Officials |
| ALISH | Agricultural Lands of Importance to the State of Hawai‘i |
| BA | Biological Assessment |
| BMP | Best Management Practices |
| CFR | Code of Federal Regulations |
| DA | Department of the Army |
| DAR | Division of Aquatic Resources |
| DLNR | Department of Land and Natural Resources |
| DP | Development Plan |
| DTS | Department of Transportation Services |
| FEMA | Federal Emergency Management Agency |
| FFPA | Federal Farmland Protection Act |
| DOFAW | Division of Forestry and Wildlife |
| FIRM | Flood Insurance Rate Map |
| FTA | Federal Transit Administration |
| GIS | Geographic Information System |
| GPS | Global Positioning System |
| HBMP | Hawai‘i Biodiversity and Mapping Program |
| HCP | Habitat Conservation Plan |
| HECO | Hawaiian Electric Company |
| HRT | Honolulu Rapid Transit |
| LPA | Locally Preferred Alternative |
| MMPA | Marine Mammal Protection Act |
| NFIP | National Flood Insurance Program |
| NOAA | National Oceanic and Atmospheric Administration |
| NMFS | National Marine Fisheries Service |
| NPDES | National Pollution Discharge Elimination System |
| NRCS | Natural Resources Conservation Service |
| OMPO | O‘ahu Metropolitan Planning Organization |
| ORTP | O‘ahu Regional Transportation Plan |

| | |
|-------|---------------------------------------|
| OTS | O‘ahu Transportation Study |
| OTPP | O‘ahu Transportation Project Plan |
| PHNWR | Pearl Harbor National Wildlife Refuge |
| ROW | Right-of-Way |
| RTP | Regional Transportation Plan |
| TSM | Transportation System Management |
| UBC | Uniform Building Code |
| UH | University of Hawai‘i |
| USDA | U.S. Department of Agriculture |
| USFWS | U.S. Fish and Wildlife Service |
| VMT | Vehicle Miles Traveled |
| WQC | Water Quality Criteria |

This report provides an evaluation of potential impacts and mitigation measures related to natural resources to support the Alternatives Analysis (AA) for the Honolulu High-Capacity Transit Corridor Project. The project area is an approximately 23-mile-long transit corridor from Kapolei on the western end of the 'Ewa Plain to the University of Hawai'i, at Mānoa, (UH Mānoa) in Honolulu. The four alternatives being considered are as follows:

- No Build Alternative
- Transportation System Management Alternative
- Managed Lane Alternative
- Fixed Guideway Alternative

This report was prepared to evaluate each alternative's potential impacts on natural resources within the corridor so that they could be compared and evaluated. The natural resources evaluated include geology and natural hazards (flood, tsunami, and earthquake), farmlands, wildlife biology (birds), and vegetation biology (including street trees).

Alternative 1: No Build

The No Build Alternative includes no new construction related to this project; however, other projects defined in the 2030 O'ahu Regional Transportation Plan (ORTP) would proceed as planned. Although this project includes no impacts on the project area, by 2030, the project corridor would be more urbanized than it is currently, especially in the 'Ewa and Kapolei areas, reducing the amount of farming, open space, and habitat for wildlife and plants.

Alternative 2: Transportation System Management

No major construction projects would be undertaken under the Transportation System Management (TSM) Alternative. The TSM Alternative would provide an enhanced bus system based on a hub-and-spoke route network, convert the present morning peak-hour-only zipper lane to both a morning and afternoon peak-hour zipper-lane operation, implement relatively low-cost capital improvements on selected roadway facilities to give priority to buses, and complete the projects defined in the O'ahu 2030 RTP.

Because of the limited nature of actions proposed under the TSM Alternative, no major impacts on natural resources are expected, both in the long-term and the short-term. Similar to the No Build Alternative, the project corridor would become more urbanized than it is currently, especially in the 'Ewa and Kapolei areas, reducing the amount of farming, open space, and habitat for wildlife and plants.

Alternative 3: Managed Lane

The Managed Lane Alternative has two possible modes of operation: 3a - the two-direction option and 3b - the reversible lanes option. The main difference between the two is that the two-direction option requires an approximately 50-foot-wide structure and the reversible lane option requires an approximately 40-foot-wide structure. In both cases, the bottom of the structure would average between 17 and 30 feet above ground level. Under both alternatives, an approximately 13 mile-long elevated structure would be constructed, extending from Waipahu to Downtown Honolulu, primarily above the median of existing roadways in heavily developed areas.

Impacts on natural resources by either Alternative 3a or 3b are expected to be minor and primarily affect vegetation, particularly street trees. No direct impacts on natural hazards, farmlands, or wildlife are anticipated. A possible indirect impact on farmland, street trees, and vegetation in general is the shade that would be produced by the managed-lane structure. If the Managed Lane Alternative is selected as the Locally Preferred Alternative (LPA), a “shadow analysis” may be necessary to determine if sunshine would be reduced, particularly at the Waiiau Stream taro patch and the Sumida Watercress Farm on Kamehameha Highway. Possible direct impacts on street trees would likely include the following:

- Removal of the five notable monkeypod trees at the intersection of Nimitz Highway and Sand Island Access Road
- Removal, transplanting, or trimming of some trees on the Aloha Stadium property and inside Pu‘uwai Momi Apartments (low-income housing) property
- Transplanting of fan palms and shower trees on Kamehameha Highway in the vicinity of the Arizona Memorial
- All 83 trees on the mauka side of Nimitz Highway between Kamehameha Highway and Middle Street would be affected.
- Some scrambled egg trees, coconut and Manila palms, shower trees, and kou trees in the median of Nimitz Highway east of Middle Street would be affected.

Impacts on street trees could result in secondary impacts on wildlife. Street trees with large canopies provide ideal roosting and nesting sites for white terns, a state threatened species. Although no white terns were observed along the Alternative 3 alignment during this study, the habitat is available and terns could use it in the future.

Alternative 4: Fixed Guideway

The Fixed Guideway Alternative involves construction of an approximately 23-mile-long fixed guideway from Kapolei to UH Mānoa. A number of possible alignments are under consideration. The fixed guideway would be elevated along most or all of its length. Because of its length and associated park-and-ride lots, maintenance facilities, and transit centers, the Fixed Guideway Alternative would result in a greater natural resource impact than the other three alternatives.

Similar to the other alternatives, the Fixed Guideway Alternative is not expected to impact natural hazards.

The Fixed Guideway Alternative would impact farmlands and wildlife in the 'Ewa area; however, all areas currently under cultivation or occupied by kiawe woodlands in the 'Ewa Plain may be developed in the near future whether this project proceeds or not. Some lands in the 'Ewa Plain that are categorized as Prime or Unique farmlands have already been developed for urban uses. Also, as discussed above, under the Managed Lane Alternative, a shadow analysis to evaluate impacts on farmland may be necessary during preparation of the Environmental Impact Statement (EIS) for the LPA to determine if sunshine would be reduced, particularly at the Waiiau Stream taro patch and the Sumida Watercress Farm. Because the fixed guideway structure would be taller than the managed lane structure, it could have a greater shadow impact.

The Fixed Guideway Alternative would have limited impact on vegetation in open areas of the 'Ewa Plain. Most of the area has been heavily disturbed by farming in the past, but a few native species are present, including 'ilima, 'uha-loa, ko'oloa-'ula (*Abutilon menziesii*), and kauna'oa-pehu. *Abutilon menziesii* is an endangered species and is known to be present at the southern end of North-South Road. A "Habitat Conservation Plan for *A. menziesii* at Kapolei" already exists.

Street trees would also be affected by the Fixed Guideway Alternative. Because this alternative would extend farther into the city of Honolulu, it would have more impacts on street trees than the Managed Lane Alternative. Street tree impacts depend largely on the alignment selected.

Possible impacts on natural resources are discussed below within the geographical area in which they would occur.

Section I. Kapolei to Fort Weaver Road

The four alignments are similar in their potential impacts on natural resources, with each having the following individual characteristics:

- The Kamokila Boulevard/Farrington Highway alignment would not impact the *A. menziesii* population but would impact some of the 294 street trees on Kamokila Boulevard.
- The Kapolei Parkway/North-South Road alignment could impact the *A. menziesii* population.
- The Saratoga Avenue/North-South Road alignment could impact the *A. menziesii* population.
- The Geiger Road/Fort Weaver Road alignment would not impact the *A. menziesii* population and is the only alignment that would not impact any active farmlands. However, some of the 286 street trees on Fort Weaver Road would be impacted, including the one notable banyan in the median near old Fort Weaver Road.

Section II. Fort Weaver Road to Aloha Stadium

There are no alternative alignments in Section II. Possible impacts along the alignment include shading of farms as discussed above. In addition, some impacts on street trees along the alignment would likely occur. Many new plantings along the median of Farrington Highway in Waipahu would likely be affected, but there are few street trees along Kamehameha Highway and none of them are in the median.

Section III. Aloha Stadium to Middle Street

The four alignments are similar in their potential impacts on natural resources, with each having the following individual characteristics:

- The Salt Lake Boulevard alignment would result in the fewest number of impacts on street trees.
- The alignment makai of the airport viaduct could impact some street trees, but fewer than the mauka alignment. A few street trees along this alignment are potential nesting and roosting sites for white terns.
- The alignment mauka of the airport viaduct would impact more street trees than the makai alignment. A few street trees along this alignment are potential nesting and roosting sites for white terns.
- The Aolele Street alignment contains more street trees, but few of them are in the median and some of those are Indian Coral trees that are already in poor condition as a result of a Gall Wasp infestation. Some street trees along this alignment are potential nesting and roosting sites for white terns.

Section IV. Middle Street to Iwilei

The two alignments in this section have similar potential impacts on natural resources. The North King Street alignment has more street trees, but only two of them are considered notable. The Dillingham Boulevard alignment has fewer trees, but most of them are considered notable. None of the street trees along either alignment are in the median, but shoulder trees would be affected by road widening.

Section V. Iwilei to UH Mānoa

The five primary alignment options and one spur in this section of the Fixed Guideway Alternative have similar impacts. All alignments would impact some street trees, and some street trees along all of the alignments are potential white tern roosting and nesting habitat. Specifics of each alignment are discussed below.

- The four alignments that include Kona Street (Ala Moana Center) all have similar impacts. Ten notable monkeypod trees in the median of Kona Street, seven notable monkeypod trees in the median along Kapi‘olani Boulevard, and several relatively new shower trees in the median of University Avenue would be affected. Some large trees planted on the shoulder along each alignment would also be affected, but probably to a lesser degree than the trees planted in the medians.

- The Beretania Street/South King Street alignment contains more total trees and more notable trees than the other four primary alternatives, but none of the trees are in the median and therefore impacts on them would be less.
- The Waikīkī Spur alignment contains more street trees than the primary routes, including 10 exceptional mahogany in the median of Kalākaua Avenue and many relatively new plantings in the median of Kūhiō Avenue.

Mitigation

Mitigation measures would be straight-forward and easy to manage. No mitigation would be necessary for Alternatives 1 and 2. The following sections summarize some mitigation related to certain impacts that could result from Alternatives 3 and 4.

Wildlife

Suitable trees for white tern nesting and roosting are present throughout Downtown Honolulu. The relatively small number of trees removed or trimmed should not have a significant impact on the terns, and no immediate or direct mitigation is needed. Street trees and plantings are discussed below.

Tree removal and trimming during construction and maintenance along both the Managed Lane and Fixed Guideway Alternatives would need to take into account the potential presence of roosting or nesting white terns. In areas of urban Honolulu east of Hickam Air Force Base to Waikīkī, mature street trees provide ideal nesting habitat for white terns. To prevent possible impacts on this state-listed threatened species, it is recommended that tree removal or trimming be conducted (a) during fall and early winter when fewer white terns are nesting, (b) after the trees have been inspected for the presence of terns and none were found, and (c) after any white tern chicks present have fledged.

Vegetation

The only known threatened or endangered vegetation that could be affected by any of the alternatives is the population of ko‘oloa-‘ula (*A. menziesii*) at the south end of North-South Road. This population would only be affected if certain alignments of the Fixed Guideway Alternative were selected. If one of the alignments that could affect this population is selected or if another population of threatened or endangered vegetation is encountered during more detailed EIS studies, a habitat conservation plan would be developed and followed.

As part of the environmental planning for North-South Road and a portion of Kapolei Parkway, a “Habitat Conservation Plan for *Abutilon menziesii* at Kapolei” was finalized in March 2004. Mitigation measures have already been specified for those populations of *A. menziesii* related to the construction of North-South Road. Two proposed alignments include North-South Road as an easement. Future construction on North-South Road for the proposed fixed guideway system should consider the impact it may have on the *A.*

menziesii population, including possible shading of the population and secondary disturbance due to dust and debris from construction.

A landscaping plan would be prepared during final design to replace common weedy species that would be removed with similar, more aesthetically pleasing or native vegetation. The new vegetation will be designed to serve a number of purposes, including habitat restoration, erosion control, and beautification.

Street Trees

A tree preservation plan would be developed to minimize and mitigate impacts on street trees. In general, healthy mature trees that are notable or otherwise distinctive would be kept in place where possible; other trees may need to be removed (or transplanted, if viable) and replaced with new landscaping appropriate to the area and new structure, depending on which alternative is selected. In addition, tree project zones would be established during construction.

The landscaping plan for the project, discussed above, would include the planting of new street trees in areas where existing ones had to be removed and could not be transplanted.

Table S-1 summarizes potential impacts on natural resources by alternative.

Table S-1. Natural Resources-Potential Impacts Summary

| Alternative | Geology and Natural Hazards | Farmlands | Wildlife | Botanical Resources | Street Trees |
|--|-----------------------------|---|--|--|--|
| Alternative 1: No Build Alternative | | | | | |
| No Build Alternative | None | None | Introduced birds associated with kiawe woodland, agriculture and open fields would be lost to urbanization | Loss of some vegetated open spaces to urbanization | None |
| Alternative 2: TSM Alternative | | | | | |
| TSM Alternative | None | None | Same as No Build | Same as No Build | None |
| Alternative 3: Managed Lane Alternative | | | | | |
| 3a. Two-direction Option | | | | | |
| Waiawa IC to Hālawā Stream | None | Shadow impacts analysis recommended; may cause more shadow than Reversible option | No impact on common introduced birds; no sensitive species present | May impact Waiawa Stream vegetation | Possible impact on trees at Aloha Stadium and Pu'uwai Momi Apartments. On Kamehameha Highway near Arizona Memorial, transplant fan palms and shower trees. Transplant 10 Queen Palms on Nimitz Highway. Remove five notable monkeypods on Nimitz Highway at Sand Island Access Road. |
| Hālawā Stream to Pacific Street | None | None | White tern | None | |
| 3b. Reversible Option | | | | | |
| Waiawa IC to Hālawā Stream | None | Shadow impacts analysis recommended | Same as Alternative 3a | Same as Alternative 3a | Same as Alternative 3a |
| Hālawā Stream to Pacific Street | None | None | Same as Alternative 3a | None | |

| Alternative | Geology and Natural Hazards | Farmlands | Wildlife | Botanical Resources | Street Trees |
|--|-----------------------------|--|------------------|--|---|
| Alternative 4: Fixed Guideway Alternative | | | | | |
| Section 1. Kapolei to Fort Weaver Road | | | | | |
| Kamokila Boulevard/ Farrington Highway | None | Impacts on leased agricultural lands makai of Farrington Highway | Same as No Build | Disturbance and loss of native and weedy species | Impact to Indian Coral trees on Kapolei Parkway; Transplant 76 Kamani trees |
| Kapolei Parkway/ North-South Road | None | Impacts on leased agricultural lands makai of Farrington Highway | Same as No Build | Loss of weedy plant species. Incidental take license needed for possible disturbance to <i>Abutilon menziesii</i> population | Impact to Indian Coral trees on Kapolei Parkway; Transplant 7 monkeypod trees |
| Saratoga Avenue/ North-South Road | None | Impacts on leased agricultural lands makai of Farrington Highway | Same as No Build | Loss of weedy and possible native species. Incidental take license may be needed for possible disturbance to <i>Abutilon menziesii</i> population) | Impact to Indian Coral trees on Kapolei Parkway; Other impacts undetermined; additional fieldwork necessary; possible impacts on canopy trees |
| Geiger Road/Fort Weaver Road | None | None | Same as No Build | Loss and disturbance of weedy and possible native species | Impact to Indian Coral trees on Kapolei Parkway; transplant all street trees in Fort Weaver Road median; remove one notable monkeypod. Impacts undetermined in Kalaeloa; additional fieldwork necessary |

| Alternative | Geology and Natural Hazards | Farmlands | Wildlife | Botanical Resources | Street Trees |
|--|-----------------------------|--|--|-------------------------|--|
| Section II. Fort Weaver Road to Aloha Stadium | | | | | |
| Farrington Highway/ Kamehameha Highway | None | Shadow impacts analysis recommended for small agricultural parcels on Kamehameha Highway | No effect on common introduced species; no sensitive species present | None (see street trees) | Transplant all median landscaping on Farrington Highway in Waipahu |
| Section III. Aloha Stadium to Middle Street | | | | | |
| Salt Lake Boulevard | None | None | Same as Section II | None (see street trees) | Possible impact on trees at Aloha Stadium and Pu'uwai Momi Apartments |
| Makai of the Airport Viaduct | None | None | Same as Section II | None (see street trees) | Remove a few Indian Coral trees on Salt Lake Boulevard; pruning or other impact on two monkeypods on Kikowaena Street |
| Mauka of the Airport Viaduct | None | None | Same as Section II | None (see street trees) | On Kamehameha Highway near Arizona Memorial transplant fan palms and shower trees. Pruning of shower trees on Nimitz |
| Aolele Street | None | None | Same as Section II | None (see street trees) | On Kamehameha Highway near Arizona Memorial transplant fan palms and shower trees. Transplant 10 Queen Palms on Nimitz Highway |
| Section IV. Middle Street to Iwilei | | | | | |
| North King Street | None | None | Same as Section II | None (see street trees) | Transplant various trees on Aolele Street. Possible impact on damaged Indian Coral trees in Ke'ehi Lagoon Park |
| | | | | | Transplant fiddlewoods on mauka side of North King Street; possibly transplant fiddlewoods on Middle Street |

| Alternative | Geology and Natural Hazards | Farmlands | Wildlife | Botanical Resources | Street Trees |
|---|------------------------------------|------------------|--|----------------------------|---|
| Dillingham Boulevard | None | None | Same as Section II | None (see street trees) | Several notable trees affected by widening Dillingham Boulevard – one monkeypod and 26 Kamani trees; additional Kamani tree impacts at Honolulu Community College transit stop; possibly transplant fiddlewoods on Middle Street |
| Section V. Iwilei to UH Mānoa | | | | | |
| Hotel Street/ Kawaiahaʻo Street/ Kapiʻolani Boulevard | None | None | Alteration or removal of mature trees may impact roosting/nesting of white terns | None (see street trees) | Transplant some minor fiddlewoods on Hotel Street; removal of notable monkeypods on Kona Street possible, but additional design detail needed to confirm; removal of some notable monkeypods on Kapiʻolani Boulevard between Kalākaua Avenue and McCully Street; transplant 27 new shower tree plantings on University Avenue |
| Hotel Street/ Waimanu Street/ Kapiʻolani Boulevard | None | None | Same as above | None (see street trees) | Transplant some minor fiddlewoods on Hotel Street; possible impact on notable monkeypod at Waimanu Street and Ward Avenue; removal of notable monkeypods on Kona street possible, but additional design detail needed to confirm; removal of some notable monkeypods on Kapiʻolani Boulevard between Kalākaua Avenue and McCully Street; transplant 27 new shower tree plantings on University Avenue |

| Alternative | Geology and Natural Hazards | Farmlands | Wildlife | Botanical Resources | Street Trees |
|--|------------------------------------|------------------|-----------------|----------------------------|--|
| Nimitz Highway/Queen Street /Kapi'olani Boulevard | None | None | Same as above | None (see street trees) | Right-of-way (ROW) take may affect notable monkeypod on Queen Street; removal of notable monkeypods on Kona street possible, but additional design detail needed to confirm; removal of some notable monkeypods on Kapi'olani Boulevard between Kalākaua and McCully Avenues |
| Nimitz Highway/ Halekauwila Street/ Kapi'olani Boulevard | None | None | Same as above | None (see street trees) | Remove/replace four notable monkeypods on makai side of Halekauwila Street; removal of notable monkeypods on Kona street possible, but additional design detail needed to confirm; removal of some notable monkeypods on Kapi'olani Boulevard between Kalākaua Avenue and McCully Street; transplant 27 new shower tree plantings on University Avenue |
| Beretania Street/South King Street | None | None | Same as above | None (see street trees) | Impacts depend on method of tunnel construction; tree impacts may occur at transit stations; pruning of Shower, Earpod, and Banyan trees likely on King Street, but tree removal possible at transit stations |
| Waikīkī Spur | None | None | Same as above | None (see street trees) | Tree protection zones needed for exceptional mahogany trees on Kalākaua Avenue; pruning or removal/replacement of several new plantings along Kūhiō Avenue |

The City and County of Honolulu Department of Transportation Services (DTS), in coordination with the U.S. Department of Transportation Federal Transit Administration (FTA), has carried out an Alternatives Analysis (AA) to evaluate alternatives that would provide high-capacity transit service on O‘ahu. The primary project study area is the travel corridor between Kapolei and the University of Hawai‘i at Mānoa (UH Mānoa) (Figure 1-1). This corridor includes the majority of housing and employment on O‘ahu. The east-west length of the corridor is approximately 23 miles. The north-south width of the corridor is at most four miles, as much of the corridor is bounded by the Ko‘olau and Wai‘anae Mountain Ranges to the north and the Pacific Ocean to the south.

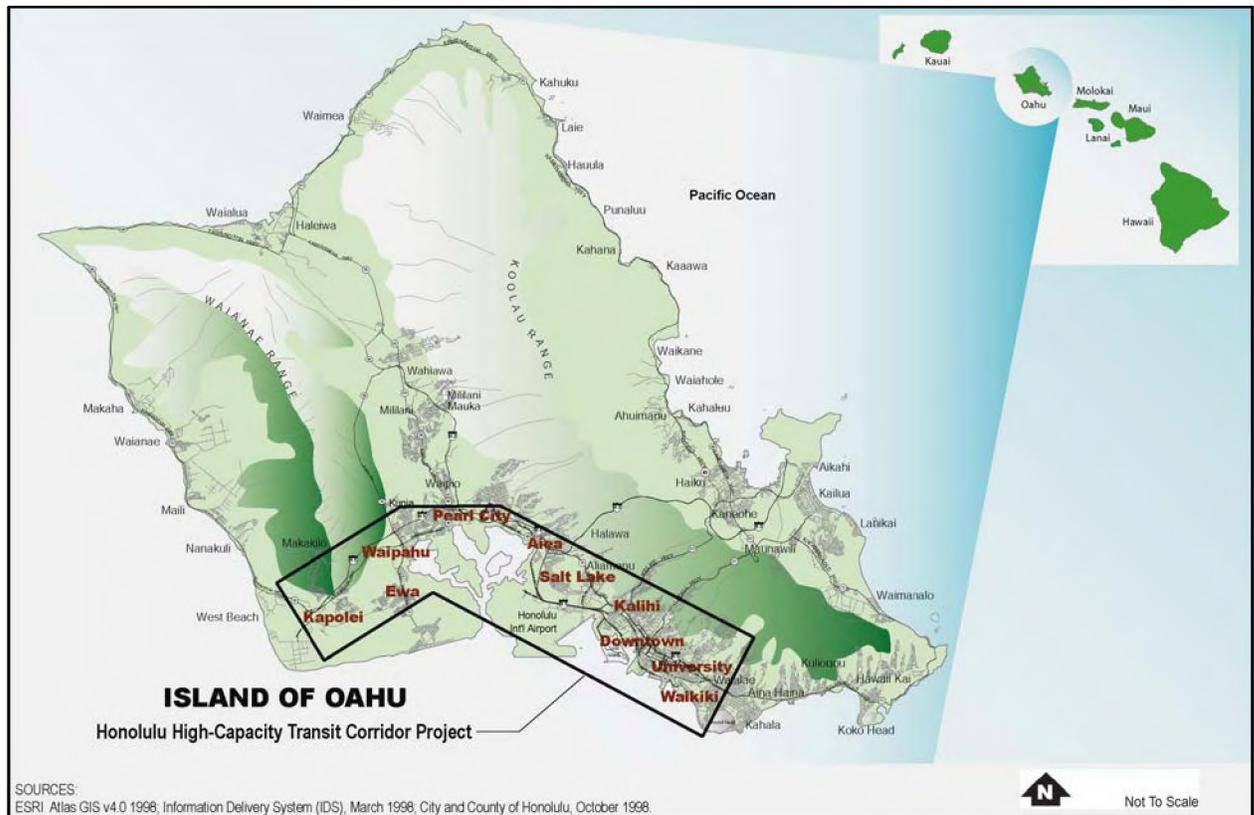


Figure 1-1. Project Vicinity

Project Description

Description of the Study Corridor

The study corridor extends from Kapolei in the west (Wai‘anae or ‘Ewa direction) to the University of Hawai‘i at Mānoa (UH Mānoa) in the east (Koko Head direction), and is confined by the Wai‘anae and Ko‘olau Mountain Ranges to the north (mauka direction) and the Pacific Ocean to the south (makai direction). Between Pearl City and ‘Aiea, the corridor’s width is less than one mile between the Pacific Ocean and the base of the Ko‘olau Mountains.

The General Plan for the City and County of Honolulu directs future population and employment growth to the ‘Ewa and Primary Urban Center (PUC) Development Plan areas and the Central O‘ahu Sustainable Communities Plan area. The largest increases in population and employment are projected in the ‘Ewa, Waipahu, Downtown, and Kaka‘ako districts, which are all located in the corridor (Figure 1-2).

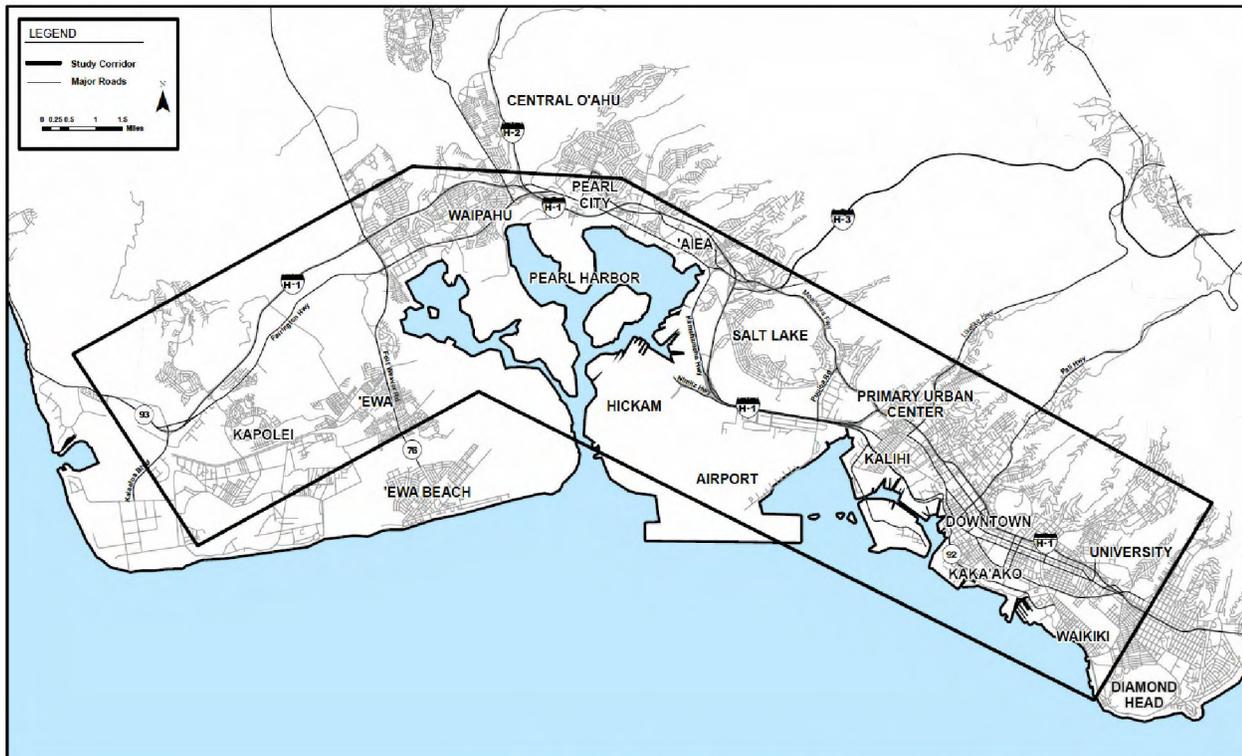


Figure 1-2. Areas and Districts in the Study Corridor

Currently, 63 percent of the 876,200 people living on O‘ahu and 81 percent of the 499,300 jobs on O‘ahu are located within the study corridor. By 2030 this distribution will increase to 69 percent of the population and 84 percent of the employment as development continues to be concentrated into the PUC and ‘Ewa Development Plan areas. Kapolei is the center of the ‘Ewa Development Plan area and has been designated as O‘ahu’s “second city.” City and State government offices have opened in Kapolei, and the University of Hawai‘i is developing a master plan for a new West O‘ahu campus there. The Kalaeloa Community Development District (formerly known as Barbers Point Naval Air Station) covers 3,700 acres adjacent to Kapolei and is planned for redevelopment. The Department of Hawaiian Home Lands is also a major landowner in the area and is planning for residential and retail development. In addition, developers have several proposals to continue the construction of residential subdivisions.

Continuing Koko Head, the corridor follows Farrington and Kamehameha Highways through a mixture of low-density commercial and residential development. This part of the corridor passes through the makai portion of the Central O‘ahu Sustainable Communities Plan area.

Farther Koko Head, the corridor enters the PUC Development Plan area, which is bounded by commercial and residential densities that begin to increase in the vicinity of Aloha Stadium. The Pearl Harbor Naval Reserve, Hickam Air Force Base, and Honolulu International Airport border the corridor on the makai side. Military and civilian housing are the dominant land uses mauka of Interstate Route H-1 (H-1 Freeway), with a concentration of high-density housing along Salt Lake Boulevard.

As the corridor continues Koko Head across Moanalua Stream, the land use becomes increasingly dense. Industrial and port land uses dominate along the harbor, shifting to primarily commercial uses along Dillingham Boulevard, a mixture of residential and commercial uses along North King Street, and primarily residential use mauka of the H-1 Freeway.

Koko Head of Nu‘uanu Stream, the corridor continues through Chinatown and Downtown. The Chinatown and Downtown areas, with 62,300 jobs, have the highest employment density in the corridor. The Kaka‘ako and Ala Moana neighborhoods, comprised historically of low-rise industrial and commercial uses, are being revitalized with several high-rise residential towers currently under construction. Ala Moana Center, both a major transit hub and shopping destination, is served by more than 2,000 weekday bus trips and visited by more than 56 million shoppers annually.

The corridor continues to Waikīkī and through the McCully neighborhood to UH Mānoa. Today, Waikīkī has more than 20,000 residents and provides more than 44,000 jobs. It is one of the densest tourist areas in the world, serving approximately 72,000 visitors daily (DBEDT, 2003). UH Mānoa is the other major destination at the Koko Head end of the corridor. It has an enrollment of more than 20,000 students and approximately 6,000 staff (UH, 2005). Approximately 60 percent of students do not live within walking distance of campus (UH, 2002) and must travel by vehicle or transit to attend classes.

Alternatives under Consideration

Four alternatives will be evaluated in the Alternatives Analysis (AA) report. They were developed through a screening process that considered alternatives identified through previous transit studies, a field review of the study corridor, an analysis of current housing and employment data for the corridor, a literature review of technology modes, work completed by the O‘ahu Metropolitan Planning Organization (OMPO) for its Draft 2030 Regional Transportation Plan, and public and agency comments received during a formal project scoping process held in accordance with requirements of the National Environmental Policy Act (NEPA) and the Hawai‘i EIS Law (Chapter 343, Hawai‘i Revised Statutes). The four alternatives are described in detail in the *Honolulu High-Capacity Transit Corridor Project Alternatives Analysis Definition of Alternatives Report* (DTS, 2006a). The alternatives identified for evaluation in the AA report are as follows:

- No Build Alternative
- Transportation System Management Alternative
- Managed Lane Alternative
- Fixed Guideway Alternative

Alternative 1: No Build

The No Build Alternative includes existing transit and highway facilities and committed transportation projects anticipated to be operational by 2030. Committed transportation projects are those programmed in the O‘ahu 2030 Regional Transportation Plan prepared by OMPO. The committed highway elements of the No Build Alternative will also be included in the build alternatives (discussed below).

The No Build Alternative’s transit component would include an increase in fleet size to accommodate growth in population, while allowing service frequencies to remain the same as today. The specific number of buses, as well as required ancillary facilities, will be determined during the preparation of the AA.

Alternative 2: Transportation System Management

The Transportation System Management (TSM) Alternative would provide an enhanced bus system based on a hub-and-spoke route network and relatively low-cost capital improvements on selected roadway facilities to give priority to buses. The TSM Alternative would include the same committed highway projects as assumed for the No Build Alternative.

Alternative 3: Managed Lane

The Managed Lane Alternative would include construction of a two-lane, grade-separated facility between Waipahu and Downtown Honolulu for use by buses, paratransit vehicles, and vanpool vehicles. High-occupancy vehicles (HOV) and toll-paying, single-occupant vehicles also would be allowed to use the facility provided that sufficient capacity would be available to maintain free-flow speeds for buses and the above-noted paratransit and vanpool vehicles. Variable pricing strategies for single-occupant vehicles would be implemented to ensure free-flow speeds for high-occupancy vehicles.

Intermediate bus access points would be provided in the vicinity of Aloha Stadium and Middle Street. Buses using the managed lane facility would be restructured and enhanced, providing additional service between Kapolei and other points ‘Ewa of the PUC, as well as Downtown Honolulu and UH Mānoa.

Alternative 4: Fixed Guideway

The Fixed Guideway Alternative would include the construction and operation of a fixed-guideway transit system between Kapolei and UH Mānoa. The system could use any fixed-guideway transit technology approved by FTA and meeting performance requirements, and could be automated or employ drivers.

Station and supporting facility locations are currently being identified and would include a vehicle maintenance facility and park-and-ride lots. Bus service would be reconfigured to bring riders on local buses to nearby fixed-guideway transit stations.

Although this alternative would be designed to be within existing street or highway rights-of-way as much as possible, property acquisition at various locations is expected to

be necessary. Future extensions of the system to Central O‘ahu, East Honolulu, or within the corridor are possible, but are not being addressed in detail at present.

A broad range of modal technologies was considered for application to the Fixed Guideway Alternative, including light rail transit, personal rapid transit, automated people mover, monorail, magnetic levitation (maglev), commuter rail, and emerging technologies still in the developmental stage. Several technologies were selected in an earlier screening process and will be considered as possible options for the fixed-guideway technology. Technologies that were not carried forward from the screening process include personal rapid transit, commuter rail, and the emerging technologies. The screening process is documented in the *Honolulu High-Capacity Transit Corridor Project Screening Report* (DTS, 2006b).

The study corridor for the Fixed Guideway Alternative will be evaluated in five sections to simplify analysis and impact evaluation in the AA process and report. In general, each alignment under consideration within each of the five sections may be combined with any alignment in the adjacent sections.

Each alignment has distinctive characteristics and environmental impacts and provides different service options. Therefore, each alignment will be evaluated individually and compared to the other alignments in each section. The sections that will be evaluated and the alignments being evaluated for each section are listed in Table 1-1. In addition to the combinations of alignments, a shorter 20-mile Alignment also was evaluated.

Table 1-1. Fixed Guideway Alternative Analysis Sections and Alignments

| Section | Alignments Being Considered |
|--|---|
| I. Kapolei to Fort Weaver Road | Kamokila Boulevard/Farrington Highway |
| | Kapolei Parkway/North-South Road |
| | Saratoga Avenue/North-South Road |
| | Geiger Road/Fort Weaver Road |
| II. Fort Weaver Road to Aloha Stadium | Farrington Highway/Kamehameha Highway |
| III. Aloha Stadium to Middle Street | Salt Lake Boulevard |
| | Makai of the Airport Viaduct |
| | Mauka of the Airport Viaduct |
| | Aolele Street |
| IV. Middle Street to Iwilei | North King Street |
| | Dillingham Boulevard |
| V. Iwilei to UH Mānoa | Hotel Street/Kawaiaha‘o Street/Kapi‘olani Boulevard with or without Waikīkī Branch |
| | Hotel Street/Waimanu Street/Kapi‘olani Boulevard with or without Waikīkī Branch |
| | Nimitz Highway/Queen Street/Kapi‘olani Boulevard with or without Waikīkī Branch |
| | Nimitz Highway/Halekauwila Street/Kapi‘olani Boulevard with or without Waikīkī Branch |
| | Beretania Street/South King Street |
| | Waikīkī Branch |

Project Purpose

The purpose of the Honolulu High-Capacity Transit Corridor Project is to provide improved mobility for persons traveling in the highly congested east-west transportation corridor between Kapolei and UH Mānoa, confined by the Wai‘anae and Ko‘olau Mountain Ranges to the north and the Pacific Ocean to the south. The project would provide faster, more reliable public transportation services in the corridor than those currently operating in mixed-flow traffic. The project would also provide an alternative to private automobile travel and improve linkages between Kapolei, the urban core, UH Mānoa, Waikīkī, and urban areas in-between. Implementation of the project, in conjunction with other improvements included in the 2030 O‘ahu Regional Transportation Plan (ORTP), would moderate anticipated traffic congestion in the corridor. The project also supports the goals of the O‘ahu General Plan and the ORTP by serving areas designated for urban growth.

Project Area Needs

Improved Mobility for Travelers Facing Increasingly Severe Traffic Congestion

The existing transportation infrastructure in the corridor between Kapolei and UH Mānoa is overburdened handling current levels of travel demand. Motorists experience substantial traffic congestion and delay at most times of the day during both the weekdays and weekends. Average weekday peak-period speeds on the H-1 Freeway are currently less than 20 miles per hour (mph) in many places and will degrade even further by 2030. Transit vehicles are caught in the same congestion. Travelers on O‘ahu’s roadways currently experience 51,000 vehicle hours of delay, a measure of how much time is lost daily by travelers stuck in traffic, on a typical weekday. This is projected to increase to more than 71,000 daily vehicle hours of delay by 2030, assuming implementation of all of the planned improvements listed in the ORTP (except for a fixed guideway system). Without these improvements, the ORTP indicates that daily vehicle-hours of delay could increase to as much as 326,000 vehicle hours.

Current a.m. peak-period travel times for motorists from West O‘ahu to Downtown average between 45 and 81 minutes. By 2030, after including all of the planned roadway improvements in the ORTP, this travel time is projected to increase to between 53 and 83 minutes. Average bus speeds in the system have been decreasing steadily as congestion has increased. Currently, express bus travel times from ‘Ewa Beach to Downtown range from 45 to 76 minutes and local bus travel times from ‘Ewa Beach to Downtown range from 65 to 110 minutes during the peak period. By 2030, these travel times are projected to increase by 20 percent on an average weekday. Within the urban core, most major arterial streets will experience increasing peak-period congestion, including Ala Moana Boulevard, Dillingham Boulevard, Kalākaua Avenue, Kapi‘olani Boulevard, King Street, and Nimitz Highway. Expansion of the roadway system between Kapolei and UH Mānoa is constrained by physical barriers and by dense urban neighborhoods that abut many existing roadways. Given the current and increasing levels of congestion, a need exists to offer an alternative way to travel within the corridor independent of current and projected highway congestion.

Improved Transportation System Reliability

As roadways become more congested, they become more susceptible to substantial delays caused by incidents, such as traffic accidents or heavy rain. Even a single driver unexpectedly braking can have a ripple effect delaying hundreds of cars. Because of the operating conditions in the study corridor, current travel times are not reliable for either transit or automobile trips. To get to their destination on time, travelers must allow extra time in their schedules to account for the uncertainty of travel time. This is inefficient and results in lost productivity. Because the bus system primarily operates in mixed-traffic, transit users experience the same level of travel time uncertainty as automobile users. A need exists to reduce transit travel times and provide a more reliable transit system.

Accessibility to New Development in ‘Ewa/Kapolei/Makakilo as a Way of Supporting Policy to Develop the Area as a Second Urban Center

The General Plan for the City and County of Honolulu projects the highest population growth rates for the island will occur in the ‘Ewa Development Plan area (comprised of the ‘Ewa, Kapolei, and Makakilo communities), which is expected to grow by 170 percent between 2000 and 2030. This growth represents nearly 50 percent of the total growth projected for the entire island. The Wai‘anae, Wahiawā, North Shore, Windward, Waimānalo, and East Honolulu areas will have population growth of between zero and 16 percent because of this policy, which keeps the country “country.” Kapolei, which is developing as a “second city” to Downtown Honolulu, is projected to grow by nearly 600 percent to 81,100 people, the ‘Ewa neighborhood by 100 percent, and Makakilo by 125 percent between 2000 and 2030. Accessibility to the overall ‘Ewa Development Plan area is currently severely impaired by the congested roadway network, which will only get worse in the future. This area is less likely to develop as planned unless it is accessible to Downtown and other parts of O‘ahu; therefore, the ‘Ewa, Kapolei, and Makakilo area needs improved accessibility to support its future growth as planned.

Improved Transportation Equity for All Travelers

Many lower-income and minority workers live in the corridor outside of the urban core and commute to work in the PUC Development Plan area. Many lower-income workers also rely on transit because of its affordability. In addition, daily parking costs in Downtown Honolulu are among the highest in the United States (Colliers, 2005), further limiting this population’s access to Downtown. Improvements to transit capacity and reliability will serve all transportation system users, including low-income and under-represented populations.

Project Schedule

Projects developed through the FTA New Starts process progress through many stages from system planning to operation of the project. The Honolulu High-Capacity Transit Corridor Project is currently in the Alternatives Analysis phase, which includes defining and evaluating specific alternatives to address the purpose of and need for the project as

discussed in this chapter. The anticipated project development schedule for completion of the 20-mile Alignment is shown in Figure 1-3.

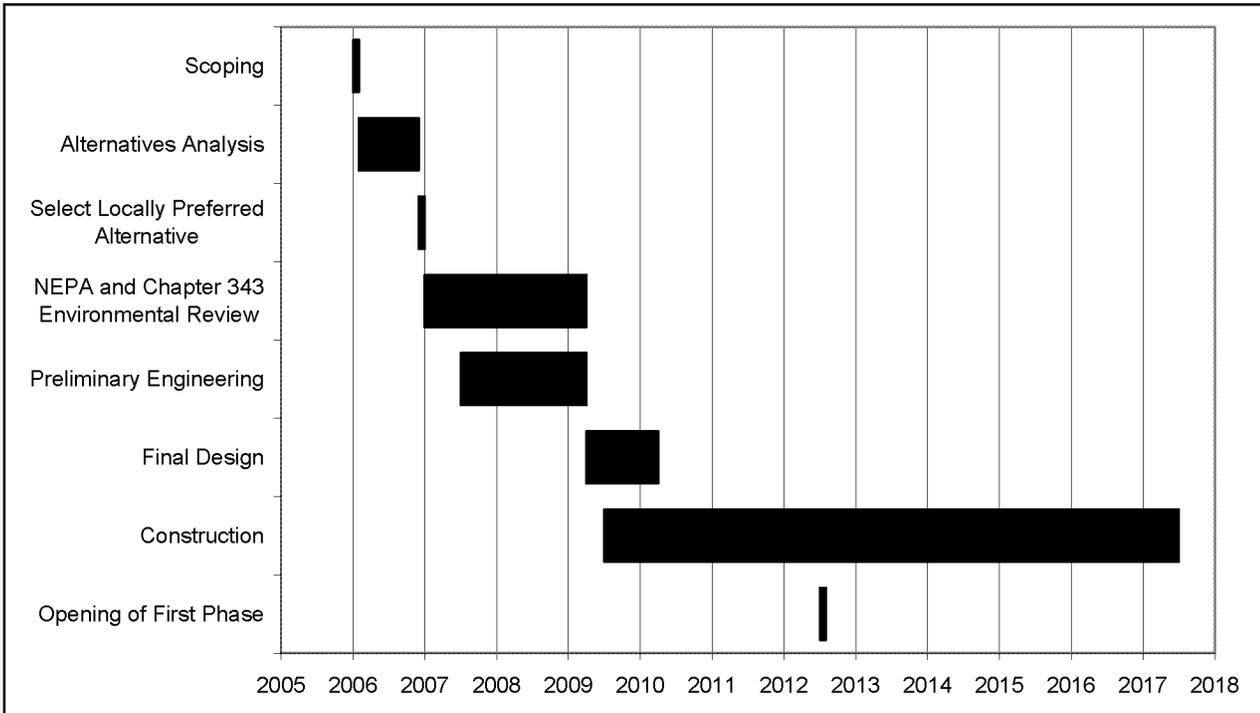


Figure 1-3. Project Schedule

Purpose of this Report

The following topics are analyzed in this Natural Resources Technical Report:

- Geology and Natural Hazards
- Farmlands
- Wildlife
- Vegetation, including street trees

The level of analysis presented in this report is meant to support the Alternative Analysis (AA) being performed prior to the selection of a locally-preferred alternative (LPA). More detailed analyses will be performed as part of an Environmental Impact Statement (EIS) to be prepared for the LPA.

Geology and Natural Hazards

The geology of O‘ahu is diverse and complex and will have major impacts on construction methods and feasibility of some portions of the alignment. Where elevated structures or tunnels are proposed, detailed subsurface investigations will be required. Previous transit studies (Geolabs, 1991, 1992) provide substantial information on the subsurface conditions.

Tsunamis

Tsunamis are ocean waves produced by earthquakes or underwater landslides. They are often incorrectly referred to as tidal waves, but a tsunami is actually a series of waves that can travel at speeds averaging 450 (and up to 600) miles per hour in the open ocean. Areas at greatest risk are less than 25 feet above sea level and within one mile of the shoreline.

Earthquakes

Earthquakes are sudden and violent earth movements that occur without warning. The Uniform Building Code (UBC) provides minimum design criteria to address the potential for damages due to these seismic disturbances.

Flood Zones

Flood zones are land areas identified by the Federal Emergency Management Agency (FEMA). Each flood zone describes that land area in terms of its risk of flooding. A Flood Insurance Rate Map (FIRM) is a map created for floodplain management and insurance purposes. A FIRM will generally show a community’s base flood elevations, flood zones, and floodplain boundaries.

The project must comply with U.S. DOT Order 5650.2 on Floodplain Management and Protection, the rules and regulations of the National Flood Insurance Program and all applicable ordinances for flood hazard districts, as stated in the City and County of Honolulu's Land Use Ordinance.

Farmlands

Under the Federal Farmland Protection Act (FPPA), federal agencies must formally assess their projects' impact on agriculture. If "prime" or "unique" farmlands would be affected by the project alternatives, then coordination would need to be conducted with the U.S. Department of Agriculture's (USDA) Natural Resources Conservation Service (NRCS).

Coordination with NRCS would be initiated by the preparation and submittal of Form AD-1006 or CPA-106, "Farmland Conversion Impact Rating" form, in accordance with 7 CFR 658.4(a). A Farmland Conversion Impact Rating score would be determined for each alternative under consideration. The size and location of the project's footprint-impacts on prime and unique farmlands would be documented in the Farmland Conversion Impact Rating forms. If the farmland conversion impact rating for any alternative is equal to or greater than the regulatory threshold of 160 points, alternatives that avoid farmland impacts must be evaluated.

This coordination would be conducted after completion of the Alternatives Analysis and selection of the LPA. If the score for the LPA exceeds or is likely to exceed the 160-point threshold, other alternatives would be considered and their conversion impact rating would be calculated. These additional scores would be disclosed and discussed in the draft EIS.

Biological Resources

Section 7 of the Endangered Species Act of 1973, as amended, requires federal agencies to consider impacts on endangered or threatened species and the critical habitat of such species. It requires that federal agencies consult with the U.S. Fish and Wildlife Service (USFWS) and/or the National Marine Fisheries Service (NOAA Fisheries or NMFS), depending on whether terrestrial or marine species may be affected, respectively. If impacts on protected species are possible, a Biological Assessment (BA) would be prepared to address effects of any major construction activity on a listed or candidate species or the destruction or adverse modification of designated critical habitat. Subsequently, a Biological Opinion would be rendered by the Service stating whether the federal action is likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of critical habitat (40 CFR 402).

The State of Hawaii's counterpart law is Chapter 195D, Hawai'i Revised Statutes (HRS), as amended, under which listed species are similarly protected. Chapter 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 Hawaii's threatened and endangered species."

In a letter dated March 30, 2006, a written request for a list of species potentially affected by the project was sent to each of the following regulatory agencies:

- U.S. Department of Interior, U.S. Fish and Wildlife Service (USFWS)
- U.S. Department of Commerce, National Oceanographic and Atmospheric Administration, National Marine Fisheries Service (NOAA Fisheries or NMFS)
- State of Hawai‘i, Department of Land and Natural Resources (DLNR), Division of Forestry and Wildlife (DOFAW)
- DLNR, Division of Aquatic Resources (DAR)

The following is a summary of the replies received from these agencies:

- USFWS reply dated April 12, 2006: USFWS stated that no designated critical habitats exist within or near the proposed project area, defined as within one-third mile of the project, but records show two faunal and one botanical listed species have been observed: *Lasiurus cinereus semotus* (‘ōpe‘ape‘a, Hawaiian hoary bat), *Gallinula chloropus sandvicensis* (‘alae‘ula, common moorhen, Hawaiian gallinule), and *Abutilon menziesii* (ko‘oloa‘ula, red ‘ilima). These species may occur in locations other than those identified (see letter in Appendix A), but the Hawaiian gallinule is restricted to wetlands, and potential impacts on the entire population of the red ‘ilima were adequately addressed in a Habitat Conservation Plan prepared by the State Department of Transportation (DOT) for the North-South Road Project in 2004. A State incidental take license was issued on March 18, 2005, and USFWS suggested that DTS secure a certificate of inclusion from the State for the proposed transit improvements.
- NOAA Fisheries (NMFS) reply dated April 12, 2006: NMFS provided a list of all protected species under its jurisdiction. In addition to the Endangered Species Act, NMFS-protected species are also defined by the Marine Mammal Protection Act of 1972 (MMPA), as amended. The following endangered species may occur in waters or shorelines around the project area: Hawaiian monk seal (*Monachus schauinslandi*), humpback whale (*Megaptera novaeangliae*), sperm whale (*Physeter macrocephalus*), blue whale (*Balaenoptera musculus*), fin whale (*Balaenoptera physalus*), leatherback turtle (*Dermochelys coriacea*), Hawksbill turtle (*Eretmochelys imbricata*), green turtle (*Chelonia mydas*), Olive Ridley turtle (*Lepidochelys olivacea*), and loggerhead turtle (*Caretta caretta*). The remainder of the list consists of additional whales, dolphins, and seals protected under the MMPA (see correspondence in Appendix A for a complete list.)
- DLNR-DOFAW reply dated April 10, 2006: DOFAW recommended that a plant survey be included in the EIS. Three endangered plants are known to be scattered throughout the ‘Ewa-Kapolei-Kalaeloa region: *Archranthes splendens* spp. *rotundata*, *Chamaesyce skottsbergii*, and *Abutilon menziesii*.
- DLNR-DAR reply dated May 1, 2006: DAR noted whales, marine turtles, and monk seals as species of primary concern. DAR also requested additional information in the EIS about avoiding, minimizing, or mitigating impacts, if any.

Copies of all correspondence are included in Appendix A.

Geology and Natural Hazards

Based on a literature and map reviews, the geologic history and conditions of the corridor are described. In areas where tunnels or elevated structures are proposed, subsurface conditions are described in more detail. This information was taken from prior studies in these areas, as no drilling or field sampling will be undertaken until the LPA has been selected.

The Island of O‘ahu is subject to flooding, hurricanes, earthquakes, and tsunamis. The potential effects of these natural hazards on the various project alternatives are described. Building codes or other considerations necessary for construction have been noted.

Since protection of floodplains and floodways is required by Executive Order 11988, *Floodplain Management*; U.S. DOT Order 5650.2, *Flood Management and Protection*; FHPM-6-7-3-2; and 23 CFR 650, existing floodways and floodplain limits within the study area were identified using Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRMs) and other existing data. Potential impacts on floodplains and floodways, such as changes to floodplain elevations and changes to areas subject to flooding, have been identified for each alternative. Where necessary, reasonable and feasible measures to minimize floodplain impacts have been proposed.

Farmlands

The farmlands impact criteria was used to evaluate impacts the proposed alternatives would have on farmlands. In preparation for the AA, existing Geographic Information System (GIS) data were used to identify potential conflicts with “prime” or “unique” farmlands, as identified by “Agricultural Lands of Importance to the State of Hawai‘i” (ALISH) data. Land use and soil data also were consulted to support or verify the designation as “prime” or “unique” farmland. For example, if an area is currently designated as “prime” or “unique” farmland according to ALISH, but existing or planned land use indicates that the area is or will be developed, such information was considered when determining the suitability of the property for use as part of the transit system.

When the project footprint, or “limits of construction,” has been identified, the amount of farmland lost as a result of project construction will be calculated. In particular, anticipated impacts on “unique” or “prime” farmland will be noted. This detailed assessment will be conducted following the selection of the LPA as part of an EIS. If “unique” or “prime” farmlands are affected by the project alternatives to be analyzed in the draft EIS, coordination will be conducted with the Natural Resources Conservation Service (NRCS). This coordination may occur before or after the draft EIS is released. Coordination would be initiated by the preparation and submittal of Form AD-1006 or CPA-106 to determine Farmland Conversion Impact Ratings.

This Natural Resources Technical Report and the Alternatives Analysis provide a qualitative comparison of farmland affected by each alternative. The Farmland Conversion Impact Rating will be calculated for the LPA subsequent to its selection.

Biological Resources

The following subsections outline the methods employed to evaluate the impacts on wildlife, vegetation, urban street trees, and wetland resources in the project area.

Fieldwork was conducted to the extent possible from publicly accessible areas, as no rights-of-entry were obtained for this phase of the natural resource assessment. Areas have been identified for potential candidate rights-of-entry to conduct more detailed fieldwork on the LPA once it has been selected.

After the City Council selects the LPA, more in-depth fieldwork to assess biological resources along the LPA alignment will be conducted, if necessary, and the impacts analysis will be refined. This additional analysis will be documented in the draft EIS.

Wildlife Biology

Literature review and fieldwork were conducted to evaluate sections of the proposed alternatives for the presence of any protected, rare, threatened, or endangered wildlife species. Previous studies, pertinent literature, and the USFWS Critical Habitat maps for O‘ahu were reviewed for the study area prior to undertaking the wildlife field survey. Topographic maps and aerial photographs were examined to determine terrain and habitat characteristics, access, boundaries, and reference points. In addition, a request to the Hawai‘i Biodiversity and Mapping Program (HBMP) for a database of federal and State protected species (plants and animals) was made and the information reviewed as part of the AA process. The spatial parameters for the HBMP search were established following the literature review; the spatial parameter selected was a quarter mile from the alternative’s alignment.

The following studies and reports were consulted for particular species: Miles (1986) and Vanderwerf (2003) for white terns and O‘ahu Elepaio; Kepler and Scott (1990) and USFWS (1997) for Hawaiian hoary bat; USFWS (1999) for endangered waterbirds; and David (2000) for Newell’s shearwater (*Puffinus auricularis newelli*).

A scoping field inspection of the alignments was conducted section-by-section to eliminate areas that are unlikely to harbor habitat for biological species (e.g., highly urbanized and built areas). Coordination with the USFWS and the State Department of Land and Natural Resources (DLNR) was conducted to help determine potential interactions with protected species (see Chapter 2).

Field observations of wildlife along the Alternative 3 and 4 alignments within the project area (Figure 1-2) were conducted primarily in the morning around 07:00 to 11:00 hours February 19 through 21, 2006, and in the afternoon between 14:45 and 15:45 hours on February 21, 2006. Daytime field observations were made on May 19, 2006, at the 22 proposed sites for Alternative 4 maintenance facilities, park-and-rides, and transit centers (Figure 3-1). A modified point count method was used to sample bird habitat along the

various alignments. This method provides quantitative results in a short period of time. The point count method gives the number of species and quantitative information in the form of an index of abundance. All birds seen and heard at all distances from the point count station were recorded. Objective comparisons of a species' abundance can be made between the index of abundance of two or more alignments or habitats because data are reflected as measures of dispersion about the mean values and the results can be compared by statistical tests, if required.

In the 'Ewa region, additional evening observations were made on February 19, 2006, between 18:00 and 19:00 hours, along all potential alignments to document any occurrence of the endangered Hawaiian hoary bat and the state-listed endangered short-eared owl (*Asio flammeus sandwichensis*).

The presence and "species richness" of native, migratory, and threatened or endangered species were determined through the modified point count method. Any habitat along the alignments that supports such species has been identified. The list of species obtained during the point counts allows for a comparison of the number of species (species richness) at each habitat or alignment. Two parameters of richness were measured. The average number of species per point count station is the "mean richness." "Total richness" is a cumulative parameter representing the total number of species sampled in the habitat or alignment. The values for mean richness and total richness for each site are reported for each alternative to quantify the wildlife value.

For sections of the corridor where protected species (federal or state) have previously been reported, a follow-up survey was conducted to determine the status of the populations. Prior reporting was identified through the Hawai'i Biodiversity and Mapping Program (HPMP) database, published reports, and interviews with resource agencies. If necessary, more in-depth work will be conducted for the LPA after it is selected by the City Council.

Vegetation Biology

Literature review and fieldwork were conducted to evaluate sections of the proposed alignments for any protected, rare, or endangered plant species. Previous studies, pertinent literature and the USFWS Critical Habitat maps for O'ahu were obtained and reviewed for the study area prior to conducting the botanical field survey. Topographic maps and aerial photographs were examined to determine terrain and habitat characteristics, access, boundaries, and reference points. In addition, a request to the HBMP for a database of federal and state protected species (plants and animals) was made and the information reviewed as part of the AA process. The spatial parameters for the HBMP search were established following the literature review, and a scoping field inspection of the alignments was conducted section-by-section to eliminate areas unlikely to harbor habitat for biological species (e.g., highly urbanized and built areas). Coordination was conducted with federal and state resource agencies, including the USFWS and the DLNR, to help determine potential interactions with protected species (see Chapter 2).

A general description of vegetation types is provided for all proposed alternatives. The width of the survey corridor was 100 feet on each side of the centerline of the proposed alignment. Field investigations of the vegetation biology along the proposed alternative alignments were conducted during February and March 2006. These investigations focused on the 'Ewa Plain area and did not proceed east of Aloha Stadium. Vegetation east of Aloha Stadium was surveyed by an arborist as discussed below.

Each section was rated for relative abundance of introduced vegetation. For sections of the corridor where rare or endangered species have been reported, a follow-up survey was conducted to establish if the plants or populations still exist. If necessary, more in-depth work will be conducted for the LPA after it is selected by the City Council.

Street Trees

A certified arborist evaluated street trees along the alignments as described below. To characterize existing street tree conditions in general, all past tree surveys conducted in the area were reviewed: in particular, the tree inventory conducted for the Primary Corridor Transportation Project (2001-2002). Site visits were then conducted between February 15 and March 10, 2006, in all proposed corridors under consideration in the AA process.

Along corridors that were not previously surveyed, a preliminary tree survey was conducted to generally characterize each alignment. During this initial evaluation, the following types of data were noted for each section of each alignment:

- Location of trees (not individuals, but predominance)
- Quantities of trees in clusters
- Tree species
- Tree condition – such as approximate height, crown spread, health, notable or exceptional tree
- Potential for successful transplanting
- Other comments – including if white terns (*Gygis alba*) were observed nesting in trees
- Once the project footprint and profile (height) of alignments were determined, the certified arborist used the data collected to evaluate what tree impacts are likely to occur for each segment of each alignment. The certified arborist evaluated each alignment based on its potential impact on the stability and health of trees along that alignment.

After completion of the AA and selection of the LPA by the City Council, more in-depth fieldwork and data collection will be conducted to provide more complete information about street trees along the LPA alignment. This information will be included in the draft EIS.

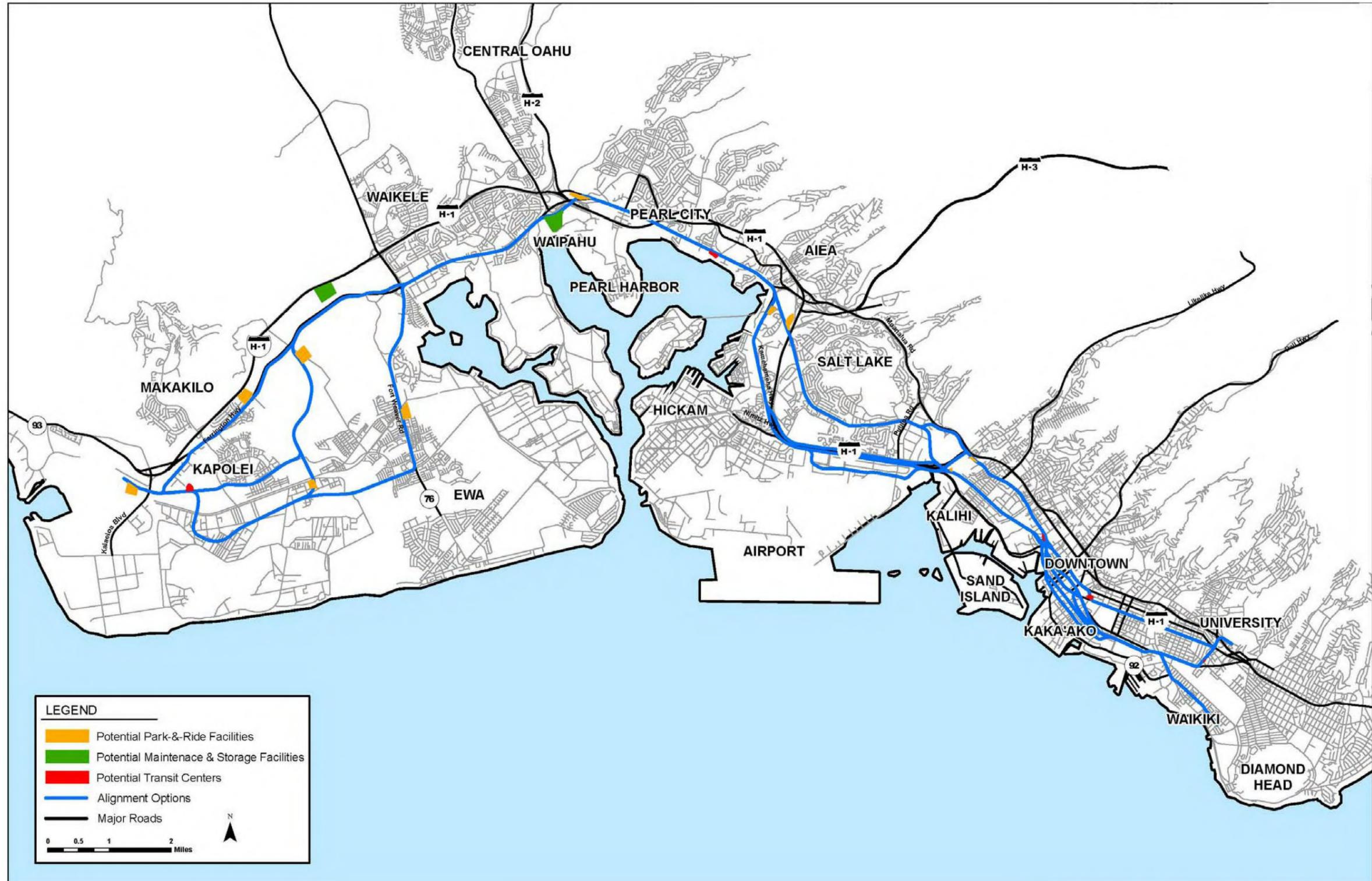


Figure 3-1. Additional Sites Reviewed for Natural Resources

Geology and Natural Hazards

Within the corridor, coral reefs and eroded volcanic material have formed a wedge of sedimentary rock and sediments, referred to as caprock, which rests on the underlying volcanic rock (Figure 4-1). Caprock is composed predominantly of coral-algal limestone interlaid with terrigenous clays and muds. Volcanic ash from the Honolulu volcanic series is often found in the caprock. The caprock ranges between approximately zero and 1,000 feet thick in the corridor (Wentworth, 1951).

The volcanic rocks exposed toward the 'Ewa end of the corridor near Kapolei are part of the Wai'anae volcanic series. There is recent alluvium in the corridor, consisting mainly of clayey organic silt with variable amounts of sand, some pockets of gravel and cobbles, and localized thin layers of marine sediments. Low-lying areas were filled during urbanization and are usually underlain by recent alluvium. Often, these areas were originally marshlands.

The 'Ewa and central portions of the corridor are mostly alluvium and volcanic rock. The volcanic rocks are typical a'a and pāhoehoe flows. They vary greatly in strength, thickness, hardness, and other engineering properties. There are also pyroclastic deposits that are generally permeable, low in strength, and may be highly weathered. Soil coverage on top of these rocks is generally thin to nonexistent.

In the PUC (Pearl City to UH Mānoa) part of the corridor, volcanic rock of the Ko'olau Range lies underneath the caprock. Occasionally, these rocks are exposed toward the Koko Head end and they dominate the central portion. The rocks are mostly volcanic lava flows and pyroclastic deposits. The Downtown Honolulu area consists mainly of silty sand and coral gravel dredged from Honolulu Harbor. It is unconsolidated, with high porosity and permeability. The stratigraphic history of the area is highly complex because of numerous sea level changes with associated reefs and sedimentary deposits interlayered with secondary volcanic activity superimposed on the topography of the Ko'olau Range.

Tsunami

Tsunamis are a concern for coastal portions of O'ahu. The State of Hawai'i Civil Defense publishes a series of maps showing areas that should be evacuated in the event of a tsunami warning. None of the potential alignments is located in a tsunami evacuation area. NOAA's Pacific Tsunami Warning Center in 'Ewa Beach provides warnings for tsunamis to Hawai'i.

Earthquakes

Small earthquakes are common in Hawai'i, but occur primarily in areas of active volcanism. Because volcanoes on O'ahu are dormant, only minor earthquakes have been recorded on the island.

The Universal Building Code (UBC) scale is rated from Seismic Zone 1 through Zone 4. Zone 1 has the lowest level for potential seismic-induced ground movement; Zone 4, the highest. O'ahu has been designated within Seismic Zone 2a.

Floodplains

The FIRMs show several areas near the alignments falling within the 100-year base floodplains (Figure 4-2 to Figure 4-6). These floodplains are associated with streams, estuaries, and canals.

The largest of these floodplain areas occurs Koko Head of Ward Avenue, makai of South King Street, and 'Ewa of Kapahulu Avenue. This area includes Ala Moana Regional Park, the Ala Moana Center, and Waikīkī. The area includes the 100-year base floodplains associated with the Mānoa-Pālolo Stream and the Ala Wai Canal. It also includes areas that would be inundated by worst-case hurricane conditions.

Another large area designated as floodplain occurs near Ke'ehi Lagoon. The area includes floodplains associated with the Moanalua and Kalihi Streams.

Other flood zones within the corridor are associated with streams entering Pearl Harbor. Hono'uli'uli, Waikele, Kapakahi and Waiawa Streams form floodplains where they enter West and Middle Lochs. Kalauao and 'Aiea Streams have floodplains associated with them as they enter the East Loch of Pearl Harbor. Floodplains are also associated with Kalo'i Gulch, near Kapolei Parkway and North-South Road.

Isolated floodplains occur at the confluence of Nu'uanu and Waolani Streams near the intersection of Pali Highway and H-1 Freeway, as well as along the Hālawa Stream near Moanalua Freeway.

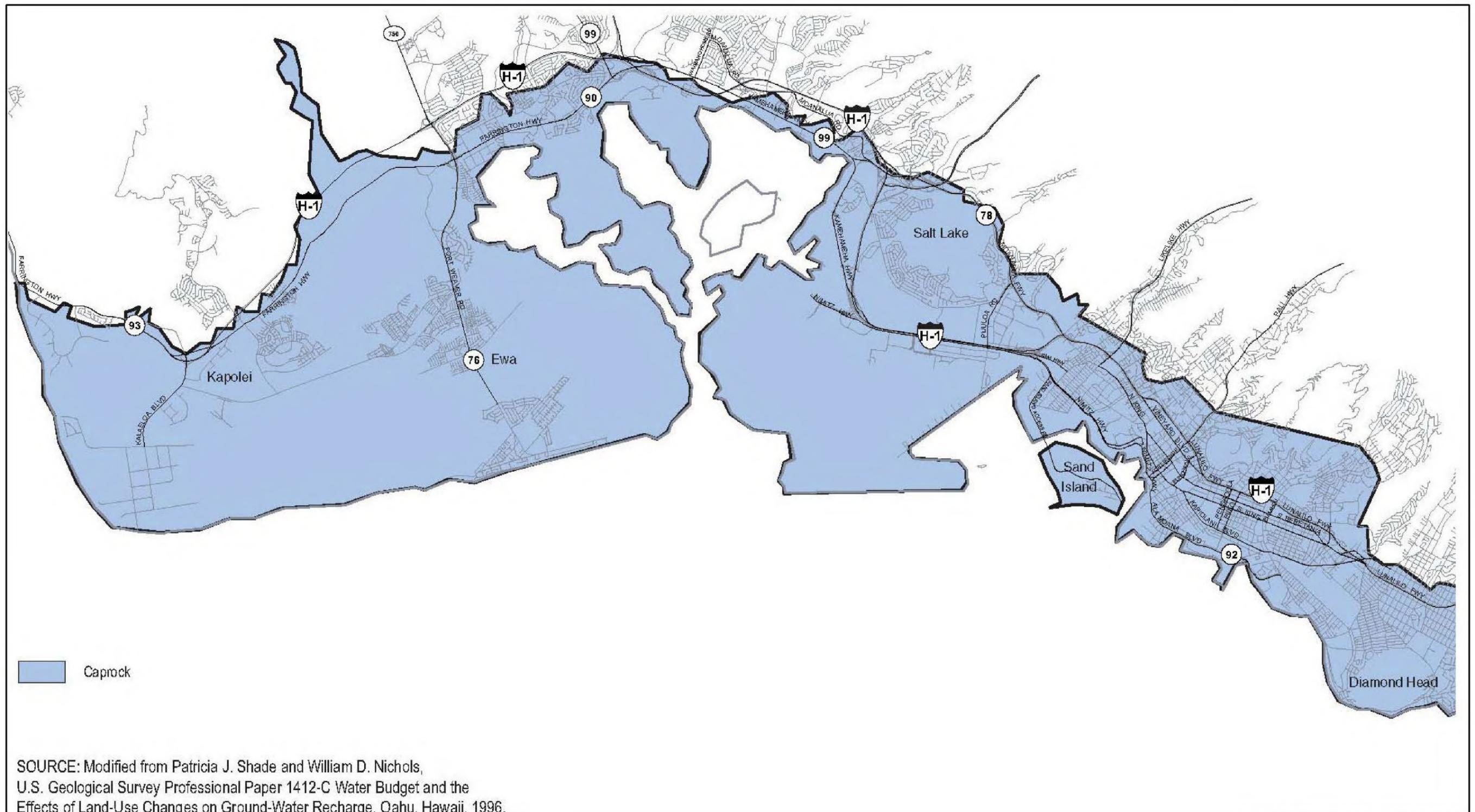


Figure 4-1. Extent of Caprock

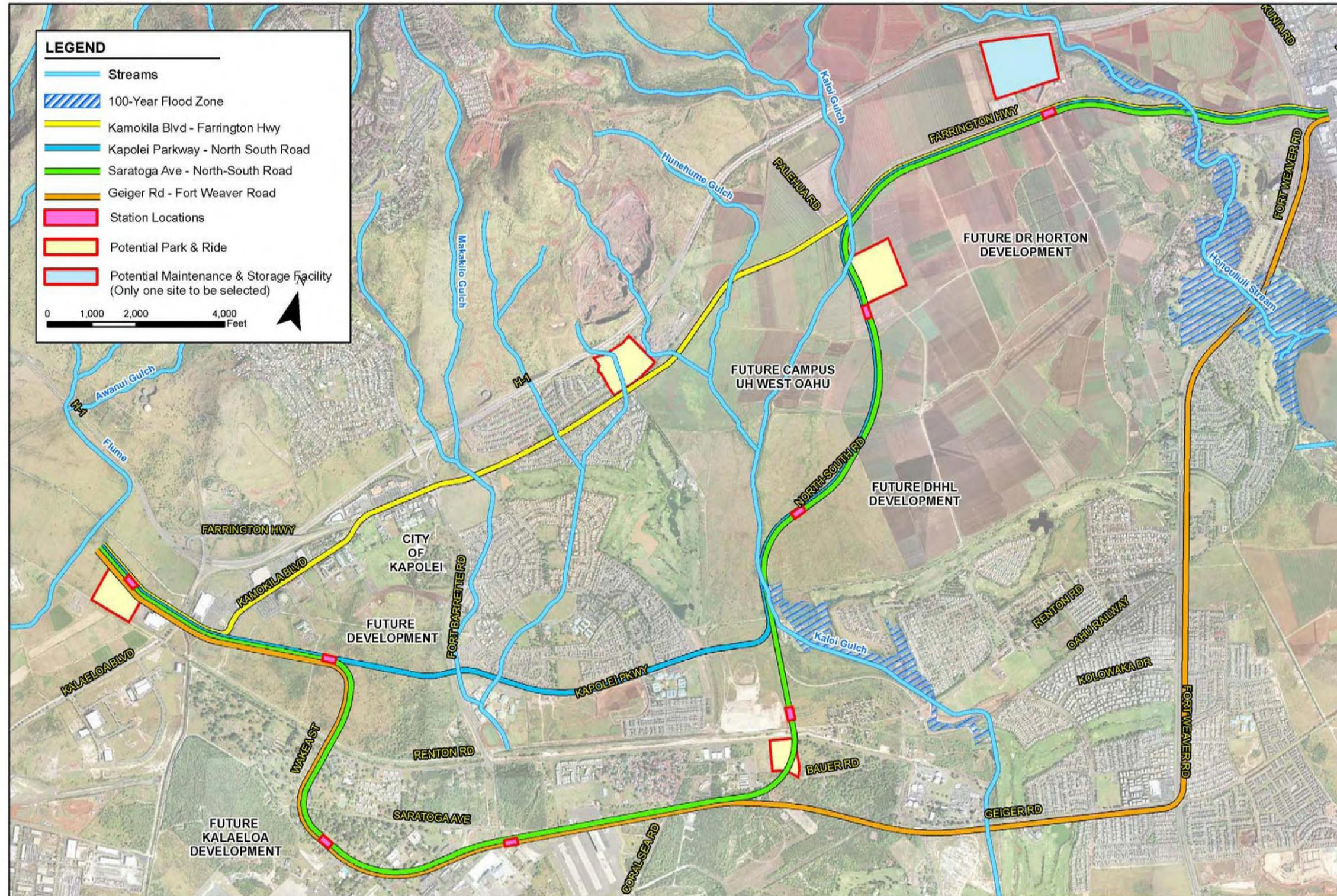


Figure 4-2. Streams and Floodplains in the Study Area, Alternative 4, Section I

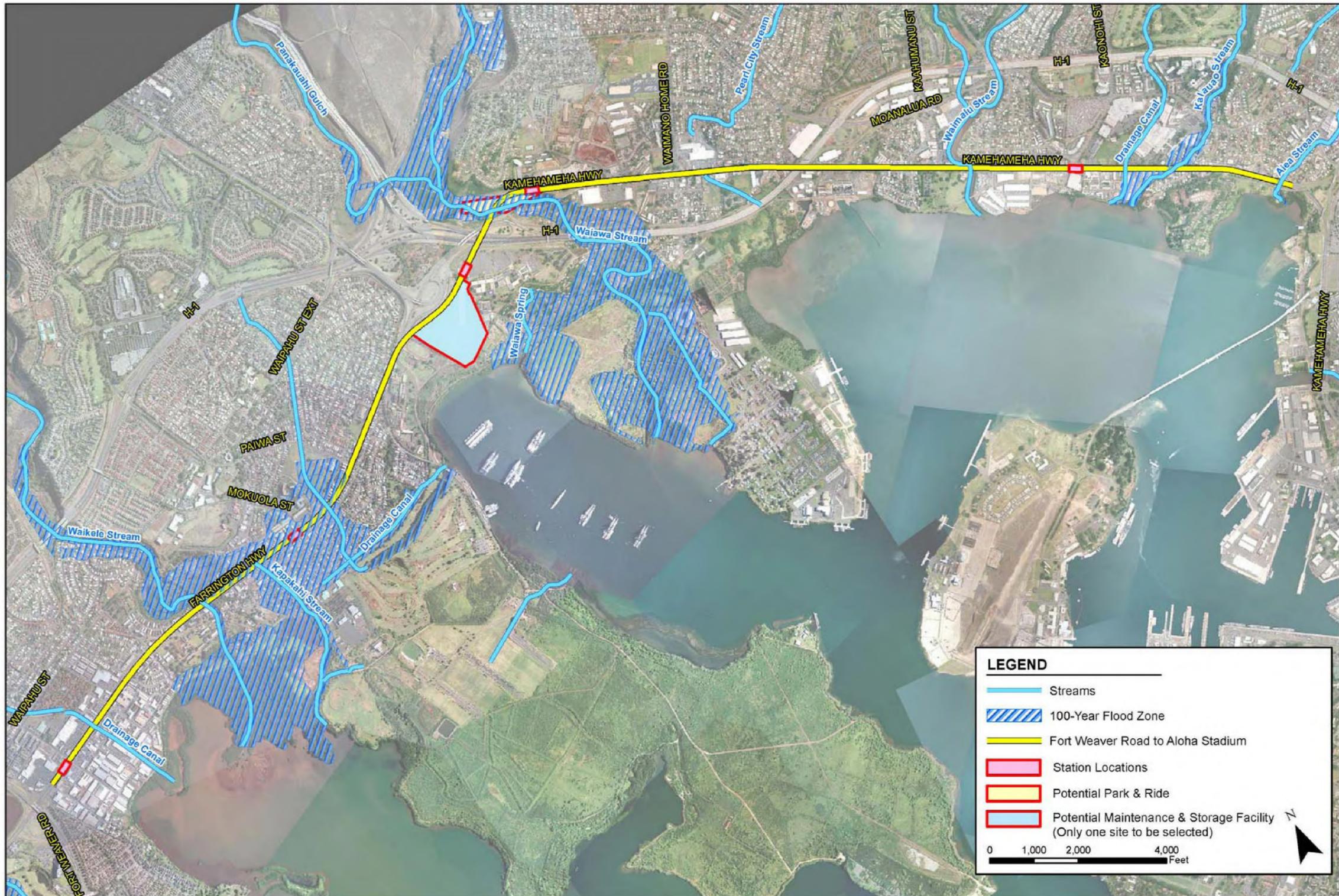


Figure 4-3. Streams and Floodplains in the Study Area, Alternative 4, Section II

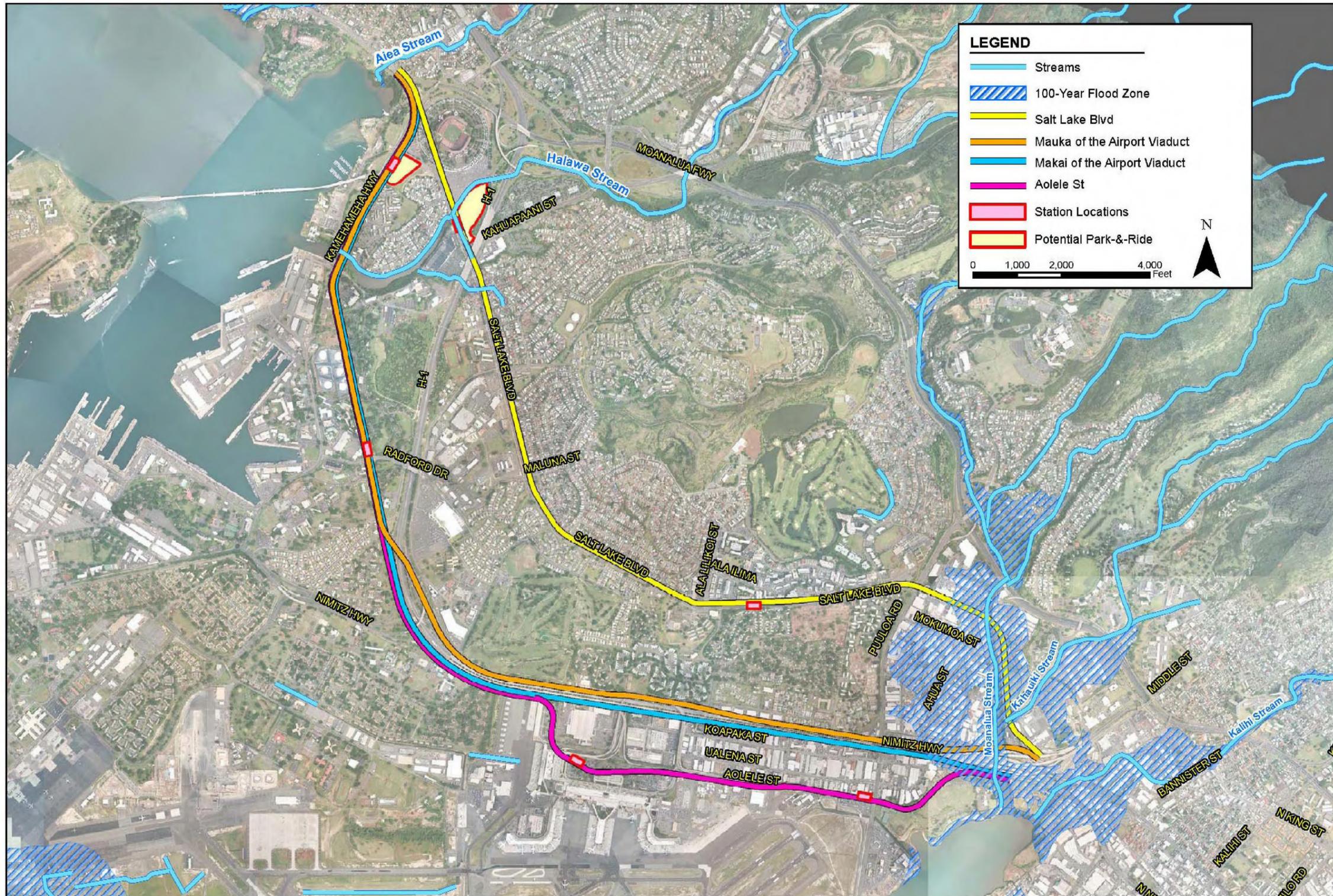


Figure 4-4. Streams and Floodplains in the Study Area, Alternative 4, Section III

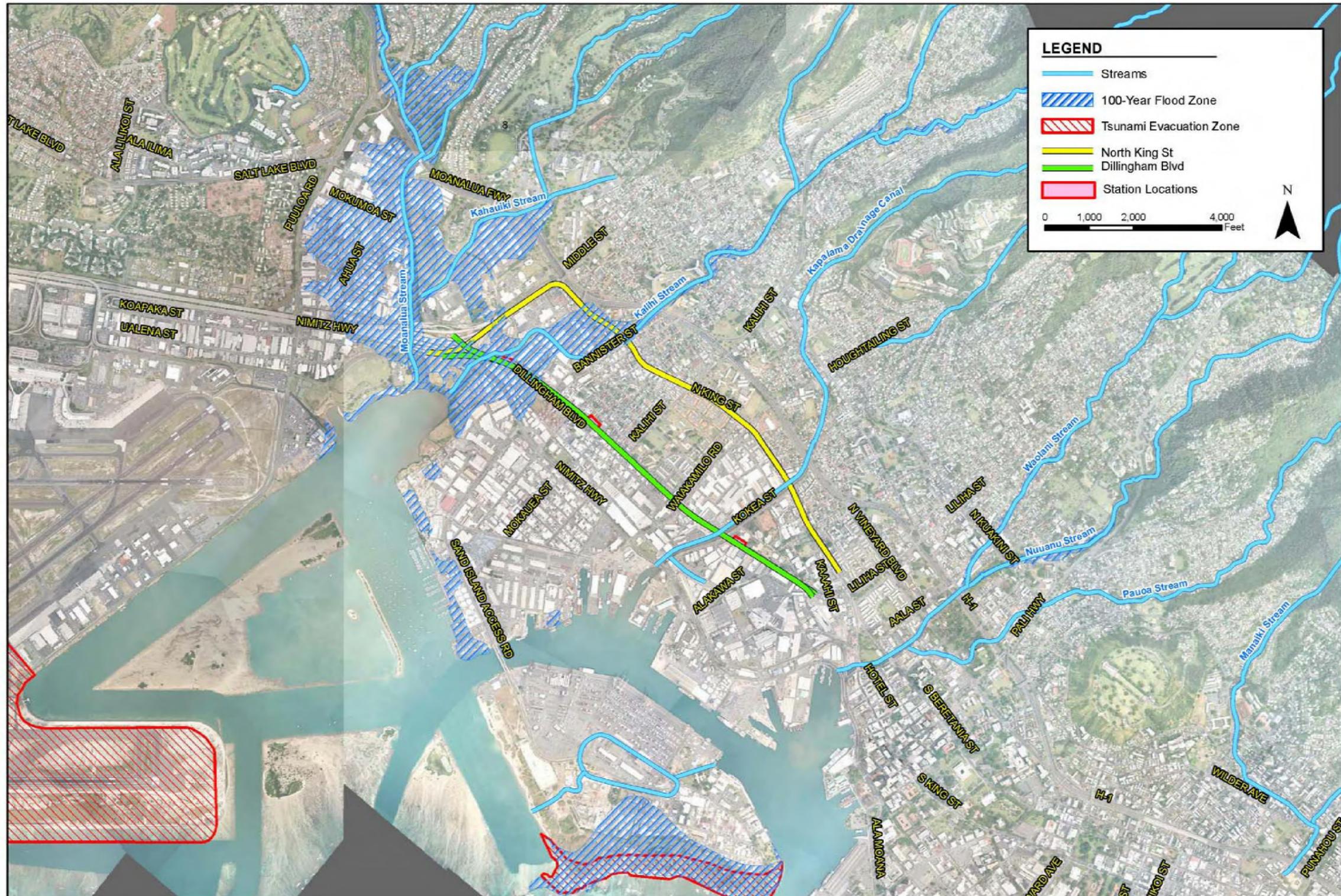


Figure 4-5. Streams and Floodplains in the Study Area, Alternative 4, Section IV

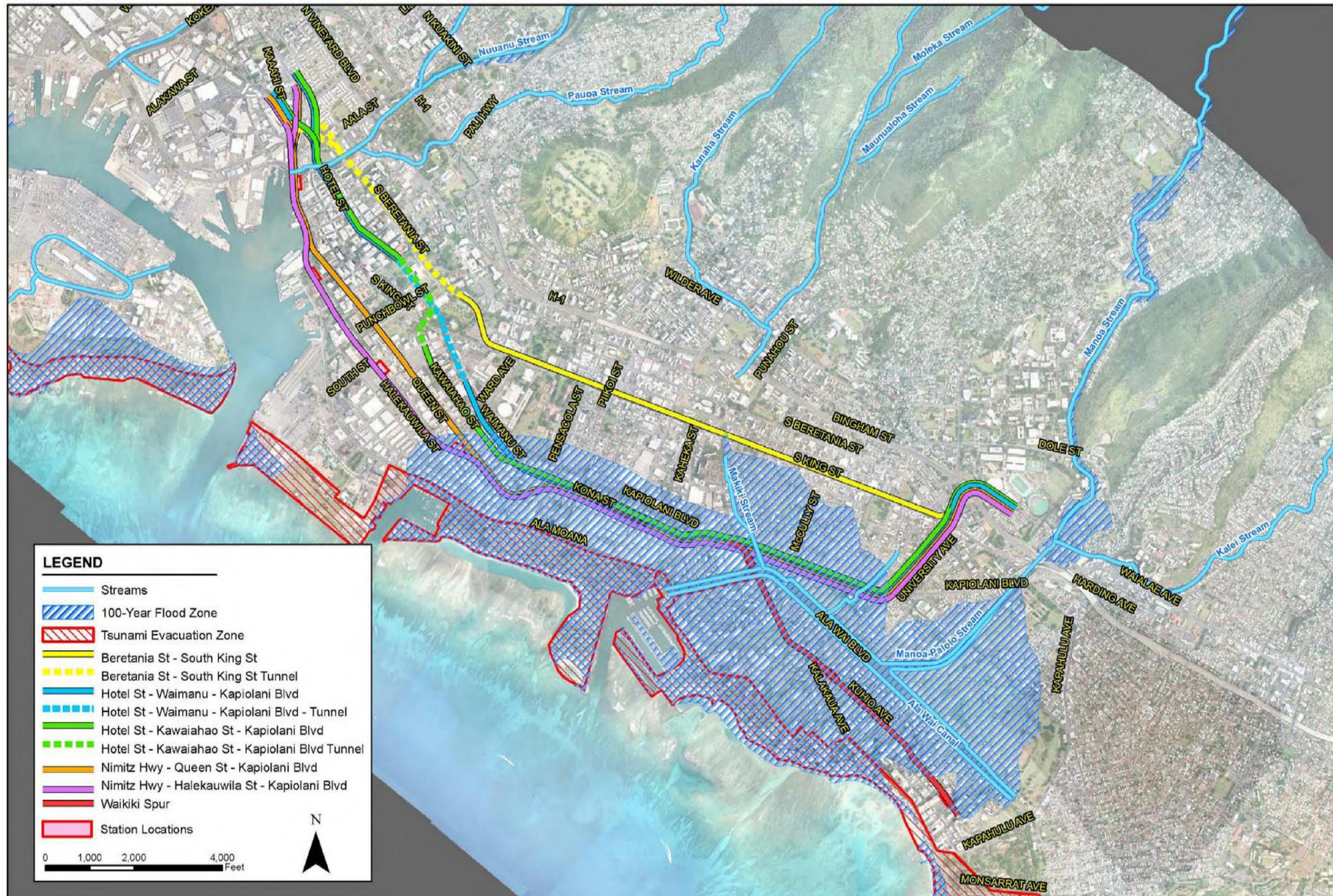


Figure 4-6. Streams and Floodplains in the Study Area, Alternative 4, Section V

Farmlands

The 'Ewa Plain was once a major agricultural area primarily used to cultivate sugarcane. However, sugarcane has not been cultivated in 'Ewa since 1995. Despite recent rapid urbanization, much of the 'Ewa Plain is still classified and/or zoned for agricultural use by the State of Hawai'i and City and County of Honolulu, respectively. In particular, the State of Hawai'i still designates much of 'Ewa that is not urbanized to be “prime” or “unique” farmlands under the “Agricultural Lands of Importance to the State of Hawai'i” (ALISH) land classification system. Other nearby land uses are discussed in the *Honolulu High-Capacity Transit Project Land Use Plans and Policies Technical Report*.

Figures 4-7 and 4-8 show areas of “prime” or “unique” farmlands under ALISH in the Kapolei/'Ewa and Waipahu/Pearl City areas, respectively. (These map sections correspond to Section I and Section II of the Fixed Guideway Alternative and the Waiawa Interchange to Hālawā Stream section of the Managed Lane Alternative.) The remainder of the project corridor does not contain known agricultural uses or lands designated as “prime” or “unique”.

Due to the availability and quality of the area for agriculture, some former sugarcane fields in the area referred to as East Kapolei (east of the Villages of Kapolei and mauka of 'Ewa Villages) have been converted to small-scale, diversified agriculture farms cultivating a variety of vegetables, fruits, and herbs. Active farms are located between the H-1 Freeway and Farrington Highway on both the east and west sides of the existing Palehua Road, and south of Farrington Highway to the east and west of North-South Road (currently under construction).

These farms have short-term leases with the Estate of James Campbell or DLNR, the two major landowners in the area. In addition to these landowners, agricultural stakeholders in the project vicinity include Sugarland Farms, Inc., Aloun Farms, Inc., A.M. Enterprise, Inc., Garst Seed, and Rucker G Livestock (ranching). Figure 4-9 shows the location of these tenant farms in East Kapolei. Other potential agricultural lands are either fallow or not active; much of the area has already been developed.

Although currently designated as “prime” or “unique” farmland according to ALISH, some areas have existing or planned land uses for development. For example, East Kapolei is designated “prime” land and is still actively farmed, but long-term plans for East Kapolei do not include agricultural use. As discussed in the *Honolulu High-Capacity Transit Project Land Use Plans and Policies Technical Report*, all of East Kapolei is slated (zoned or planned) for development, along with the rest of the 'Ewa/Kapolei region, in accordance with the City's *General Plan* and the *'Ewa Development Plan*. The University of Hawai'i has already begun planning its UH-West O'ahu campus on a site along the west side of North-South Road. Tenant farms in East Kapolei are on short-term leases with the Estate of James Campbell or DLNR, with the understanding that these lands are not intended for indefinite agricultural use.

In the more urbanized corridor along Farrington Highway and Kamehameha Highway in Waipahu and Pearl City, some limited areas are still designated as “prime” or “unique”

farmland (Figure 4-8). Part of the City’s Waipahu Cultural Garden Park, located slightly mauka of Farrington Highway in the heart of Waipahu, is designated “unique” land. Makai of Kamehameha Highway in Pearl City, active cultivation of taro and potentially other crops is occurring on coastal property along Pearl Harbor, directly ‘Ewa of Hawaiian Electric Company (HECO)’s Waiiau Power Plant.

Two active watercress farms are located along or near Kamehameha Highway: Watercress of Hawai‘i is just mauka of the Pearl City Peninsula and is part of an area designated as “unique” but otherwise filled with non-agricultural land uses; Sumida Farm is on the mauka side of Kamehameha Highway in the vicinity of PearlrIDGE Center and is designated “unique”. Although not designated by the State as “prime” or “unique” land, another small taro patch is owned by HECO on the mauka side of Kamehameha Highway across the street from the power plant. These agricultural uses are surrounded by the dominant commercial and industrial uses in these neighborhoods.

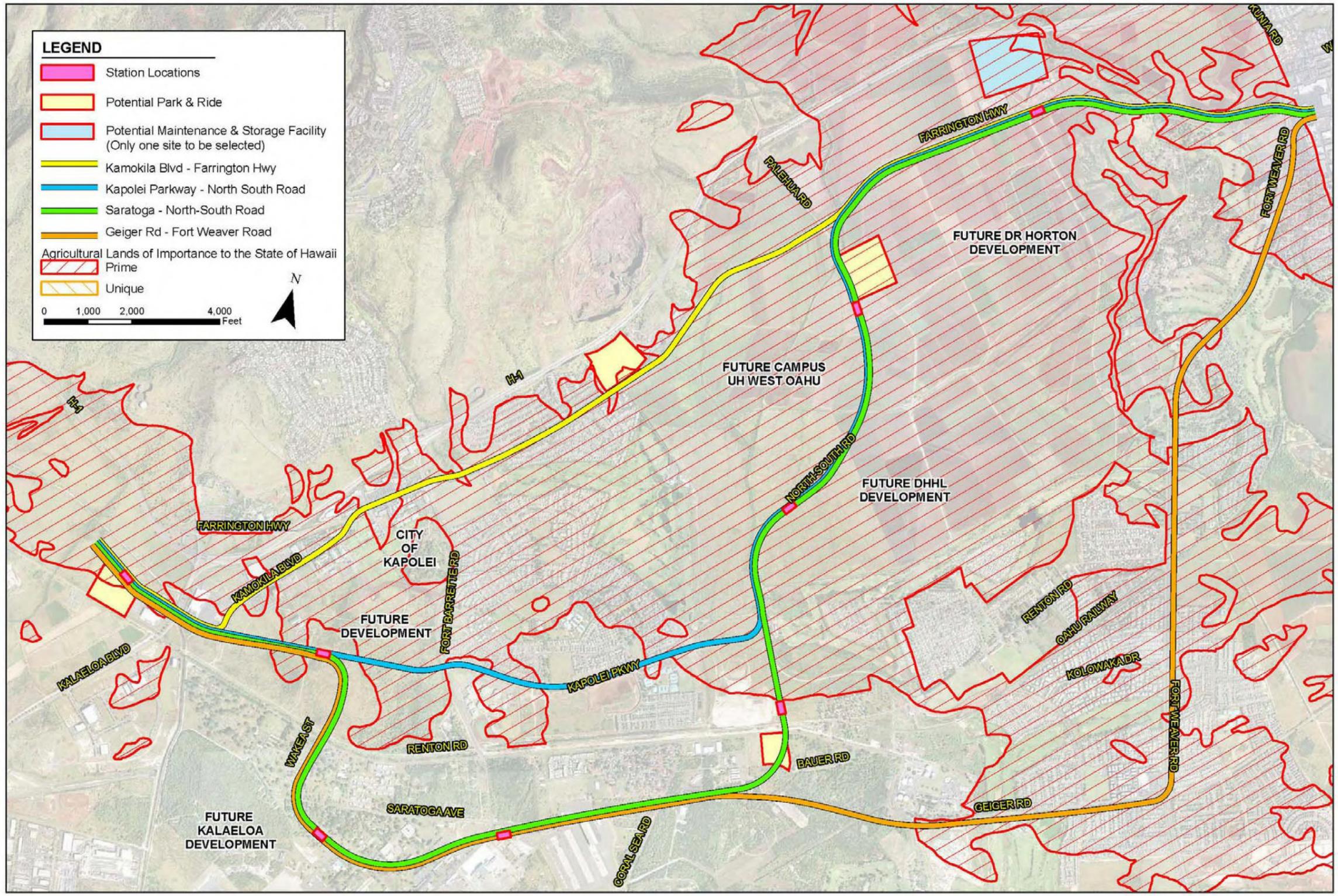


Figure 4-7. Agricultural Lands of Importance to the State of Hawai'i (Map 1 of 2)

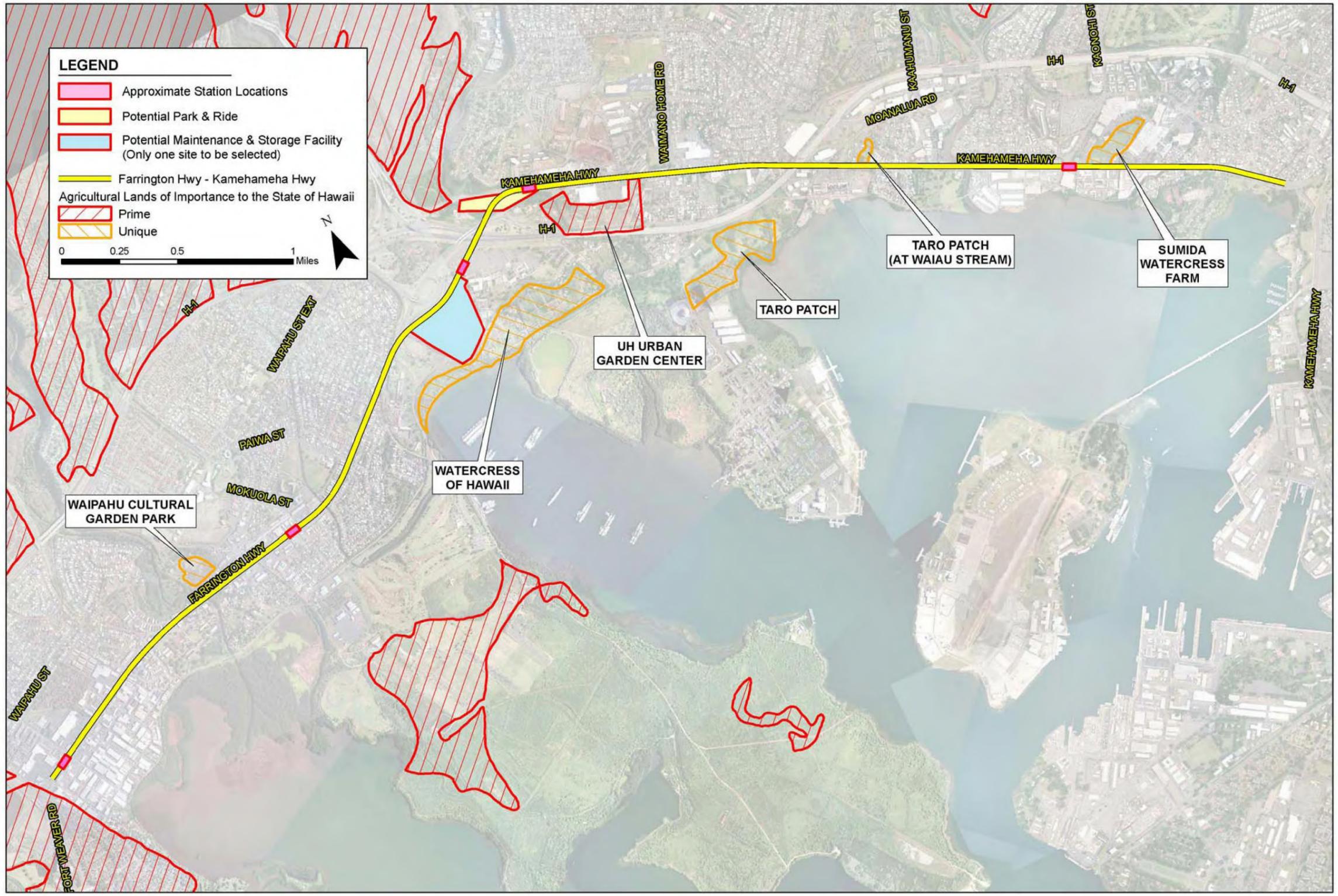


Figure 4-8. Agricultural Lands of Importance to the State of Hawai'i (Map 2 of 2)

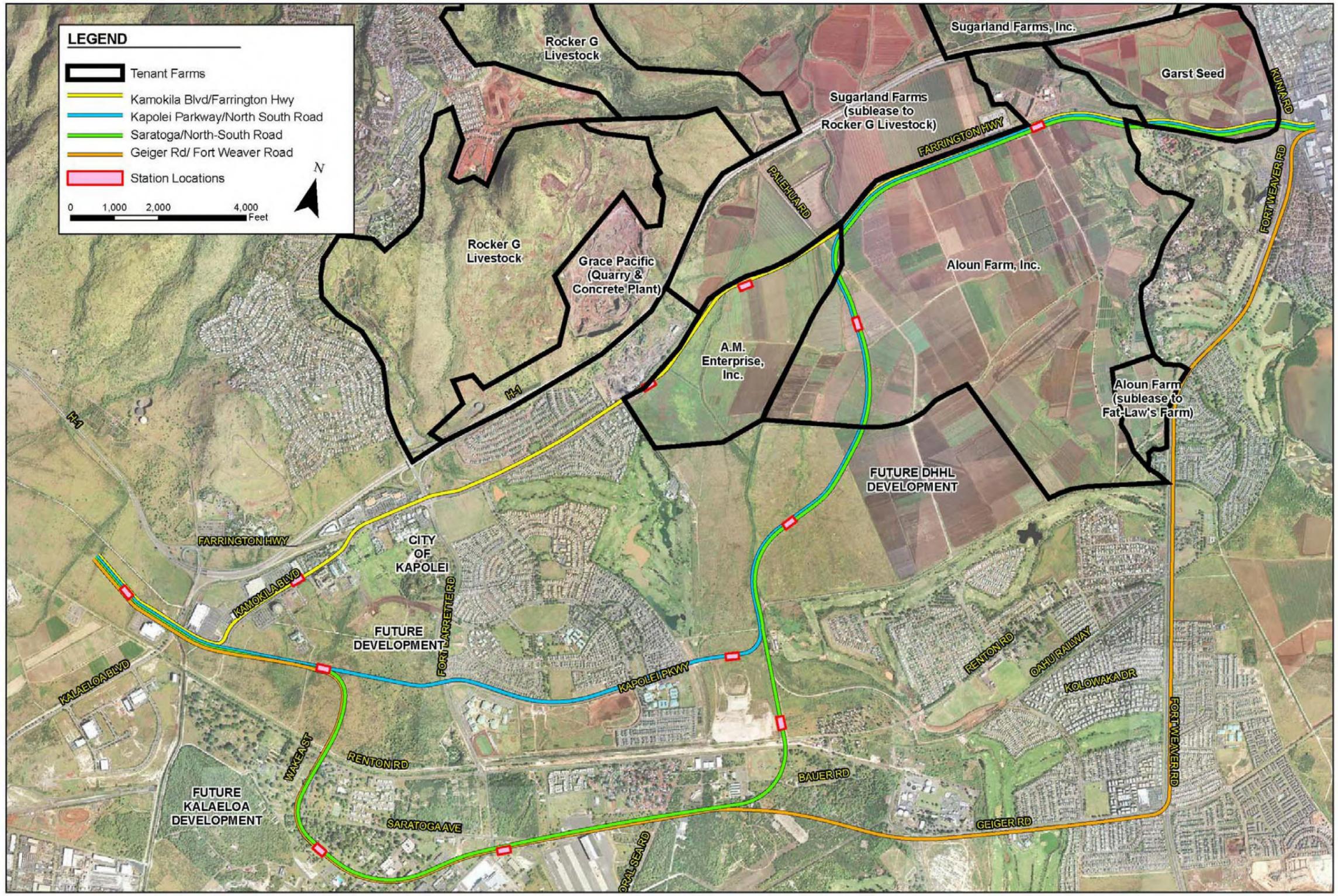


Figure 4-9. Tenant Farms in East Kapolei

Wildlife Biology

Existing Documentation on Protected Species

Coordination with governmental agencies and the literature review indicate that there are no designated critical habitats within the proposed project area. The following species were reported as being present or potentially present in or near the project area:

- The USFWS noted that the Hawaiian hoary bat (‘ōpe‘ape‘a, *Lasiurus cinereus semotus*), federally listed as endangered, has been sporadically sighted within the project area of metropolitan Honolulu (USFWS, 1999). However, Kepler and Scott (1990) suggest that bats found on O‘ahu may be migrant or vagrant individuals.
- The pueo, or short-eared owl (*Asio flammeus sandwichensis*), is a state-listed endangered species for only the island of O‘ahu. It may be present in the project area because its expected habitat is open grassland and woodland. These birds are diurnal and crepuscular and therefore can be observed in day time.
- The O‘ahu elepaio (*Chaoiempis sandwichensis ibidis*) is listed as an endangered species, but its habitat is associated with the upland forests of the Ko‘olau and Wai‘anae Mountains on O‘ahu and therefore it is not expected to occur in the project area (USFWS, 2002; Vanderwerf, et al., 2001).
- The following waterbird species, federally listed as endangered, have been observed in the wetland areas within the project area (USFWS, 1999):
 - Hawaiian coot (*Fulica americana alai*)
 - Hawaiian duck (*Anas wyvilliana*)
 - Hawaiian common moorhen (*Gallinula chloropus sandvicensis*). The endangered common moorhen has been recorded at the Sumida Watercress Farm on Kamehameha Highway in Waimalu (HBMP 2006)
 - Hawaiian stilt (*Himantopus mexicanus knudseni*)
- The threatened Newell’s shearwater may occasionally overfly the corridor, but no nesting colonies have been seen on O‘ahu. However, small numbers of Newell’s shearwater have been recovered on O‘ahu following downing incidents. The majority of these birds were found on the Honolulu side of the Ko‘olau Mountain Range (David, 2000). Newell’s shearwaters nest high in the mountains in burrows excavated under thick vegetation (David, 2000).
- White terns (*Gygis alba*) are a relatively recent addition to the avifauna of O‘ahu but are known to be present in portions of the project area and are listed as endangered in the State of Hawai‘i; however, they are not federally listed as rare, threatened, or endangered. Prior to the 1960s, they could only be seen with regularity in the Northwestern Hawaiian Islands. Their establishment on O‘ahu may be a result of crowded conditions elsewhere, which have forced the birds to search for other roosting and nesting localities (Miles, 1986; Vanderwerf, 2003).

The major sites used by white terns on O‘ahu include Kapi‘olani Park, Waikiki, and Downtown Honolulu areas, with some activity scattered elsewhere in urban Honolulu (Bruner, 1992, Vanderwerf 2003).

- NMFS and/or DLNR-DAR noted that the following endangered species may occur in the waters or shorelines around, but not in, the project area:
 - Hawaiian monk seal (*Monachus schauinslandi*)
 - Humpback whale (*Megaptera novaeangliae*)
 - Sperm whale (*Physeter macrocephalus*)
 - Blue whale (*Balaenoptera musculus*)
 - Fin whale (*Balaenoptera physalus*)
 - Leatherback turtle (*Dermochelys coriacea*)
 - Hawksbill turtle (*Eretmochelys imbricata*)
 - Green turtle (*Chelonia mydas*)
 - Olive Ridley turtle (*Lepidochelys olivacea*)
 - Loggerhead turtle (*Caretta caretta*).

Results of Fieldwork

Except for portions of the ‘Ewa Plain, the study area consists of heavily urbanized environments. Birds are the most prominent wildlife in the project area; therefore, the primary focus of field investigations was to document the species of birds and their population at count stations along the alignments being considered for the Managed Lane and Fixed Guideway Alternatives.

The marine mammal and turtle species identified by NMFS and DLNR-DAR were not addressed during field work because of a lack of habitat in the project area.

Results of the wildlife counts performed along the transit alignments on February 19 through 21, 2006, are summarized in Table 4-1 and Table 4-2 and detailed in Appendix C. Results of the wildlife count performed at potential maintenance facilities, park-and-ride lots, and transit centers on May 19, 2006, are summarized in Table 4-3. As shown in the tables, 26 bird species were observed along the transit routes and 13 were observed at the other sites. The only endangered or threatened species observed during the study was the white tern. No bats were found during the evening drive survey or over man-made water impoundments. No short-eared owls were found, but a barn owl was seen near the end of Saratoga Avenue among the large banyan trees.

Table 4-1. Results of Bird Counts along Proposed Alignment Corridors

| Alternative | Birds per Station (average) | Mean Richness (Average Species per Station) | Total Richness (Total Species per Station) | Total White Terns | T and E Fed/State* |
|---|-----------------------------|---|--|-------------------|--------------------|
| Alternative 3: Managed Lane Alternative | | | | | |
| Kamehameha Highway (7)/ Nimitz Highway (6) | 21 | 6.1 | 11 | 0 | 0 |
| Alternative 4: Fixed Guideway Alternative (by section) | | | | | |
| Section I. Kapolei to Fort Weaver Road | | | | | |
| Kamokila Boulevard/ Farrington Highway (7) | 70 | 8 | 19 | 0 | 0 |
| Kapolei Parkway/North-South Road (6) | 58 | 8.3 | 21 | 0 | 0 |
| Saratoga Avenue/North-South Road (7) | 84 | 7.5 | 19 | 0 | 0 |
| Geiger Road/Fort Weaver Road (10) | 66 | 7.4 | 19 | 0 | 0 |
| Section II. Fort Weaver Road to Aloha Stadium | | | | | |
| Farrington Highway/ Kamehameha Highway (7) | 35 | 6.5 | 11 | 0 | 0 |
| Section III. Aloha Stadium to Middle Street | | | | | |
| Salt Lake Boulevard (5) | 29 | 6 | 11 | 0 | 0 |
| Mauka of the Airport Viaduct (7) | 26 | 6.7 | 10 | 0 | 0 |
| Makai of the Airport Viaduct (6) | 27 | 7.4 | 10 | 0 | 0 |
| Aolele Street (4) | 23 | 6 | 10 | 0 | 0 |
| Section IV. Middle Street to Iwilei | | | | | |
| North King Street (4) | 22 | 4.7 | 8 | 0 | 0 |
| Dillingham Boulevard (3) | 15 | 4.6 | 8 | 0 | 0 |
| Section V. Iwilei to UH Mānoa | | | | | |
| Beretania Street/South King Street (5) | 37 | 5.6 | 10 | 0 | 0 |
| Hotel Street/ Kawaiaha'o Street/Kapi'olani Boulevard (8) | 3 | 5.5 | 9 | 0 | 0 |
| Hotel Street/ Waimanu Street/Kapi'olani Boulevard (8) | 23 | 5.8 | 11 | 4 | 4 |
| Nimitz Highway/Queen Street/ Kapi'olani Boulevard (8) | 22 | 5 | 10 | 4 | 4 |
| Nimitz Highway/Halekauwila Street/ Kapi'olani Boulevard (8) | 27 | 6.4 | 11 | 4 | 4 |
| Waikīkī Spur (4) | 26 | 7 | 11 | 3 | 3 |

Note: * = includes white terns (which are only state-listed).
(number) in parenthesis denotes number of count stations in area.
T and E = Threatened and Endangered (number of individuals observed, not number of species).

Table 4-2. Species Presence along Each Alignment

| Species | Section I | | | | | II | Section III | | | IV | | Section V | | | | | |
|-----------------------|-------------------------|-------------------------|--------------------------|------------------------|---------------------------|-----------|---------------|---------------|--------|---------|------------|--------------------|--------------------------|--------------|------------------------|--------------------------|--------------|
| | Kamokila/ Farrington | Kapolei/North- South | Saratoga/North- South | Geiger/ Fort Weaver | Farrington/ Kamehameha | Salt Lake | Mauka Viaduct | Makai Viaduct | Aolele | N. King | Dillingham | Hotel/ Kawaihau | Hotel/Waimanu Streets | Nimitz/Queen | Nimitz/ Halekauwila | Beretania/ South King | Waikiki Spur |
| cattle egret | X | X | X | X | X | | X | X | X | | | | | | | X | |
| black francolin | X | X | X | X | | | | | | | | | | | | | |
| gray francolin | X | X | X | X | | | | | | | | | | | | | |
| ring-necked pheasant | X | X | X | X | | | | | | | | | | | | | |
| feral pigeon | | | | | X | | X | X | X | | | | | X | X | X | X |
| spotted dove | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| zebra dove | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| barn owl | | | X | | | | | | | | | | | | | | |
| red-vented bulbul | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| red-whiskered bulbul | | | | | | | | | | | | | | | | | X |
| Japanese white-eye | X | X | X | X | X | X | X | X | X | | X | X | X | X | X | X | X |
| northern mockingbird | | X | | | | | | | | | | | | | | | |
| common myna | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| saffron finch | X | | X | X | | | | | | | | | | | | | |
| red-crested cardinal | X | X | X | X | X | X | X | | | | X | X | X | X | X | X | |
| northern cardinal | X | X | X | X | | | | | | | | | | | | | |
| house finch | X | X | X | X | X | X | X | X | X | | | | | | | | |
| common waxbill | X | X | X | X | X | | | | | | | | | | | | |
| nutmeg manikin | X | | X | X | | | | | | | | | | | | | |
| chestnut mannikin | X | X | X | X | | | | | | | | | | | | | |
| Java sparrow | | X | | X | | X | | | | | | | | X | X | X | |
| English sparrow | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| ruddy turnstone | X | X | X | X | | | | | | | | | | | | | |
| Pacific golden plover | X | X | X | X | | X | | X | X | X | X | | | | | | |
| unknown duck | | | | | | | | | | | | | | | | | X |
| white tern | | | | | | | | | | | | | X | X | | | X |

Table 4-3. Species Presence at Potential Maintenance Facilities, Park-and-Ride Lots, and Transit Center Sites

| Species | Kapolei Parkway & Hanna Street | Kapolei Parkway & Wākea Street | Transit Center | Saratoga Avenue & North-South | Road Park-and-Ride | Kalaeloa Maintenance Facility | Farrington Hwy. & UH West O'ahu | Park-and-Ride | North-South Road & Farrington | Highway Park-and-Ride | Farrington Highway Maintenance Facility | Farrington Highway & Kunia Road | Maintenance Facility | Fort Weaver Road & Renton Road | Park-and-Ride | Farrington Highway & Leoku Street | Park-and-Ride | Waiawa Maintenance Facility | Kamehameha Highway & Kuaia | Street Park-and-Ride (Waiawa) | Kamehameha Highway & Kaonohi | Street Transit Center | Aloha Stadium Park-and-Ride | Salt Lake Boulevard & Kahuapa'ani | Street Park-and-Ride | Fort Shafter Maintenance Facility | Dillingham Boulevard & Middle | Street Park-and-Ride | Middle Street Transit Center | Ka'ahi Street Transit Center | Beretania Street & Alapa'i Street | Transit Center | Convention Center Transit Center | | |
|----------------------|--------------------------------|--------------------------------|----------------|-------------------------------|--------------------|-------------------------------|---------------------------------|---------------|-------------------------------|-----------------------|---|---------------------------------|----------------------|--------------------------------|---------------|-----------------------------------|---------------|-----------------------------|----------------------------|-------------------------------|------------------------------|-----------------------|-----------------------------|-----------------------------------|----------------------|-----------------------------------|-------------------------------|----------------------|------------------------------|------------------------------|-----------------------------------|----------------|----------------------------------|--|--|
| cattle egret | X | | | | | | | | X | | X | | | | | | | | | X | | | | | | | | | | | | | | | |
| ring-necked pheasant | X | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| spotted dove | X | | | | | | | | X | | | | | | | | | | | X | | | | | | | | | | | | | | | |
| zebra dove | | | | | | | | | X | | X | | | | | | | | | X | | | | | | | | | | | | | | | |
| red-vented bulbul | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Japanese white-eye | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| common myna | X | X | X | X | | | | | X | | | X | | | | | | | | | | | | | | | | | | | | | | | |
| northern cardinal | | | X | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| house finch | X | X | X | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| common waxbill | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| nutmeg manikin | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| chestnut manikin | X | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ruddy turnstone | X | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

No trapping for rodents was conducted, but it is expected that black rats (*Rattus rattus*), Norway rats (*Rattus norvegicus*), Polynesian rats (*Rattus exulans*), and the house mouse (*Mus musculus*) occur throughout the study corridor. Mongoose (*Herpestes auropunctatus*) and feral cats (*Felis catus*) were observed and are also expected to occur throughout the corridor.

The potential alignments cross many streams, sometimes the same stream more than once, but no endangered waterbirds were observed at any crossings. Most streams are heavily modified as drainage canals and do not provide suitable waterbird habitat. No waterbirds were observed at the Sumida Watercross Farm on the Kamehameha Highway in Waimalu during the field investigation. Fort Weaver Road is in the vicinity of the Hono‘uli‘uli Unit of the Pearl Harbor National Wildlife Refuge (PHNWR), and Kamehameha Highway is in the vicinity of the Waiawa Unit of PHNWR. Both units were established to protect the four endangered waterbirds discussed above: Hawaiian coot, Hawaiian duck, Hawaiian common moorhen, and Hawaiian stilt.

The following observations were made during the survey, as shown in Table 4-2 and 4-3.

- Only introduced species were observed during the survey. The following introduced species occurred in all areas surveyed: spotted dove (*Streptopelia chinensis*), zebra dove (*Geopelia striata*), red-vented bulbul (*Pycnonotus cafer*), common myna (*Acridotheres tristis*), house finch (*Carpodacus mexicanus*), and English sparrow (*Passer domesticus*). These species are highly adaptable and are probably the most commonly observed birds on O‘ahu. The introduced Japanese white-eye (*Zosterops japonica*) is also very common and was present in most areas.
- More birds per station and a slightly greater number of species were observed in the ‘Ewa Plain area. The introduced species in the ‘Ewa Plain area do not adapt well to more heavily developed areas. These species include: black and gray francolin (*Francolinus francolinus* and *pondicerianus*), ring-necked pheasant (*Phasianus colchicus*), common waxbill (*Estrilda troglodytes*), nutmeg and chestnut manikin (*Lonchura* and *punctulata*), and ruddy turnstone (*Arenaria interpres*).
- The only threatened or endangered bird species observed during the study was the white tern, which was only observed in Alternative 4, Section V – Iwilei to UH Mānoa segment. The large canopy street trees in this area provide roosting and nesting opportunities for the tern, which is a relatively new O‘ahu inhabitant.

Vegetation Biology

The discussion in this section focuses on the ‘Ewa Plain area where relatively undeveloped land is present in the project study area. This area includes the western portion of Alternatives 3 and 4, Sections I and II (Kapolei to Aloha Stadium). Vegetation within the ‘Ewa Plain study area consists of the following:

- Ruderal (weedy) patches, such as undeveloped properties

- Plants within abandoned agricultural areas, such as the area makai of the H-1 Freeway near Kapolei
- Plantings in cultivated agricultural areas, such as the watercress farms and taro patches in the Pearlridge/Pearl City areas, and diversified agriculture farms in 'Ewa.

Vegetation in the more developed portions of the study area, from Aloha Stadium east, consists solely of maintained street plantings, such as roadway medians and shoulders. No native habitat or species are present in the more developed areas east of Aloha Stadium. The last section of this chapter discusses street plantings in detail, both in developed portions of the 'Ewa Plain and in the eastern developed areas.

Existing Documentation on Protected Species

Based on coordination with the USFWS for previous transit proposals, three federally endangered plant species have been observed within the 'Ewa area of the study corridor:

- ko'oloa'ula (*Abutilon menziesii*)
- 'awīwī (*Centaurium sebaeoides*)
- 'ihi'ihī (*Marsillea villosa*)

In addition, a Species of Concern, the plant pu'uka'a (*Torulinium odoratum ssp. auriculatum*) has been reported within the 'Ewa portion of the study area. The DLNR-DOFAW also indicated that *Achyranthes splendens spp. rotundata*, *Chamaesyce skottsbergii*, and ko'oloa'ula (*Abutilon menziesii*) are known to be scattered throughout the 'Ewa-Kapolei-Kalaeloa region.

HBMP supplied historical and present locations of known Threatened or Endangered plant species within the greater alignment corridor for review. The only rare plant mapped on or immediately adjacent to the alignments was the ko'oloa'ula (*Abutilon menziesii*) populations at the southern end of North-South Road. A management plan is already in place for this endangered taxa, and more detail is provided below. A review of the USFWS Critical Habitat for O'ahu determined that no Critical Habitat was designated along any of the proposed alternative alignments.

Results of Fieldwork

The preliminary botanical survey and search for any protected, rare, or endangered plant species were conducted along all alignments being considered for Alternatives 3 and 4 during February and March 2006.

The existing vegetation along each individual alignment is discussed below and summarized in Table 4-4, which includes an estimate of native vegetation cover by percentage. Table 4-4 also contains baseline information about the locations of proposed support facilities (e.g. maintenance, park-and-ride lots, and transit centers) that would be affected under the Fixed Guideway Alternative. While as complete as possible, these descriptions do not contain complete species lists for the alignments nor do they encompass all possible species that may exist along alignments in the study area.

Because Sections III through V are urbanized, they are not discussed in detail; however, they are included in the table. Access to much of the survey area was restricted, especially in the Kapolei and 'Ewa sections. A follow-up survey, if necessary, after the selection of the LPA would provide a more thorough botanical survey, especially for those areas of restricted access.

Table 4-4. Dominant Vegetation by Alignment (Kapolei to Aloha Stadium)

| Alternative | Environment | Vegetation | % Native cover |
|--|---|--|----------------|
| Alternative 3: Managed Lane | | | |
| Kamehameha Highway | Established highway | Koa haole scrub | 0% |
| Nimitz Highway | Established highway | Street plantings | 0% |
| Alternative 4: Fixed Guideway Alignments (by section) | | | |
| Section I. Kapolei to Fort Weaver Road | | | |
| Proposed terminus behind <i>Honolulu Advertiser</i> building | Open field | Buffelgrass (<i>Cenchrus ciliaris</i>) scrub with 'ilima (<i>Sida fallax</i>), 'uhaloa (<i>Waltheria indica</i>), and lion's ear (<i>Leonotis nepetifolia</i>) | 10% |
| Kamokila Boulevard (KB)/ Farrington Highway (FH) | Mix of urban, residential, and suburban areas. Suburban areas have open scrub, crop lands, and golf courses | KB and FH: Street plantings on median and along roadside include non-native grass with kiawe (<i>Prosopis pallida</i>) and monkeypod (<i>Samanea saman</i>) trees and bougainvillea (<i>Bougainvillea sp.</i>). FH: Koa haole scrub with Kiawe and buffelgrass | <1% |
| Kapolei Parkway (KP)/ North-South Road (NSR) | Mix of residential and suburban areas. Suburban areas have crop lands and open scrub | KP: Koa haole/buffelgrass scrub with kiawe, castor bean (<i>Ricinus communis</i>), and golden-crownbeard (<i>Verbesina encelioides</i>) NSR: Koa haole/grassland scrub with 'ilima and uhaloa; ko'oloa'ula (<i>A. menziesii</i>) population at southern end of NSR | <1% |
| Saratoga Avenue (SA)/ North-South Road (NSR) | Former Barbers Point Naval Air Station housing, open scrub, and crop lands | Wākea mauka of Roosevelt: Kiawe/buffelgrass scrub Wākea makai of Roosevelt: Large unmaintained trees including kiawe (<i>Prosopis pallida</i>), African tulip (<i>Spathodea campanulata</i>), Chinese banyan (<i>Ficus microcarpa</i>), earpod (<i>Enterolobium cyclocarpum</i>), and opiuma (<i>Pithecelobium dulce</i>); with buffelgrass and passion fruit (<i>Passiflora edulis</i>) understory. SA: Mixed scrub with koa haole and 'ilima NSR: See above | 5% |
| Geiger Road (GR)/ Fort Weaver Road (FWR) | Primarily residential development with golf courses. Few open scrub areas in undeveloped section of Geiger Road | Unbuilt GR: Kiawe trees with 'ilima and buffelgrass; native vine kauna'oa pehu (<i>Cassytha sandwicensis</i>) in several kiawe trees FWR: Mainly street trees (monkeypod) and plantings with non-native grass Note: Access to some areas restricted | 10% |

| Alternative | Environment | Vegetation | % Native cover |
|---|---|---|----------------|
| Section II. Fort Weaver Road to Aloha Stadium | | | |
| Farrington Highway (FH)/ Kamehameha Highway (KH) | Urban towns of Waipahu, Pearl City, Waiawa, and Waimalu; passes Pearl Harbor Park, 'Aiea State Rec. Area, Sumida Watercress Farm, and several drainage canals | FH and KH: Street plantings; trees include monkeypod, opiuma, macaranga (<i>Macaranga tanarius</i>), and java plum (<i>Syzygium cumini</i>); scrubs include <i>Pritchardia</i> sp. and hibiscus; mowed non-native grass in median strip Stream vegetation along banks dominated by California grass (<i>Brachiaria mutica</i>), ivy gourd (<i>Coccinea grandis</i>), and honohono grass (<i>Commelina diffusa</i>). Waiawa Interchange: Koa haole scrub | <1% |
| Section III. Aloha Stadium to Middle Street | | | |
| Salt Lake Boulevard | Residential areas | Street plantings | 0% |
| Mauka of the Airport Viaduct | Military, residential, golf course and commercial development | Street plantings | 0% |
| Makai of the Airport Viaduct | Military and commercial development; passes Veterans Memorial Park | Street plantings | 0% |
| Aolele Street | Commercial area with drainage channel; passes through Ke'ehi Lagoon Park and by Veterans Memorial Park | Street plantings | 0% |
| Section IV. Middle Street to Iwilei | | | |
| North King Street | Urbanized portion of Honolulu; crosses Ke'ehi, Kalihi, and Kapālama Drainage Canals | Street plantings | 0% |
| Dillingham Boulevard | | Street plantings | 0% |
| Section V. Iwilei to UH Mānoa | | | |
| Beretania Street/ South King Street | Urbanized portion of Honolulu | Street plantings | 0% |
| Hotel Street/ Kawaiāha'o Street/ Kapi'olani Boulevard | Urbanized portion of Honolulu, crosses Nu'uānu Drainage Canal | Street plantings | 0% |
| Hotel Street/ Waimānu/ Kapi'olani Boulevard | | Street plantings | 0% |
| Nimitz Highway/ Queen Street/ Kapi'olani Boulevard | | Street plantings | 0% |

| Alternative | Environment | Vegetation | % Native cover |
|--|---|---|----------------|
| Nimitz Highway/ Halekauwila Street/ Kapi'olani Boulevard | | Street plantings | 0% |
| Waikiki Spur | Residential/ tourist development, crosses Ala Wai Drainage Canal | Street plantings | 0% |
| Alternative 4: Maintenance Facilities, Park-and-Ride Lots, and Transit Centers (by section) | | | |
| Section I. Kapolei to Fort Weaver Road | | | |
| Kapolei Parkway & Hanua Street Park- and-Ride Lot | Disturbed open grassland/haole koa scrub field | Buffelgrass scrub with "ilima | 10% |
| Kapolei Parkway & Wākea Street Transit Center | Disturbed open weedy scrub and grassland | Koa haole/buffelgrass scrub with verbesina, kiawe, castor bean | 1% |
| Saratoga Avenue & North-South Road Park-and-Ride Lot | Park (baseball field) and disturbed kiawe scrub forest | Street trees and buffelgrass scrub with kiawe, opiuma, "ilima | 1% |
| Kalaeloa Maintenance Facility | Disturbed scrub and kiawe scrub forest | Kiawe forest and buffelgrass scrub with opiuma, koa haole, guinea grass, ficus | 5% |
| Farrington Highway & UH West O'ahu Park-and-Ride Lot | Cement plant baseyard | Street trees along Farrington Highway (Banyan, coral tree hedge) | 0% |
| North-South Road & Farrington Highway Park-and- Ride Lot | Agriculture fields, corn crops and fallow fields | Corn and fallow fields. Koa haole scrub along Kalo'i Gulch | 1% |
| Farrington Highway Maintenance Center | Fallow agriculture fields | Fallow fields with guinea grass, buffelgrass, bulgar | 0% |
| Farrington Highway & Kunia Road Maintenance Facility | Agriculture fields, corn crops and fallow fields | Corn and fallow fields | 0% |
| Fort Weaver Road & Renton Road Park-and-Ride Lot | Disturbed grassland | Buffelgrass scrub with tree tobacco, koa haole | 1% |
| Section II: Fort Weaver Road to Aloha Stadium | | | |
| Farrington Highway & Leokū Street Park-and-Ride Lot | Industrial/parking lot | None | 0% |
| Waiawa Maintenance Facility | Disturbed scrub | Koa haole scrub with guinea grass, java plum, monkey pod, Antigonon, Pluchea | 1% |
| Kamehameha Highway & Kuala Street Park-and- Ride Lot (Waiawa) | Waiawa Stream and disturbed scrub | Koa Haole scrub with guinea grass, java plum, California grass, macarnaga | 1% |

| Alternative | Environment | Vegetation | % Native cover |
|--|------------------------|--|----------------|
| Kamehameha Highway & Kaonohi Street Transit Center | Industrial/parking lot | Street trees and ornamental planting (Hibiscus and Tecoma trees) | 0% |

As shown in Table 4-4, the maximum native cover observed in the ‘Ewa Plain was 10%. This illustrates that most areas are substantially disturbed and dominated by non-native grasses, shrubs, and trees. Native species observed during the survey included the following:

- ‘ilima (*Sida fallax*)
- ‘uha-loa (*Waltheria indica*)
- ko‘oloa-‘ula (*Abutilon menziesii*)
- kauna‘oa-pehu (*Cassitha sandwicensis*)

While ‘ilima, ‘uhaloa, and kauna‘oa-pehu are not considered threatened or endangered, *A. menziesii* is protected by both the federal Endangered Species Act of 1973, as amended, and Chapter 195D, HRS, as amended. *A. menziesii* is a shrub of the mallow family, growing six to eight feet tall, with coarsely toothed, silvery, heart-shaped leaves that are about one to three inches long. Flowers are medium red to dark red and less than an inch in diameter. It has been sold as an ornamental plant at local nurseries in the past under the name “red ‘ilima.” Other populations of ko‘oloa-‘ula currently exist on Lāna‘i and Maui.

As part of the environmental planning for North-South Road and a portion of Kapolei Parkway, a “Habitat Conservation Plan for *Abutilon menziesii* at Kapolei” was finalized in March 2004. Mitigation measures have already been specified for these populations of *A. menziesii* related to construction of North-South Road. Two proposed alignments for this project include North-South Road as an easement. Future construction on North-South Road for the proposed Fixed Guideway system must consider potential impacts on the current *A. menziesii* population, including possible shading of the population and secondary disturbance due to dust and debris from construction.

Street Trees

This section focuses on street trees that occur along the project’s alignments. Because street plantings comprise much of the vegetation in the project area, a certified arborist conducted a preliminary survey of street trees along each alignment. Field work was conducted between February 15 and March 10, 2006.

A summary of street trees along each alignment is provided in Table 4-5. Tree species found along these alignments, with their corresponding scientific names, are shown in Table 4-6. Complete data tables for street trees along the proposed alignments are included as Appendix B of this Report.

Table 4-5. Summary of Street Trees along Proposed Transit Alignments within Study Area

| Alternative and Section | Street Tree Species | Approx. Total | Exceptional | Notable | Condition and Comments |
|--|---|---------------|-------------|---------|--|
| Alternative 3: Managed Lane | | | | | |
| Kamehameha Highway: Waiawa Interchange to Salt Lake Boulevard | Monkeypod, Mango, Fiddleleaf, Kiawe, Opiuma | 27 | | | Good; trees in median at the Waiawa Interchange only |
| Kamehameha Highway: Salt Lake Boulevard to Nimitz Highway merge | Fan Palm, Shower, Opiuma, Banyan, and Monkeypod | 38 | | | Fan Palms in fair condition, all others good; only a few in median |
| Nimitz Highway: Kamehameha Highway to Middle Street (mauka side) | Queen Palm, African Tulip, Opiuma, Brassia, Banyan | 83 | | | Good condition |
| Nimitz Highway: Middle Street to Waiakamilo Road | Kiawe, Monkeypod, Norfolk Island Pine, Kou, Fan Palm, Scrambled Egg Tree, Brassia, Coconut Palm, Areca Palm, Shower, Earpod | 136 | | 5 | Notable: Monkeypods in the traffic island at Sand Island Access Road intersection. Others in good condition, scrub growth; few Palms in median |
| Nimitz Highway: Waiakamilo Road to River Street | Fan Palm, Plumeria, Shower, African Tulip, Kou, Pink Tecoma, Manila Palm, Banyan, Monkeypod, Coconut | 107 | | 5 | Notable: Two Monkeypods, three Banyans. Others in good condition |
| Alternative 4: Fixed Guideway (by section) | | | | | |
| Section I. Kapolei to Fort Weaver Road | | | | | |
| Kamokila Boulevard/Farrington Highway | | | | | |
| Kapolei Parkway (extension) to Kamokila Boulevard | Monkeypod, Indian Coral | 561 | 0 | 0 | Poor to good |
| Kamokila Boulevard/Farrington Highway to Fort Barrette Road | Shower, Kamani | 294 | | | Good; 76 Kamani trees in median |
| Farrington Highway: Fort Barrette Road to Kapolei Golf Course Road | Shower | 226 | | | Good |
| Farrington Highway: Kapolei Golf Course Road to Fort Weaver Road | Kiawe | 8 | | | Fair; scrub trees |

| Alternative and Section | Street Tree Species | Approx. Total | Exceptional | Notable | Condition and Comments |
|--|--|---------------|-------------|---------|--|
| <i>Kapolei Parkway/North-South Road</i> | | 43 | 0 | 0 | |
| Kapolei Parkway (extension) to Kamokila Boulevard | Monkeypod, Indian Coral | 33 | | | Poor to good |
| Kapolei Parkway: Kamokila Boulevard to Fort Barrette Road | Undetermined | | | | Open scrub |
| Kapolei Parkway: Fort Barrette Road to Bridge at end of road | Monkeypod | 7 | | | Fair |
| North-South Road (under construction): Kapolei Parkway to Farrington Highway | Undetermined | | | | Open scrub and farmland. North-South Road under construction; street trees will be planted |
| Farrington Highway: North-South Road to Fort Weaver Road | Kiawe | 3 | | | Fair; scrub trees |
| <i>Saratoga Avenue/North-South Road</i> | | 41 | 0 | 0 | |
| Kapolei Parkway (extension) to Kamokila Boulevard | Monkeypod, Indian Coral | 33 | | | Poor to good |
| Wākea Street (future): Kamokila Boulevard to Saratoga Avenue | Monkeypod, Banyan, Kiawe, undetermined | | | | N/A; open scrub and abandoned subdivision |
| Saratoga Avenue: Wākea Street to Coral Sea Road | Kiawe | 5 | | | Fair; scrub trees |
| Coral Sea Road to North-South Road junction | Undetermined | | | | N/A; abandoned, scrub trees |
| North-South Road (under construction): Kapolei Parkway to Farrington Highway | Undetermined | | | | Open scrub and farmland. North-South Road under construction; street trees will be planted |
| Farrington Highway: North-South Road to Fort Weaver Road | Kiawe | 3 | | | Fair; scrub trees |
| <i>Geiger Road/Fort Weaver Road</i> | | 336 | 0 | 1 | |
| Kapolei Parkway (extension) to Kamokila Boulevard | Monkeypod, Indian Coral | 33 | | | Poor to good condition |
| Wākea Street (future): Kamokila Boulevard to Saratoga Avenue | Monkeypod, Banyan, Kiawe, undetermined | | | | N/A; open scrub and abandoned subdivision |
| Saratoga Avenue: Wākea Street to Coral Sea Road | Kiawe | 5 | | | Fair; scrub trees |
| Coral Sea Road to Geiger Road | Undetermined | | | | N/A; abandoned, scrub trees |
| Geiger Road to Fort Weaver Road | Fern Trees | 12 | | | Fair; none in median |

| Alternative and Section | Street Tree Species | Approx. Total | Exceptional | Notable | Condition and Comments |
|--|---|---------------|-------------|----------|--|
| Fort Weaver Road: Geiger Road to Farrington Highway | False Kou, Buttonwood, Mania Palm, Banyan, Gold Tree, Monkeypod | 286 | | 1 | Notable: Banyan in median near Old Fort Weaver Road. All Monkeypods on Koko Head-side in good condition, others fair; none in median |
| Section II. Fort Weaver Road to Aloha Stadium | | | | | |
| Farrington Highway: Fort Weaver Road to Waiawa Interchange | Banyan, Kou, Fan Palm, Shower, Monkeypod | 230 | | | Good; new plantings in median important to streetscape |
| Kamehameha Highway: Waiawa Interchange to Salt Lake Boulevard | Monkeypod, Mango, Fiddleleaf, Kiawe, Opiuma | 27 | | | Good; trees in median at the Waiawa Interchange only |
| Section III. Aloha Stadium to Middle Street | | | | | |
| Salt Lake Boulevard | | 78 | 0 | 0 | |
| Salt Lake Boulevard: Kamehameha Highway to Pu'uloa Road | Silver Trumpet, Monkeypod, Banyan, Kiawe, Indian Coral | 68 | | | All good, except Indian Coral in poor to fair condition; few in median |
| Pūko'ia Street: Pu'uloa Road to Ahua Street | Monkeypod, Pink Tecoma | 5 | | | Fair to good; none in median |
| Ahua Street to Nimitz Highway | Mangrove, Ironwood, Kiawe | | | | Undetermined; runs along stream bank |
| Kikowaena Street: Ahua Street to Middle Street | Monkeypod, African Tulip, Yellow Poinciana | 5 | | | Good |
| Makai of the Airport Viaduct | | 89 | 0 | 0 | |
| Kamehameha Highway: Salt Lake Boulevard to Nimitz Highway merge | Fan Palm, Shower, Opiuma, Banyan, Monkeypod | 38 | | | Fan Palms in fair condition, all others good; only a few in median |
| Nimitz Highway: Kamehameha Highway to Middle Street | Queen Palm, African Tulip, Opiuma, Brassia | 51 | | | Good |
| Mauka of the Airport Viaduct | | 121 | 0 | 0 | |
| Kamehameha Highway: Salt Lake Boulevard to Nimitz Highway merge | Fan Palm, Shower, Opiuma, Banyan, Monkeypod | 38 | | | Fan Palms in fair condition, all others good; only a few in median. |
| Nimitz Highway: Kamehameha Highway to Middle Street (mauka side) | Queen Palm, African Tulip, Opiuma, Brassia, Banyan | 83 | | | Good |
| Aolele Street | | 176 | 0 | 0 | |
| Kamehameha Highway: Salt Lake Boulevard to Nimitz Highway merge | Fan Palm, Shower, Opiuma, Banyan, Monkeypod | 38 | | | Fan Palms in fair condition, all others good; only a few in median |

| Alternative and Section | Street Tree Species | Approx. Total | Exceptional | Notable | Condition and Comments |
|---|---|---------------|-------------|-----------|---|
| Aolele Street: Nimitz Highway to Ke'ehi Lagoon Park (Middle Street) | Banyan, Coconut, Hong Kong Orchid, Fiddleleaf Fig, Shower, Indian Coral | 138 | | | Poor to good, Indian Coral trees poor to fair condition due to gall wasp infestation; few in median |
| Section IV. Middle Street to Iwilei | | | | | |
| <i>North King Street</i> | | 85 | 0 | 2 | |
| Middle Street: Dillingham Boulevard to North King Street | Fiddlewood | 15 | | | Good; none in median |
| North King Street: Middle Street to Nu'uano Stream | Monkeypod, Royal Poinciana, Fiddlewood | 70 | | 2 | Notable: One Monkeypod near First Hawaiian Bank, and one Royal Poinciana near Kaiulani Elementary School. All others are Fiddlewoods in fair to good condition; none in median |
| <i>Dillingham Boulevard</i> | | 52 | | 40 | |
| Dillingham Boulevard: Middle Street to Nu'uano Stream | Kamani, Monkeypod, Banyan | 52 | | 40 | Mostly notable trees of all species; none in median |
| Section V. Iwilei to UH Mānoa | | | | | |
| <i>Hotel Street/ Kawaiaha'o Street/Kapi'olani Boulevard</i> | | 232 | 0 | 65 | |
| Hotel Street: Nu'uano Stream to Richards Street | Fiddlewood, Tulipwood, Formosan Koa, Monkeypod, Coconut | 90 | | 13 | Notable: 13 Monkeypods, mostly set back from street; others fair |
| Kawaiaha'o Street: South Street to Queen Street | Monkeypod, Yellow Poinciana, Kou | 6 | | 5 | Notable: four Monkeypods and one Yellow Poinciana; others fair. |
| Kona Street: Pensacola Street to Kapi'olani Boulevard | Monkeypod, Pink Tecoma, Coconut | 30 | | 12 | Notable: 12 Monkeypods; 10 in median; others good; some in median |
| Kapi'olani Boulevard: Atkinson Drive to University Avenue | Monkeypod, Satinleaf, Fiddlewood | 51 | | 35 | Notable: 35 Monkeypods; 7 in median; others good |
| University Avenue: Kapi'olani Boulevard to H-1 Overpass | Shower, Alibangbang, Podocarpus | 55 | | | Fair to good; many Shower trees makai of South King in median |
| <i>Hotel Street/Waimanu Street/Kapi'olani Boulevard</i> | | 227 | 0 | 61 | |
| Hotel Street: Nu'uano Stream to Richards Street | Fiddlewood, Tulipwood, Formosan Koa, Monkeypod, Coconut | 90 | | 13 | Notable: 13 Monkeypods, mostly set back from street; others fair |
| Waimanu Street: Dreier Street to Queen Street | Monkeypod | 1 | | 1 | Notable: At 'Ewa/mauka corner of Waimanu Street and Ward Avenue |

| Alternative and Section | Street Tree Species | Approx. Total | Exceptional | Notable | Condition and Comments |
|---|--|---------------|-------------|-----------|--|
| Kona Street: Pensacola Street to Kapi'olani Boulevard | Monkeypod, Pink Tecoma, Coconut | 30 | | 12 | Notable: 12 Monkeypods; 10 in median. Others good; some in median |
| Kapi'olani Boulevard: Atkinson Drive to University Avenue | Monkeypod, Satinleaf, Fiddlewood | 51 | | 35 | Notable: 35 Monkeypods; 7 in median. Others good |
| University Avenue: Kapi'olani Boulevard to H-1 Overpass | Shower, Alibangbang, Podocarpus | 55 | | | Fair to good; many shower trees makai of South King in median |
| Nimitz Highway/Queen Street/Kapi'olani Boulevard | | 196 | 0 | 55 | |
| Nimitz Highway: Nu'uannu Stream to Queen Street | Fiddlewood, Coconut, Monkeypod, Banyan | 9 | | 7 | Notable: Three Monkeypods and four Banyans in Walker Park. Others fair |
| Queen Street: Nimitz Highway to Kamake'e Street | Monkeypod, Tecoma, Coconut, Shower | 51 | | 1 | Notable: Monkeypod fronting State Department of Taxation building. Others good |
| Kona Street: Pensacola Street to Kapi'olani Boulevard | Monkeypod, Pink Tecoma, Coconut | 30 | | 12 | Notable: 12 Monkeypods; 10 in median. Others good; some in median |
| Kapi'olani Boulevard: Atkinson Drive to University Avenue | Monkeypod, Satinleaf, Fiddlewood | 51 | | 35 | Notable: 35 Monkeypods; 7 in median. Others good |
| University Avenue: Kapi'olani Boulevard to H-1 Overpass | Shower, Alibangbang, Podocarpus | 55 | | | Fair to good; many shower trees makai of South King in median |
| Nimitz Highway/Halekauwila Street/Kapi'olani Boulevard | | 161 | 0 | 68 | |
| Nimitz Highway: Nu'uannu Stream to Richards Street | Fiddlewood, Coconut, Monkeypod, Banyan | 9 | | 7 | Notable: Three Monkeypods and four Banyans in Walker Park. Others fair |
| Halekauwila Street: Richards Street to Ward Avenue | Monkeypod, Shower | 16 | | 14 | Notable: 14 Monkeypods. Others good |
| Halekauwila Street to Kona Street connection | Undetermined | | | | N/A; developed properties |
| Kona Street: Pensacola Street to Kapi'olani Boulevard | Monkeypod, Pink Tecoma, Coconut | 30 | | 12 | Notable: 12 Monkeypods; 10 in median. Others good; some in median |
| Kapi'olani Boulevard: Atkinson Drive to University Avenue | Monkeypod, Satinleaf, Fiddlewood | 51 | | 35 | Notable: 35 Monkeypods; 7 in median. Others good |
| University Avenue: Kapi'olani Boulevard to H-1 Overpass | Shower, Alibangbang, Podocarpus | 55 | | | Fair to good; many shower trees makai of South King in median |
| Wai'iki'i Spur | | 361 | 10 | 0 | |
| Kalākāua Avenue: Kapi'olani Boulevard to Kūhiō Avenue | Mahogany, Shower | 50 | 10 | | Exceptional: Ten Mahogany trees in the median of Kalākāua Avenue. Others good |

| Alternative and Section | Street Tree Species | Approx. Total | Excep-tional | Notable | Condition and Comments |
|---|-----------------------------------|---------------|--------------|------------|--|
| Kūhiō Avenue: Kalākaua Avenue to Kapahulu Avenue | Monkeypod, Coconut, Shower | 311 | | | Good; many in median |
| <i>Beretania Street/South King Street</i> | | 289 | 0 | 236 | |
| South Beretania Street: Dillingham Boulevard to Alapa'i Transfer Center | Showers, Milo, Coconut, Monkeypod | 90 | | 45 | Notable: 45 Monkeypods. Others good |
| South King Street: Alapa'i Transit Center to University Avenue | Showers, Earpod, Banyan | 199 | | 191 | Notable: 183 Shower trees highly valued by The Outdoor Circle, two earpods, six banyans. Others good |

Source: Steve Nimz and Associates. February 2006.

Table 4-6. Street Tree Species Found Along Alternatives 3 and 4 Alignments

| | |
|---|---|
| African Tulip: <i>Spathodea campanulata</i> | Mahogany: <i>Swietenia mahagoni</i> |
| Alibangbang: <i>Bauhinia hookeri</i> | Mango: <i>Mangifera indica</i> |
| Areca Palm: <i>Dyopsis lutescens</i> | Manila Palm: <i>Veitchia merrillii</i> |
| Banyan: <i>Ficus</i> sp. (<i>microcarpa</i> , <i>benjamina</i> or <i>benghalensis</i>) (Note: Species not differentiated for the purposes of this preliminary survey) | Milo: <i>Thespesia populnea</i> |
| Brassia: <i>Schefflera actinophylla</i> | Monkeypod: <i>Samanea saman</i> |
| Coconut: <i>Cocos nucifera</i> | Norfolk Island Pine: <i>Araucaria heterophylla</i> |
| Earpod: <i>Enterolobium cyclocarpum</i> | Opiuma: <i>Pithecellobium dulce</i> |
| Fan Palm: <i>Pritchardia</i> sp. (represents <i>hillebrandii</i> , <i>pacifica</i> , or <i>Thurstonii</i>) | Pink Tecoma: <i>Tabebuia pentaphylla</i> |
| Fern Tree: <i>Filicium decipiens</i> | Plumeria: <i>Plumeria acuminata</i> |
| Fiddleleaf Fig: <i>Ficus lyrata</i> | Podocarpus: <i>Podocarpus</i> sp. (an indeterminate species at this time) |
| Fiddlewood: <i>Citharexylum spinosum</i> | Queen Palm: <i>Syagrus romanzoffiana</i> |
| Formosan Koa: <i>Acacia confusa</i> | Royal Poinciana: <i>Delonix regia</i> |
| Gold Tree: <i>Tabebuia donnell-smithii</i> | Satinleaf: <i>Chrysophyllum oliviforme</i> |
| Hong Kong Orchid Tree: <i>Bauhinia</i> sp. (an indeterminate species at this time) | Scrambled Egg: <i>Senna alata</i> |
| Indian Coral: <i>Erythrina variegata</i> | Shower Tree: <i>Cassia</i> sp. (represents <i>fistula</i> , <i>grandis</i> , <i>javanica</i> , or <i>Cassia</i> x <i>nealae</i> , syn: <i>C. javanica</i> x <i>C. fistula</i>) |
| Kamani: <i>Calophyllum inophyllum</i> | Silver Buttonwood: <i>Conocarpus erectus</i> , var. <i>sericeus</i> |
| Kiawe: <i>Prosopis pallida</i> | Tulipwood: <i>Harpullia pendula</i> |
| Kou: <i>Cordia subcordata</i> | Yellow Poinciana: <i>Peltophorum pterocarpum</i> |

Several streets within the study area contain mature or otherwise impressive vegetation within the medians and streetscapes. These include Dillingham Boulevard, Hotel Street, Kapi‘olani Boulevard, Kona Street, South King Street, Kalākaua Avenue, and portions of Halekauwila Street and Kawaiha‘o Street. In a majority of areas, street trees consisted of plantings such as monkeypods, palms, and shower trees. Only general observations were made about trees in areas of the alignments that are not currently crossed by existing roadways.

Some “Exceptional Trees” are located along the proposed project alignments. Such trees are defined as “a tree or grove of trees with historic or cultural value, or which by reason of its age, rarity, location, size, aesthetic quality, or endemic status has been designated by the city council as worthy of preservation” (Revised Ordinance of Honolulu Section 41-13.2, 1990). Ten mahogany trees on Kalākaua Avenue, from the Ala Wai Canal to Ala Moana Boulevard, are Exceptional Trees. A group of gold trees within the median of the Nimitz Highway, under the viaduct and near the Navy Marine Golf Course, was recently proposed as Exceptional Trees. It is anticipated that the City Council will

designate these as Exceptional Trees. However, these gold trees are not listed in Table 4-5 because the median of Nimitz Highway is not under consideration as a possible alignment in this area.

“Notable” trees were also identified as part of the study. A “notable” tree is defined as a tree(s) that the arborist deemed to be important to the urban landscape character. This category includes individual trees or tree types, as well as groups of trees that together comprise a recognized and important element of the visual landscape. Tree health was also considered in determining whether trees are “notable.” If the arborist determined a tree to be “overmature” (close to its life expectancy for successful replanting) or otherwise unhealthy, the tree was typically not deemed to be “notable.” Examples of notable trees observed are large Banyan trees in various locations, Kamani trees lining Dillingham Boulevard, and Monkeypod trees on Kapi‘olani Boulevard.

Other street plantings of interest include those on Farrington Highway in Waipahu and on Kūhiō Avenue in Waikīkī. Recent plantings in the median of Farrington Highway, between Fort Weaver Road and Waipahu High School, helped beautify this roadway approximately three years ago and were nominated for a landscaping/beautification award. While these young plantings of Shower trees, Loulu (fan) palms, and Kou trees are not listed as “notable,” their importance to the community and the Waipahu streetscape should not be overlooked. In Waikīkī, the City undertook an improvement project a few years ago on Kūhiō Avenue, which involved several new plantings of Shower trees, Monkeypods, and Coconut Palms. Exceptional and notable trees in the Hawaii Capital Special District were not surveyed because the proposed alignments are underground in this area.

This chapter discusses potential impacts by alternative. Alternatives 1 and 2 are addressed very briefly below. Under each Build Alternative (Alternatives 3 and 4), the potential long-term operational impacts are described for the following subject areas:

- Geology and Natural Hazards
- Farmlands
- Wildlife
- Vegetation (excluding street trees)
- Street Trees

Short-term, construction phase impacts are also briefly discussed for each alternative. Table 5-1 summarizes the potential impacts.

Alternative 1: No Build

While the No Build Alternative (see Chapter 1) assumes completion of projects included in the O‘ahu 2030 Regional Transportation Plan (RTP), no construction would be undertaken as part of this project. In 2030, the project corridor would be more urbanized than it is currently, especially in the ‘Ewa and Kapolei areas, reducing the amount of farming, open space, and habitat for wildlife and plants.

Impacts associated with development of the individual projects listed in the RTP are not detailed in this evaluation because the projects will undergo planning and environmental review as part of their individual project development process.

Alternative 2: Transportation System Management

Impacts under the TSM Alternative are anticipated to be similar to those of the No Build Alternative.

Under the TSM Alternative (see Chapter 1), no major construction projects would be undertaken. The TSM Alternative would provide an enhanced bus system based on a hub-and-spoke route network, conversion of the present morning peak-hour-only zipper-lane to both a morning and afternoon peak-hour zipper-lane operation, relatively low-cost capital improvements on selected roadway facilities to give priority to buses, and completion of projects included in the O‘ahu 2030 RTP.

Because of the limited nature of actions proposed under this alternative, no major impacts on natural resources are expected, both in the long-term and the short-term. Impacts on natural resources associated with development of individual projects under the TSM Alternative are not detailed in this report because those projects will undergo planning and environmental review as part of their individual project development process. Construction impacts would likely be limited to localized impacts on common types of

vegetation at project sites, and would be addressed in detail during planning and environmental review of individual projects.

Alternative 3: Managed Lane

The Managed Lane Alternative has two possible modes of operation, the two-direction option and the reversible option. Chapter 1 provides further details. For purposes of analyzing natural resource impacts, the main differences between these two is that two-direction operation requires a slightly larger project footprint because the elevated structure would need to be wider (roughly 50 feet), compared to the 40 feet width of the reversible option. In both cases, the bottom of the structure would average between 17 and 30 feet above ground level.

The following discussion assumes that the impacts of both Alternative 3 options would be the same, unless specifically noted. Table 5-1 summarizes these impacts.

Geology and Natural Hazards

The Managed Lane Alternative would not result in additional exposure to geologic hazards, tsunami or other natural hazards, such as tropical storms and hurricanes. The viaduct and other structures would be designed and constructed to withstand earthquakes per American Association of State Highway and Transportation Officials (AASHTO) guidelines and wind forces from tropical cyclones.

No adverse impacts are expected in the 100- or 500-year base floodplains. The proposed alignment would traverse some of the floodplains described in Chapter 4, but the managed lane would be elevated and supported on piers. It should not cause major changes that could affect the potential for flooding. Implementation of the project could result in minimal encroachment on the floodplain, but there would be no changes to existing flood elevation levels and it would not increase the risk of floods. The project should be in compliance with U.S. DOT Order 5650.2 on Floodplain Management and Protection. Construction would comply with the rules and regulations of the National Flood Insurance Program (NFIP) and all applicable ordinances for flood hazard districts as stated in the City and County of Honolulu's Land Use Ordinance.

Farmlands

The Managed Lane Alternative would have no direct footprint impacts on farmlands. Although some "Prime" or "Unique" agricultural lands lie adjacent to or near H-1, H-2, and Kamehameha Highway through the Waiawa/Pearl City area, the elevated structure would have no appreciable impact on any farmland operations because this alternative is located largely within existing ROWs.

If the Managed Lane Alternative is selected as the LPA, a "shadow analysis" may be necessary to determine if sunshine would be reduced, particularly at the Waiiau Stream taro patch and the Sumida Watercress Farm on Kamehameha Highway. This analysis will be performed as part of an EIS for the project and has been deferred until then for two reasons. First, Kamehameha Highway in this stretch is oriented east-west; because

the sun also travels primarily east-west, an elevated structure is not anticipated to affect sunlight on properties mauka or makai of the roadway, except possibly during winter. Second, any such impact along Kamehameha Highway would be similar to impacts of the Fixed Guideway Alternative (discussed below), and is therefore not a differentiator between Alternatives 3 and 4 for the AA.

Because the two-direction operational option under the Managed Lane Alternative would require a wider elevated structure, it may result in an incrementally greater impact on farmlands compared to the reversible option.

Wildlife

The Managed Lane Alternative would result in elevated structures that in most sections of the proposed alignment would have no effect on the majority of common, introduced urban wildlife species that are present.

No sensitive wildlife species were observed in the study area with the exception of urban Honolulu east of Hickam Air Force Base to Waikīkī where mature street trees provide ideal nesting habitat for the state-listed threatened white tern (*Gygis alba*). Vanderwerf (2003) indicates that white terns nest during all months of the year with most egg laying occurring between January and April.

The Managed Lane Alternative would have no long-term impacts on aquatic resources; however, as discussed in the construction impacts section below, some short-term aquatic impacts may occur during construction. The proposed action would use existing roadway ROWs or would not be in coastal areas, such that no interaction with coastal or marine resources is expected. Moreover, if more people were to ride transit and reduce vehicle miles traveled (VMT), less pollution from roadway runoff would enter freshwater and marine ecosystems.

Vegetation

The Managed Lane Alternative requires an elevated roadway with footings at the bases of supporting columns. The footprints themselves along with the initial construction would disturb plant species in the immediate areas of construction. In the long term, the elevated roadways may interfere with or block the present light conditions required for some species in the shadow of the roadway and may alter species composition in those areas.

The greatest impact on vegetation along the proposed alignment would most likely be in the Waiawa Interchange area where stream vegetation may be affected as a result of construction within the stream itself and secondary effects such as soil runoff from construction. However, details of possible in-stream work would be developed later during preparation of the EIS should the Managed Lane Alternative be selected as the LPA. The alignments proposed for the Managed Lane Alternative do not harbor any rare or endangered plant species.

Street Trees

The following is a brief description of street tree impacts for the Managed Lane Alternative. As with any potential tree impact, it is possible that some of impacts could be avoided by strategic placement of piers. If this alternative were to be selected as the LPA, a more detailed tree inventory and impacts analysis, by individual tree, including shadow consideration, would be conducted during the EIS phase.

A total of 391 street trees were counted along the proposed Managed Lane Alternative alignment (Table 4-5). Only 10 of those trees were considered notable and none are considered exceptional. Impacts on notable trees include removal of the five monkeypod trees at the intersection of Nimitz Highway and Sand Island Access Road. It appears the other five notable trees would not be affected by this alternative. Other street trees that would likely be impacted by this alternative include the following:

- Trees in the Aloha Stadium property and inside the Pu‘uwai Momi Apartments complex.
- Fan palms and shower trees on Kamehameha Highway in the vicinity of the Arizona Memorial, which would need to be transplanted.
- All 83 trees on the mauka side of Nimitz Highway between Kamehameha Highway and Middle Street. The 10 Queen Palm trees, all in good condition, would be proposed for transplanting. All other trees in the area are proposed to be maintained in place with periodic pruning or to be replaced by a new landscaping plan in this area.
- Some Scrambled Egg trees, Coconut and Manila palms, shower trees, and kou in the median of Nimitz Highway east of Middle Street would be removed and replaced or transplanted.

In contrast to the Fixed Guideway Alternative, the Managed Lane Alternative would not affect street trees in several areas because of its shorter alignment. For example, impacts on street trees of importance to the Waipahu community would be avoided if this alternative were selected as the LPA. See the preceding description of the affected environment (Chapter 4) and the Fixed Guideway Alternative impacts discussion below.

Construction Impacts

Geologic considerations will play a major role in the construction methods used for the Managed Lane Alternative. Construction for the pier supports could either be done by drilling shafts and pouring concrete or by driving piles. The required depth of these supports will be determined by subsurface conditions. The alignment will cross a wide variety of subsurface soil conditions. Therefore, several different foundation systems will probably be required to construct this alternative. Boring programs will be an integral part of the design phase to determine construction specifications. Extensive geotechnical engineering exploration and analysis will be required during project design.

As described in the *Honolulu High-Capacity Transit Corridor Project Hazardous Materials Technical Report*, soil and rock removed from excavations for the piers may be

contaminated with petroleum and other pollutants. Storage, worker safety, transportation, and disposal will all need to be considered.

Subsidence will also be a concern during construction for the managed lane piers in areas where there are many buildings, roads and other facilities. Subsidence, especially when extensive dewatering is required, could cause the shifting of foundations, major cracking, road collapse, and other critical damage.

Stream crossings may necessitate footings in streams, although details would not be determined until later in the planning process. Even if footings are not required within streams, water quality in streams could be affected during construction in the vicinity.

The state-listed threatened white-tern nesting and roosting sites could be affected by construction in urban Honolulu east of Hickam Air Force Base to Iwilei, where mature street trees provide habitat. However, if the trees used by white terns for nesting and roosting are not disturbed, they are not expected to be affected because they are tolerant of noise and people.

During construction, street trees may need to be trimmed to a greater extent than after the alternative is built. The construction phase typically requires a larger footprint and, therefore, some trees that are not necessarily in the way of the finished structure could be in the way of construction equipment and activities. However, none of the five notable trees not impacted by the finished project are expected to be impacted during construction. Construction impacts may include permanent removals and/or relocations of trees that are not compatible with the road-widening requirements of the project. Mitigation measures for construction impacts are discussed in Chapter 6.

Alternative 4: Fixed Guideway

For purposes of analyzing natural resource impacts, it should be noted that where the Fixed Guideway would be elevated, it would be between 25 and 36 feet wide and range between about 20 and 30 feet high at the bottom of the structure.

The first part of the following discussion highlights impacts that would be common to all alignment options, by discipline. A separate section looks at impacts specific to certain alignments. Impacts at maintenance facility, park-and-ride lot, and transit center sites associated only with this alternative are also described. Table 5-1 summarizes these impacts.

Geology and Natural Hazards

As with the Managed Lane Alternative, the Fixed Guideway Alternative would not result in additional exposure to geologic or natural hazards, and no adverse impacts are expected in the 100- or 500-year base floodplains. See discussion under the Managed Lane Alternative for additional details.

The proposed Fixed Guideway alignments would traverse some floodplains, but the majority of the guideway would be elevated and supported on piers that should not affect the potential for flooding. Some of the transit centers are in flood zones (Figure 4-2 to

Figure 4-6) the guideway and these transit centers should result in only minimal encroachment on the floodplain, and no changes to existing flood elevation levels are expected nor should they increase the risk of floods. Therefore, this alternative would also be in compliance with U.S. DOT Order 5650.2 on Floodplain Management and Protection. Any necessary construction would comply with the rules and regulations of the National Flood Insurance Program (NFIP) and all applicable ordinances for flood hazard districts as stated in the City and County of Honolulu's Land Use Ordinance.

Farmlands

Three of the four alignments in Section I for the Fixed Guideway Alternative would affect lands in the 'Ewa area, which are currently leased and used by active farms. Only the Geiger Road/Fort Weaver Road alignment option would not impact existing agricultural operations. If agricultural activities in the 'Ewa Plain remained stable, only a very limited amount of farmland would be lost due to the project because of its small footprint and use of existing ROWs. It should be noted that all areas that are currently under crop production in the 'Ewa Plain may be developed by the time this project would be ready to implement; therefore, lands are expected to be lost to agricultural production by 2030 with or without the project.

No other direct impacts would occur to farmlands due to the Fixed Guideway Alternative. Other lands in the Kapolei/'Ewa and Waipahu/Pearl City areas are categorized as "Prime" or "Unique" lands under ALISH (Figure 4-7 and Figure 4-8), but these areas are either already developed, plans exist for their development, and/or they would become part of roadway ROW under future development plans, such as in the City of Kapolei. Moreover, most of the remainder of the Fixed Guideway Alternative alignment would be located within existing roadway ROW, such as on Kamehameha Highway through Pearl City.

As discussed above under the Managed Lane Alternative's impacts, a "shadow analysis" may be necessary during preparation of the EIS for the LPA to determine if sunshine would be reduced, particularly at the Waiau Stream taro patch and the Sumida Watercress Farm. The fixed guideway structure would be higher than the managed lane structure, increasing the likelihood of shadowing impacts. However, the fixed guideway structure would be narrower than the managed lane structure, resulting in a smaller shadow. Any such impact along Kamehameha Highway would be similar to impacts of the Managed Lane Alternative (discussed above). It is assumed there would be minimal difference in shadow impacts arising from the elevated structures between the Managed Lane and Fixed Guideway Alternatives.

Wildlife

Wildlife habitat is limited in the project corridor but is most abundant in the 'Ewa area (Section I). Only a few sites proposed for maintenance centers and other facilities provide habitat, which would be disturbed and eliminated by the facilities required for the Fixed Guideway Alternative. Construction that would alter kiawe woodlands and open fields would have a lasting effect on birds such as francolins, pheasants, mockingbirds, and barn owls, which would not adapt to urbanization.

Otherwise, wildlife impacts due to the Fixed Guideway Alternative would be similar to the Managed Lane Alternative. The only possible wildlife impacts that may be greater under the Fixed Guideway Alternative concerns white terns (see discussion of white terns under Managed Lane Alternative). Because white terns use mature canopy trees as roosting and nesting sites, the Fixed Guideway Alternative could result in more impacts because it extends farther into Honolulu where more mature street trees are present. Street tree impacts are described in more detail below.

Also, as with the Managed Lane Alternative, none of the Fixed Guideway alignments would affect aquatic wildlife resources. With a few exceptions, all alignments propose using existing roadway ROW or would not be in coastal areas. Moreover, if more people were to ride transit and reduce VMT, fewer pollutants would enter the aquatic environment through roadway runoff.

Vegetation

The Fixed Guideway Alternative would have greater overall impacts than the Managed Lane Alternative on the natural resources of the project area as it includes the currently less developed 'Ewa areas of Kalaeloa, Kapolei, and Waipahu. The footprint impacts, along with initial construction impacts, would disturb plant species in the immediate areas of construction. In the long term, the elevated roadways may alter light conditions beneath and immediately adjacent to the structure. The shadowing caused by the structure may alter species composition in those areas.

This alternative also involves a number of project footprint impacts beyond the ROW, indicating that more vegetation and potential wildlife habitat would be eliminated by the Fixed Guideway Alternative when compared to the Managed Lane Alternative. In particular, the maintenance facilities, park-and-ride lots, and transit centers proposed for the 'Ewa area (Section I) have large footprints that necessitate substantial disturbance or removal of botanical resources within those proposed sites.

The majority of plant species along the proposed alignments, however, are either weedy species or street trees. The highest concentration of native plant species is located in the 'Ewa or Section I area of the proposed project. Even in Section I, the percentage of native plants is very low. Several alignments could harbor a greater number of native plant species than those observed during the initial survey for this Alternatives Analysis. These areas include the Saratoga Avenue/North-South Road and the Geiger Road/Fort Weaver Road alignments in Section I.

Two proposed alignments include North-South Road as an easement. The only endangered plant species known to occur within the survey area for this project is *Abutilon menziesii*. A temporary preserve has been established for this population. Future construction on North-South Road for the proposed Fixed Guideway system should consider potential impacts on the current *A. menziesii* preserve, including possible shading of the population and secondary disturbance due to dust and debris from construction.

Street Trees

In general, impacts on street trees due to the Fixed Guideway Alternative would be similar to those broadly defined for the Managed Lane Alternative. Street trees may be affected by direct footprint impacts (tree removal, with possible transplanting to another location), long-term proximity impacts (tree removal or pruning/trimming), and construction proximity impacts. As a result of the longer alignment of the Fixed Guideway Alternative, its impacts on street trees would be greater than that due to the Managed Lane Alternative. The Fixed Guideway Alternative would impact street trees in Waipahu, Downtown Honolulu, and possibly Waikīkī, locations where the Managed Lane Alternative would have no impacts.

Construction impacts and proposed mitigation measures are discussed in later sections of this report. The following discussion focuses on potential long-term tree impacts.

The elevated structure for the Fixed Guideway Alternative would be narrower and taller in some locations than that for the Managed Lane Alternative. As a result, the Fixed Guideway would cause different shadows to be cast on nearby vegetation, and taller tree canopies are less likely to be affected when compared to the Managed Lane Alternative. By being taller, it may be possible to keep some smaller trees underneath the Fixed Guideway structure. According to the project arborist, some trees would not be adversely affected by being below the structure. Specific street tree impacts of each alignment are discussed below.

As with the Managed Lane Alternative, if this alternative were to be selected as the LPA, a more detailed tree inventory and impacts analysis, by individual tree, would be conducted as part of the EIS phase. Such additional information would be used to develop a tree preservation plan (see Mitigation discussion in Chapter 6).

Impacts of Specific Alignments

In the foregoing discussion, specific impacts on farmlands, wildlife, vegetation, and street trees are highlighted where applicable. Geology and natural hazard impacts are not applicable for analysis by section or alignment because no impacts are anticipated. Beyond the undeveloped areas of Section I, most impacts would be limited to street trees. White tern habitat (large canopy trees) also occurs in urbanized areas and possible interactions are identified in the appropriate section.

In the following discussion, impacts common to all alignments of a particular section are described under the section heading. Impacts specific to a particular alignment are noted under the appropriate subheading. Table 5-1 summarizes these impacts.

Section I. Kapolei to Fort Weaver Road

All alignment options begin in Kapolei, where several Indian Coral trees in the median of Kapolei Parkway would be affected. These trees are in poor to fair condition as a result of gall wasp infestation; their removal would be of minor importance.

All but one of the four Section I alignments would travel on Farrington Highway, where the Fixed Guideway is proposed on the makai side of the existing ROW. As a result,

active farmlands in that area would be partially displaced by the project. However, all of those farmlands are on short-term leases with the landowner (State of Hawai‘i or the Estate of James Campbell) and may be displaced at any time for other planned development.

Wildlife impacts would be largely the same along all alignments of Section I.

Kamokila Boulevard/Farrington Highway

Of the four alignments, this alignment affects the least amount of currently open, undeveloped space. As many as 76 Kamani trees in the median of Kamokila Boulevard would need to be transplanted or removed/replaced.

Kapolei Parkway/North-South Road

Impacts on the *Abutilon menziesii* population at the southern end of North-South Road could occur.

Seven existing monkeypods in the median of Kapolei Parkway, between Fort Barrette Road and the future intersection with North-South Road, would need to be transplanted.

Saratoga Avenue/North-South Road

Impacts on the *Abutilon menziesii* population at the southern end of North-South Road could occur.

A portion of this alignment between Saratoga Avenue and North-South Road would not be within existing/planned roadway ROW. Therefore, the Fixed Guideway would require use of property that would otherwise not be used for transportation purposes.

Because access to some portions of this alignment in the Kalaeloa area was not possible during fieldwork for this phase of the analysis, it is unclear what impacts, if any, would occur on vegetation. It appears that a number of larger canopy trees could be affected.

Geiger Road/Fort Weaver Road

Some portions of this alignment were also inaccessible in the Kalaeloa area, making it difficult to determine possible impacts on vegetation.

All street trees in the median of Fort Weaver Road would be affected. Among them is a single notable banyan tree near the intersection with Old Fort Weaver Road. Other trees – false kou, buttonwood, Manila palm, and gold trees – can generally be transplanted. The 100 or so monkeypod trees on the Koko Head side of the road would require tree protection zones for construction, but would otherwise be unaffected.

Based on the review of natural resource impacts in Section I, it appears the Kamokila Boulevard/Farrington Highway alignment would result in the fewest impacts, primarily because it extends along existing roadway its entire length. The natural resource impacts along the other alignments are not extensive, and many of them would occur independent of the project as the planned roadway infrastructure and residential development in the area are completed.

Section II. Fort Weaver Road to Aloha Stadium

As with the Managed Lane Alternative, the greatest impact on vegetation along the proposed alignment would most likely be in the Waiawa Interchange area where stream vegetation may be affected by construction, possibly within the stream itself, and also by secondary effects such as runoff from construction.

Landscaping on Farrington Highway through Waipahu would be adversely affected because all median street trees would be transplanted or removed.

The Kamehameha Highway alignment of this section would have little or no impact on street trees. However, care should be taken to avoid potential impacts on the taro patch and watercress farm located along this mostly urbanized corridor (see previous Farmlands discussion).

Section III. Aloha Stadium to Middle Street

Most of the alignment options in this section would result in impacts similar to the Kamehameha Highway portion of the Managed Lane Alternative. No significant wildlife or vegetation impacts are expected. No farmlands or potential agricultural lands exist along these alignments. Impacts on street trees along this section are similar to those of the Managed Lane Alternative, with the exception of the Salt Lake Boulevard alignment. No significant tree impacts are expected along Kamehameha Highway, but some trees in the Aloha Stadium property and inside the Pu‘uwai Momi Apartments complex may be affected.

Salt Lake Boulevard

Only a few Indian Coral trees in the median of Salt Lake Boulevard near Ala Liliko‘i Street would need to be removed. Other street trees on Salt Lake Boulevard are unlikely to be affected. Two monkeypods along the makai side of Kikowaena Street may be affected, but pruning the tree canopy is likely to be sufficient.

Makai of the Airport Viaduct

On Kamehameha Highway in the vicinity of the Arizona Memorial, some fan palms and shower trees would need to be transplanted. Shower trees on the makai side of Nimitz Highway near Elliott Street would probably require pruning.

Mauka of the Airport Viaduct

On Kamehameha Highway in the vicinity of the Arizona Memorial, some fan palms and shower trees would need to be transplanted. Street tree impacts along this alignment would be almost the same as those for the Managed Lane Alternative, except there would be no impacts on Nimitz Highway at Sand Island Access Road.

Aolele Street

In the vicinity of Honolulu International Airport, a variety of trees on each side of Aolele Street are likely to require transplanting. Several Indian coral trees inside Ke‘ehi Lagoon

Park may also be affected. However, these Indian coral trees may not survive the heavy gall wasp infection from which they are currently suffering.

In summary, the impact on natural resources along each of the alignment alternatives is similar. Although a number of street trees would be affected, none of them are exceptional or notable trees and no sensitive habitats are affected.

Section IV. Middle Street to Iwilei

In this section, Middle Street may be used as a connector to transition from Section III to Section IV, depending on the alignments selected for each section. If Middle Street were used, there may be a minor impact of transplanting new plantings of fiddlewood trees on the Koko Head side of the street as the alignment transitions to North King Street.

North King Street

In addition to the possible impact along Middle Street, additional fiddlewood trees would be affected on the mauka side of North King Street. The two notable trees along this section of North King Street would not be impacted.

Dillingham Boulevard

If this alignment were selected, the street would be widened on the makai side. As a result, several notable street trees would be affected, including one notable monkeypod tree and about 26 notable Kamani trees. In addition to these trees, additional Kamani trees would be removed and replaced at the proposed transit station in front of Honolulu Community College (at Kōkea Street).

Section V. Iwilei to UH Mānoa

With the exception of the Beretania Street/King Street alignment, all other alignments would use slightly different routes through Downtown to converge upon Kona Street, Ala Moana Center, Kapi‘olani Boulevard, and University Avenue.

The following tree impacts would be common to those alignments. On Kona Street, some non-transplantable trees may be affected, but additional design details are needed to determine the nature of the impact. Between Kalākaua Avenue and McCully Street, Kapi‘olani Boulevard would be widened on the mauka side, resulting in impacts on some notable monkeypods on the mauka side, as well as the removal of median street trees to accommodate the Fixed Guideway structure. On University Avenue, 27 relatively new shower trees in the median would be transplanted to accommodate the Fixed Guideway.

While the remainder of the tree impacts for this section may differ slightly, all alignments except the Hotel Street/Kawaiaha‘o Street/Kapi‘olani Boulevard alignment would affect notable monkeypod trees in the Downtown/Kaka‘ako mauka area.

As previously discussed, large mature trees in urban Honolulu are preferred nesting sites for the state-listed threatened white tern. White terns nest year-round, with peak egg laying in the months of January through April. Construction that would alter or require the removal of a nesting tree in this area would have a negative effect on nesting success.

In contrast, construction in proximity to a nesting tree may not have an impact on these nesting birds that are tolerant of noise and people.

Tunnels are key features of some of the alignments in this section, which would help to avoid impacts on biological resources, among others.

Hotel Street/Kawaiaha‘o Street/Kapi‘olani Boulevard

In addition to the impacts indicated above, tree impacts would occur at proposed transit stations on Hotel Street, primarily involving fiddlewoods. No impact would occur at Kawaiaha‘o Church.

Hotel Street/Waimanu Street/Kapi‘olani Boulevard

As indicated above, impacts on Hotel Street would be minimal. The segment on Waimanu Street may affect a large and notable monkeypod tree at the ‘Ewa/mauka corner of the Waimanu Street/Ward Avenue intersection. This tree would be addressed in the tree preservation plan.

Nimitz Highway/Queen Street/Kapi‘olani Boulevard

On Queen Street, details of a ROW take have not yet been determined; but it is anticipated that one major impact would occur on a large and notable monkeypod in front of the State Department of Taxation building. Other trees may also be removed by the ROW take. No impacts are anticipated on Nimitz Highway.

Nimitz Highway/Halekauwila Street /Kapi‘olani Boulevard

This alignment is similar to the previous one, but extends along Halekauwila Street instead of Queen Street. A handful of notable monkeypods on the makai side of Halekauwila Street would be removed and replaced; those on the mauka side would not be affected.

Waikīkī Spur

Some impacts on the 10 exceptional mahogany trees would occur because of their location in the median of Kalākaua Avenue; however, mitigation measures would be implemented to minimize the adverse effects on these 10 trees. Monkeypod, coconut, and shower trees on Kūhiō Avenue – some recently planted by the City – would either be pruned or removed and replaced. Because plans involve eliminating one lane of traffic on Kūhiō Avenue to accommodate the fixed guideway, it is unlikely that these impacts could be avoided.

Beretania Street/South King Street

The ‘Ewa end of this proposed alignment would be a bored tunnel. Tree impacts may occur at transit stations only. However, if the trenching method is used to construct the tunnel, impacts would be much greater.

On the King Street portion, the fixed guideway would require directional pruning of tree canopies. Tree removal may be avoidable, except at transit stations. Affected trees include a group of shower trees highly valued by the Outdoor Circle.

Table 5-1. Natural Resources-Potential Impacts Summary

| Alternative | Geology and Natural Hazards | Farmlands | Wildlife | Botanical Resources | Street Trees |
|--|-----------------------------|---|--|--|--|
| Alternative 1: No Build Alternative | | | | | |
| No Build Alternative | None | None | Introduced birds associated with kiawe woodland, agriculture and open fields would be lost to urbanization | Loss of some vegetated open spaces to urbanization | None |
| Alternative 2: TSM Alternative | | | | | |
| TSM Alternative | None | None | Same as No Build | Same as No Build | None |
| Alternative 3: Managed Lane Alternative | | | | | |
| 3a. Two-direction Option | | | | | |
| Waialua IC to Hālawā Stream | None | Shadow impacts analysis recommended; may cause more shadow than Reversible option | No impact on common introduced birds; no sensitive species present | May impact Waialua Stream vegetation | Possible impact on trees at Aloha Stadium and Pu'uwai Momi Apartments. On Kamehameha Highway near Arizona Memorial, transplant fan palms and shower trees. Transplant 10 Queen Palms on Nimitz Highway. Remove five notable monkeypods on Nimitz Highway at Sand Island Access Road. |
| Hālawā Stream to Pacific Street | None | None | White tern | None | |
| 3b. Reversible Option | | | | | |
| Waialua IC to Hālawā Stream | None | Shadow impacts analysis recommended | Same as Alternative 3a | Same as Alternative 3a | Same as Alternative 3a |
| Hālawā Stream to Pacific Street | None | None | Same as Alternative 3a | None | |

| Alternative | Geology and Natural Hazards | Farmlands | Wildlife | Botanical Resources | Street Trees |
|--|-----------------------------|--|------------------|--|--|
| Alternative 4: Fixed Guideway Alternative | | | | | |
| Section I. Kapolei to Fort Weaver Road | | | | | |
| Kamokila Boulevard/ Farrington Highway | None | Impacts on leased agricultural lands makai of Farrington Highway | Same as No Build | Disturbance and loss of native and weedy species | Impacts to Indian Coral trees on Kapolei Parkway; transplant 76 Kamani trees |
| Kapolei Parkway/ North-South Road | None | Impacts on leased agricultural lands makai of Farrington Highway | Same as No Build | Loss of weedy plant species. Incidental take license needed for possible disturbance to <i>Abutilon menziesii</i> population | Impacts to Indian Coral trees on Kapolei Parkway; transplant 7 monkeypod trees |
| Saratoga Avenue/ North-South Road | None | Impacts on leased agricultural lands makai of Farrington Highway | Same as No Build | Loss of weedy and possible native species. Incidental take license needed for possible disturbance to <i>Abutilon menziesii</i> population | Other impacts undetermined; additional fieldwork necessary; possible impacts on canopy trees |
| Geiger Road/ Fort Weaver Road | None | None | Same as No Build | Loss and disturbance of weedy and possible native species | Transplant all street trees in Fort Weaver Road median; remove one notable monkeypod. Impacts undetermined in Kalaeloa; additional fieldwork necessary |

| Alternative | Geology and Natural Hazards | Farmlands | Wildlife | Botanical Resources | Street Trees |
|--|-----------------------------|--|--|-------------------------|--|
| Section II. Fort Weaver Road to Aloha Stadium | | | | | |
| Farrington Highway/ Kamehameha Highway | None | Shadow impacts analysis recommended for small agricultural parcels on Kamehameha Highway | No effect on common introduced species, no sensitive species present | None (see street trees) | Transplant all median landscaping on Farrington Highway in Waipahu |
| Section III. Aloha Stadium to Middle Street | | | | | |
| Salt Lake Boulevard | None | None | Same as Section II | None (see street trees) | Possible impact on trees at Aloha Stadium and Pu'uwai Momi Apartments Remove a few Indian coral trees on Salt Lake Boulevard; pruning or other impact on two monkeypods on Kikowaena Street |
| Makai of the Airport Viaduct | None | None | Same as Section II | None (see street trees) | On Kamehameha Highway near Arizona Memorial transplant fan palms and shower trees. Pruning of shower trees on Nimitz Highway |
| Mauka of the Airport Viaduct | None | None | Same as Section II | None (see street trees) | On Kamehameha Highway near Arizona Memorial transplant fan palms and shower trees. Transplant 10 Queen Palms on Nimitz Highway |
| Aolele Street | None | None | Same as Section II | None (see street trees) | Transplant various trees on Aolele Street. Possible impact on damaged Indian coral trees in Ke'ehi Lagoon Park |
| Section IV. Middle Street to Iwilei | | | | | |
| North King Street | None | None | Same as Section II | None (see street trees) | Transplant fiddlewoods on mauka side of North King Street; possibly transplant fiddlewoods on Middle Street |

| Alternative | Geology and Natural Hazards | Farmlands | Wildlife | Botanical Resources | Street Trees |
|--|------------------------------------|------------------|--|----------------------------|--|
| Dillingham Boulevard | None | None | Same as Section II | None (see street trees) | Several notable trees affected by widening Dillingham Boulevard – one monkeypod and 26 Kamani trees; additional Kamani tree impacts at Honolulu Community College transit stop; possibly transplant fiddlewoods on Middle Street |
| Section V. Iwilei to UH Mānoa | | | | | |
| Hotel Street/ Kawaihae 'o Street/ Kapi'olani Boulevard | None | None | Alteration or removal of mature trees may impact roosting/nesting of white terns | None (see street trees) | Transplant minor fiddlewoods on Hotel Street; removal of notable monkeypods on Kona Street possible, but additional design detail needed to confirm; removal of some notable monkeypods on Kapi'olani Boulevard between Kalākaua Avenue and McCully Street; transplant 27 new shower tree plantings on University Avenue |
| Hotel Street/ Waimanu/ Kapi'olani Boulevard | None | None | Same as above | None (see street trees) | Transplant minor fiddlewoods on Hotel Street; possible impact on notable monkeypod at Waimanu Street and Ward Avenue; removal of notable monkeypods on Kona Street possible, but additional design detail needed to confirm; removal of some notable monkeypods on Kapi'olani Boulevard between Kalākaua Avenue and McCully Street; transplant 27 new shower tree plantings on University Avenue |

| Alternative | Geology and Natural Hazards | Farmlands | Wildlife | Botanical Resources | Street Trees |
|---|------------------------------------|------------------|-----------------|----------------------------|---|
| Nimitz Highway/ Queen Street / Kapiolani Boulevard | None | None | Same as above | None (see street trees) | ROW take may affect notable monkeypod on Queen Street; removal of notable monkeypods on Kona Street possible, but additional design detail needed to confirm; removal of some notable monkeypods on Kapi'olani Boulevard between Kalākaua Avenue and McCully Street; transplant 27 new shower tree plantings on University Avenue |
| Nimitz Highway/ Halekauwila Street/ Kapiolani Boulevard | None | None | Same as above | None (see street trees) | Remove/replace four notable monkeypods on makai side of Halekauwila Street; removal of notable monkeypods on Kona Street possible, but additional design detail needed to confirm; removal of notable monkeypods on Kapi'olani Boulevard between Kalākaua Avenue and McCully Street; transplant 27 new shower tree plantings on University Avenue |
| Beretania Street/ South King Street | None | None | Same as above | None (see street trees) | Impacts depend on method of tunnel construction; tree impacts may occur at transit stations; pruning of shower, earpod, and banyan trees likely on King Street, but tree removal possible at transit stations |
| Waikīkī Spur | None | None | Same as above | None (see street trees) | Tree protection zones needed for exceptional mahogany trees on Kalākaua Avenue; pruning or removal/replacement of several new plantings along Kūhiō Avenue |

Construction Impacts

Geology and Natural Hazards

The Beretania Street/South King Street, Hotel Street/Kawaiaha‘o Street/Kapi‘olani Boulevard, and Hotel Street/Waimanu Street/Kapi‘olani Boulevard alignments in Section V have proposed tunnels. Tunnels can be built either by blasting or cutting away at the rock underground or by the cut and cover method, that is, digging out a large channel, building a tube and covering it again with earth. Excavated material will need to be transported from the work site to a disposal area.

The geology that will be encountered along any of the tunnel alignments will be mixed and highly complex when appraised from the perspective of underground construction. The major geological constituents include lava flows, alluvial deposits, organic deposits, lagoonal sediments, reef, beach deposits, cinders, and man-made fill. This environment is further complicated by groundwater and tidal influences. Extensive geotechnical engineering exploration and analysis will be required during project design. Geologic feasibility will be one of the major factors in determining the type of tunnel construction method used.

Geologic considerations will also play a major role in the construction methods used for the Fixed Guideway Alternative. Construction for the pier supports could either be done by drilling shafts and pouring concrete or by driving piles. The depth of these supports will be determined by subsurface conditions, which varies widely throughout the alignment. Therefore, several different foundation systems probably will be required to support the Fixed Guideway. Boring programs will be an integral part of the design phase to determine construction specifications. Extensive geotechnical engineering exploration and analysis will be required during project design.

The tunnels are planned under roads in densely built corridors with many historic and other important properties. Subsidence, especially if there is major dewatering, would be a major concern when constructing the tunnels and pier foundations. Subsidence could cause the shifting of foundations, major cracking, road collapse, and other critical damage.

As described in the *Honolulu High-Capacity Transit Corridor Project Hazardous Materials Technical Report*, soil and rock removed from excavations for the piers, utilities and tunnels may be contaminated with petroleum and other pollutants. Storage, worker safety, transportation, and disposal will all need to be considered. Contaminated tunnel muck will be especially burdensome to handle. The tunnels will be excavated in a dense, urban area with narrow streets and traffic congestion and there will be a large volume of material.

Farmlands, Wildlife, Vegetation

Limited impacts on farmlands, wildlife, and vegetation are expected, other than the direct project-related impacts already identified above.

In addition, construction in the 'Ewa area would temporarily affect most species of birds. Otherwise, common urban birds such as doves and mynas would resume their use of sites after construction.

The state-listed threatened white tern nesting and roosting sites could be affected by construction in areas of urban Honolulu east of Hickam Air Force Base to Waikīkī where mature street trees provide habitat.

The protected population of the endangered *Abutilon menziesii* around the North-South Road corridor could experience secondary disturbance as a result of dust and debris from construction.

Compared to the Managed Lane Alternative, the Fixed Guideway Alternative would cross more streams due to its longer alignment. These stream crossings may necessitate footings in streams, although details would not be determined until later in the planning process. Even if footings are not required within streams, water quality in streams could be affected during construction.

Street Trees

Street trees may be affected slightly more during construction than after. The construction phase typically requires a larger footprint than the finished structure and, therefore, some trees that are not in the way of the finished structure could be in the way of construction equipment. Precaution would be taken during construction to protect street trees, but damage is possible during construction. Construction impacts may include permanent removals or relocations of trees that are not compatible with the road-widening requirements of the project. Mitigation measures for construction impacts are discussed in Chapter 6.

Secondary and Cumulative

This section addresses any secondary and cumulative impacts of the four alternatives. Secondary (or indirect) impacts are defined as effects caused by the action but later in time or further removed in distance, but still reasonably foreseeable. Cumulative impacts on the environment result from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions.

Alternative 1: No Build

No secondary or cumulative impacts are attributed to the No Build Alternative. Impacts associated with development of the individual projects listed in the RTP are not detailed in this evaluation because the projects would undergo planning and environmental review as part of their individual project development process.

As a result of constructing various transportation projects according to the RTP and urban development in surrounding areas, the amount of vegetated areas would decline compared to current conditions. Although agricultural activities occur in 'Ewa and Central O'ahu, State and City policies encourage urban development, particularly in

‘Ewa. Consistent with State and City policies, urban development would convert some agricultural lands to urban land uses.

The No Build condition assumes previously approved changes. For example, as previously described, a habitat conservation plan has been prepared for the endangered plant *Abutilon menziesii* that would be directly and indirectly affected by the North-South Road and Kapolei Parkway projects.

Alternative 2: Transportation System Management

Impacts under the TSM Alternative are expected to be similar to those of the No Build Alternative. No secondary or cumulative impacts are attributed to the TSM Alternative. Impacts associated with development of the individual projects considered under the TSM Alternative are not detailed in this evaluation because the projects would undergo planning and environmental review as part of their individual project development process.

Alternative 3: Managed Lane

No impacts are expected with respect to geology and natural hazards, aside from additional paving throughout the project alignment. The following two paragraphs refer to biological resources.

Cumulative Impacts

No significant cumulative impacts are expected with the Managed Lane Alternative.

Secondary Impacts

If water quality impacts were to occur, marine and/or freshwater biological resources may be affected. According to the *Honolulu High-Capacity Transit Corridor Project Water Resources Technical Report*, however, no adverse impacts on water quality are expected due to any alternative.

Alternative 4: Fixed Guideway

No impacts are expected with respect to geology and natural hazards, aside from additional paving throughout the project alignment. The following impacts may occur with respect to biological resources.

Cumulative Impacts

The Fixed Guideway Alternative would contribute to the continuing urbanization of the ‘Ewa Plain, which by necessity would reduce open agricultural space and habitat for wildlife and vegetation. However, the urbanization of ‘Ewa, Kapolei, and Kalaeloa is consistent with the City’s *General Plan*, *‘Ewa Development Plan*, and the *Kalaeloa Redevelopment Plan*. The project area is largely urbanized, and areas that are currently vacant are designated for future development.

Secondary Impacts

The proposed project is expected to induce development near transit stations and influence economic factors that will determine the mix of businesses. It is possible that areas in floodplains along the Fixed Guideway and near transit stations would be affected by this future development.

In the 'Ewa/East Kapolei area, the endangered *Abutilon menziesii* may be adversely affected by secondary impacts related to dust, debris, and overall disturbance from construction of the Fixed Guideway Alternative. However, the management of the *A. menziesii* population in East Kapolei along the North-South Road corridor is described in a habitat conservation plan. The ultimate full take of this population, including the temporary preserve along North-South Road, is anticipated after the establishment of several outplant populations elsewhere on the island.

Long-Term Impact Mitigation

Geology and Natural Hazards

All structures will be designed and constructed to withstand earthquakes per American Association of State Highway and Transportation Officials (AASHTO) guidelines and wind forces from tropical cyclones.

All project design, components, and structures will be in compliance with U.S. DOT Order 5650.2 on Floodplain Management and Protection. Construction will comply with the rules and regulations of the National Flood Insurance Program (NFIP) and all applicable ordinances for flood hazard districts, as stated in the City and County of Honolulu's Land Use Ordinance.

Farmland

If the Farmland Conversion Impact Rating for the selected LPA exceeds the regulatory threshold of 160 points, alternatives that avoid farmland impacts will be evaluated in the draft EIS.

Wildlife

Although some mature trees favored by white terns would be removed for the Managed Lane and Fixed Guideway Alternatives, other mature trees would remain nearby as habitat. Prior to construction a biologist would survey all trees to ensure none have nesting birds or chicks. If found, construction should be delayed until chicks fledge. It is unlikely that all trees in areas frequented by white terns would be removed or pruned for the proposed project, regardless of which overall alternative or alignment is selected. Therefore, no specific wildlife mitigation is necessary, above and beyond construction phase mitigation measures described in the following section.

Maintenance issues related to large street trees in the vicinity of the Fixed Guideway Alternative will need to consider the potential presence of roosting or nesting white terns. In areas of urban Honolulu east of Hickam Air Force Base to Waikīkī, where mature street trees provide ideal nesting habitat for this state-listed threatened species, it is recommended that tree trimming be conducted during fall and early winter when fewer white terns are nesting.

Vegetation

The only known threatened or endangered vegetation that could be affected by any of the alternatives is the population of *Abutilon menziesii* at the southern end of North-South Road. This population would only be encountered if certain alignments of the Fixed Guideway Alternative were selected. If an alternative is selected that would potentially impact this population, or should another population of threatened or endangered

vegetation be discovered during the more detailed EIS studies, a habitat conservation plan will be prepared and followed.

As part of the environmental planning for North-South Road and a portion of Kapolei Parkway, a “Habitat Conservation Plan for *Abutilon menziesii* at Kapolei” was finalized in March 2004. Mitigation measures have already been specified for those populations of *A. menziesii* related to the construction of North-South Road. Two proposed alignments include North-South Road as an easement. Future construction on North-South Road for the proposed Fixed Guideway system must consider the impact it could have on the population of *A. menziesii*, including possible shading of the population and secondary disturbance due to dust and debris from construction.

A landscaping plan will be prepared during final design to replace the impacted common weedy species in the ‘Ewa Plain with similar, more aesthetically pleasing or native vegetation. New vegetation will be designed to serve a number of purposes, including habitat restoration, erosion control, and beautification.

Street Trees

A tree preservation plan would identify trees close to the Managed Lane or Fixed Guideway infrastructure if either of those alternatives is selected as the LPA. The plan would be prepared by a qualified certified arborist. In general, healthy, mature trees that are recognized to be notable or otherwise distinctive would be kept in place where possible; other trees may need to be removed (or transplanted, if viable), and replaced with new landscaping.

At this time, it cannot be accurately determined which individual trees would be affected by footings/columns for the elevated structure or the elevated structure itself under the Managed Lane or Fixed Guideway Alternatives. The tree preservation plan would identify specific impacts on individual trees and establish mitigation measures for each affected tree.

Any healthy trees removed would be candidates for transplanting. Transplanting sites would be determined in the EIS phase for the selected LPA, but in general new sites would be as close as possible to the existing tree’s location. If trees are not removed or transplanted and remain in proximity to the Fixed Guideway facility, they may require long-term maintenance, such as regular pruning, to prevent them from adversely interacting with the elevated structure.

Once pruned, trees require time to re-grow their canopies. For example, pruned or replanted monkeypod trees would take about one year to regrow their canopies, with full recovery expected in three to five years. Kamani trees, such as those on Dillingham Boulevard, would take about four to eight years to recover fully.

Construction Impact Mitigation

Both the Managed Lane and Fixed Guideway Alternatives would require similar construction techniques for the elevated structure. However, the Fixed Guideway Alternative also requires tunnels, maintenance facilities,, transit stations, and park-and-

ride lots. This section describes mitigation measures common to both of these build alternatives. Additional or specific mitigation measures for each alternative are also specified where appropriate.

Geology and Hazards

Extensive geotechnical engineering exploration and analysis will be required during project design. Boring programs will be an integral part of the design phase to determine construction specifications.

To mitigate potential impacts of subsidence induced by a sophisticated dewatering system, a structural survey of buildings, roadways and other facilities adjacent to the site may be required prior to construction. During construction, a monitoring program would include such techniques as inclinometers to measure relative lateral movement of soil at different elevations, settlement points, and observation wells to study groundwater drawdown. Monitoring data would be reviewed immediately to ensure minimal disturbance to existing facilities. Recharging the groundwater outside the excavation and other measures could be used to minimize the effects of dewatering.

As described in the separate *Hazardous Materials Technical Report* procedures to store, transport and dispose of contaminated soil and rock excavated from the piers, utility relocations and tunnels would need to be developed. Safety guidelines for construction workers handling hazardous materials would have to be implemented in some areas.

All of the alternatives would comply with U.S. DOT Order 5650.2 on Floodplain Management and Protection Implementation. Any necessary construction would comply with the rules and regulations of the NFIP and all applicable ordinances for flood hazard districts, as stated in the City and County of Honolulu's Land Use Ordinance.

The viaduct and other structures would be designed and constructed to withstand earthquakes per AASHTO guidelines and wind forces from tropical cyclones.

Farmlands

If active farms are affected by construction of the LPA, DTS would coordinate with the owners and lessees of the affected properties to minimize potential construction-phase impacts on farming operations. The Fixed Guideway Alternative may result in farmland impacts along Farrington Highway, depending on which alignment is selected. If the Fixed Guideway Alternative is selected, an AD-1006 form would be submitted to NRCS to determine the farmland impact rating score.

Wildlife

For both the Managed Lane and Fixed Guideway Alternatives, a survey of the project areas would be conducted for white terns and their nests prior to final design. Sensitive trees and areas would also be monitored immediately prior to and during construction activities that involve tree relocation, removal, or trimming. Monitoring would be coordinated with interested resource agencies, such as the USFWS and DLNR. DTS

would also coordinate tree trimming with the Department of Parks and Recreation, which has standard procedures to avoid impacts to white terns and their eggs.

It is recommended that tree trimming and construction be conducted during fall and early winter when fewer White Terns are nesting. To the extent practicable, construction that would alter or require the removal of large trees in this area must be preceded by a search for nests or fledglings by a qualified biologist. Trees having active nests should be avoided until the chicks have fledged, approximately 45 days.

Possible impacts on water quality during construction in or around streams and drainages would be mitigated using Best Management Practices (BMPs). BMPs would be designed and outlined in necessary permits (e.g., NPDES, 401 WQC, 404 DA) for review and approval by permitting agencies. These steps would mitigate potential water quality degradation and associated loss of wildlife habitat.

Vegetation and Street Trees

No mitigation would be needed under the No Build and TSM Alternatives for this project.

During construction of either the Managed Lane or Fixed Guideway Alternative, trees would need to be transplanted and/or removed. A tree protection plan developed by a certified arborist would describe appropriate mitigation measures in detail. The plan would specify precautionary measures to be taken to protect trees that are being relocated, as well as measures to protect other nearby trees during construction. Community input would be a component in preparing the tree protection plan. A Street Tree Review would also be conducted by the City's Department of Planning and Permitting (DPP) as part of the construction plan review by the City. DPP's Street Tree Review applies only to those trees not located within a Special Design District.

To minimize potential damage, tree protection zones are typically designated by fencing around individual trees, which helps keep construction equipment and other traffic off exposed roots. However, if such fenced zones cannot be established, mulch or metal plates can be placed on sensitive areas to protect exposed roots. The extent of tree-protection measures would depend on the importance of each individual tree and would be determined by a certified arborist during final design and construction. Tree removal would be considered for less important trees so as to minimize potentially onerous conditions for the contractor during construction.

No additional mitigation is expected for potential vegetation impacts other than that specified for street trees.

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Mr. Patrick Leonard
3/30/2006
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Purpose of and Need for the Proposed Project

The intent of the project is to provide improved mobility in this highly congested corridor. A high-capacity improvement project would serve areas designated for urban growth, provide an alternative to private automobile travel, and improve linkages between Kapolei, Honolulu's Urban Center, UH Manoa, Waikiki, and urban areas between these points.

Alternatives

The alternatives currently under study were developed through a screening process that included NEPA scoping activities, and subsequently identified the best reasonable alternatives from the range of possible alternatives. The current alternatives are:

1. No Build Alternative, which would include existing transit and highway facilities, and most committed transportation projects anticipated to be operational by the year 2030.
2. Transportation System Management (TSM) Alternative, which would provide an enhanced bus system based on a hub-and-spoke route network, community bus circulators, conversion of the present morning peak hour only zipper lane to both a morning and afternoon peak hour zipper lane configuration, and relatively low-cost capital improvements on selected roadway facilities to give priority to buses. Capital improvements may include intersection improvements, minor road widening, traffic engineering actions, bus route restructuring, shortened bus headways, expanded use of articulated buses, express and limited-stop service, signalization improvements, and timed-transfer operations.
3. Managed Lanes Alternative, which would include construction of a two-lane grade-separated (elevated) guideway between Waipahu and DOWNTOWN Honolulu for use by buses, high-occupancy vehicles (HOVs), and toll-paying single-occupant vehicles. The lanes would be managed by setting the minimum occupancy for HOVs and the tolls for single-occupant vehicles at levels that would preserve free-flow speeds on the facility.
4. Fixed-Guideway Alternative, which would include the construction and operation of a fixed transit guideway system between Kapolei and UH Manoa and Waikiki on one of several possible alignments.

Maps of Alternative 3 and Alternative 4 are enclosed.

Potential Interactions with Protected Species

Technical studies are being prepared for this project. We will ensure that those studies address potential impacts on the federal trust species and important habitats that you identify.



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March 30, 2006

Mr. Patrick Leonard, Field Supervisor
Pacific Islands Office
U.S. Fish and Wildlife Service
300 Ala Moana Boulevard, Room 3-122
Box 50088
Honolulu, Hawaii 96850

Subject: Proposed High-Capacity Transit Improvements From Kapolei to the
University of Hawaii at Manoa
Island of Oahu
Request for Species List, Endangered Species Act

Dear Mr. Leonard:

The City and County of Honolulu, Department of Transportation Services (DTS), in cooperation with the Federal Transit Administration (FTA), intends to propose public transit improvements in a 23-mile travel corridor between Kapolei and the University of Hawaii at Manoa, which may include an extension to Waikiki (see enclosed project study area). Parsons Brinckerhoff Quade & Douglas, Inc. is assisting DTS with this project.

Because of anticipated federal involvement with this project, coordination activities complying with Section 7 of the Endangered Species Act need to occur. I am writing to request that you provide us with a list of federal trust species, or candidate federal trust species ("species list") for the project site shown in the map enclosed. In addition, we request your input on any relevant critical habitat.

For your information, the following is a brief overview of the proposed project, including the alternatives under consideration. Please note that an Alternatives Analysis and a draft Environmental Impact Statement, pursuant to the National Environmental Policy Act and Chapter 343 of the Hawaii Revised Statutes, will be prepared for this project.

Study Area

The proposed project study area is the travel corridor between Kapolei and the University of Hawaii at Manoa (UH Manoa) and Waikiki (see attachment).



Mr. Patrick Leonard
3/30/2006
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We would appreciate receiving a species list within 30 days from the receipt of this letter. If you have any questions about this request, please call or email me at 808-566-2239, or ohtomo@pbworld.com.

Sincerely yours,

Nami Ohtomo

Nami Ohtomo
Environmental Planner

Attachments: Study Area map
Alternative 3 maps (2 pages)
Alternative 4 maps (5 pages)

c. City and County of Honolulu, Department of Transportation Services (Ms. Faith Miyamoto) – w/o attachments
State of Hawaii Department of Land and Natural Resources, Division of Forestry and Wildlife (Mr. Paul Conry) – w/o attachments



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March 30, 2006

Ms. Margaret Akamine
National Marine Fisheries Service
Pacific Islands Area Office
1601 Kapiolani Blvd., Suite 1110
Honolulu, HI 96814-4700

Subject: Proposed High-Capacity Transit Improvements From Kapolei to the University of Hawaii at Manoa Island of Oahu
Request for Species List, Endangered Species Act

Dear Ms. Akamine,

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Sincerely yours,

Nami Ohtomo
Environmental Planner

Attachments: Study Area map
Alternative 3 maps (2 pages)
Alternative 4 maps (5 pages)

- c. City and County of Honolulu, Department of Transportation Services (Ms. Faith Miyamoto) – w/o attachments
- State of Hawaii Department of Land and Natural Resources, Division of Aquatic Resources (Dr. Dan Polhemus) – w/o attachments



Purpose of and Need for the Proposed Project

The intent of the project is to provide improved mobility in this highly congested corridor. A high-capacity improvement project would serve areas designated for urban growth, provide an alternative to private automobile travel, and improve linkages between Kapolei, Honolulu's Urban Center, UH Manoa, Waikiki, and urban areas between these points.

Alternatives

The alternatives currently under study were developed through a screening process that included NEPA scoping activities, and subsequently identified the best reasonable alternatives from the range of possible alternatives. The current alternatives are:

1. No Build Alternative, which would include existing transit and highway facilities, and most committed transportation projects anticipated to be operational by the year 2030.
2. Transportation System Management (TSM) Alternative, which would provide an enhanced bus system based on a hub-and-spoke route network, community bus circulators, conversion of the present morning peak hour only zipper lane to both morning and afternoon peak hour zipper lane configuration, and relatively low-cost capital improvements on selected roadway facilities to give priority to buses. Capital improvements may include intersection improvements, minor road widening, traffic engineering actions, bus route restructuring, shortened bus headways, expanded use of articulated buses, express and limited-stop service, signalization improvements, and timed-transfer operations.
3. Managed Lanes Alternative, which would include construction of a two-lane grade-separated (elevated) guideway between Waipahu and DOWNTOWN HONOLULU for use by buses, high-occupancy vehicles (HOVs), and toll-paying single-occupant vehicles. The lanes would be managed by setting the minimum occupancy for HOVs and the tolls for single-occupant vehicles at levels that would preserve free-flow speeds on the facility.
4. Fixed-Guideway Alternative, which would include the construction and operation of a fixed transit guideway system between Kapolei and UH Manoa and Waikiki on one of several possible alignments.

Maps of Alternative 3 and Alternative 4 are enclosed.

Potential Interactions with Protected Species

Technical studies are being prepared for this project. We will ensure that those studies address potential impacts on the federal trust species and important habitats that you identify.



**Parsons
Brinckerhoff
Quade &
Douglas, Inc.**
American Savings Bank Tower
1001 Bishop Street, Suite 2400
Honolulu, HI 96813
808-531-7094
Fax: 808-528-2368

March 30, 2006

Mr. Paul Conry, Administrator
State of Hawaii Department of Land and Natural Resources
Division of Forestry and Wildlife
1151 Punchbowl Street, Room 325
Honolulu, Hawaii 96813

Subject: Proposed High-Capacity Transit Improvements From Kapolei to the
University of Hawaii at Manoa
Island of Oahu
Protected species information request

Dear Mr. Conry

The City and County of Honolulu, Department of Transportation Services (DTS), in cooperation with the Federal Transit Administration (FTA), intends to propose public transit improvements in a 23-mile travel corridor between Kapolei and the University of Hawaii at Manoa, which may include an extension to Waikiki (see enclosed project study area). Parsons Brinckerhoff Quade & Douglas, Inc. is assisting DTS with this project.

I am writing to request your assistance with developing a list of those species in the study area, which are protected by Hawaii Revised Statutes Chapter 195D, Hawaii's endangered species law. In addition, we request your input on any relevant habitat of importance to such species. Please note that a similar "species list" request is being sent to the U.S. Fish and Wildlife Service, the National Marine Fisheries Service, and DLRN's Division of Aquatic Resources.

For your information, the following is a brief overview of the proposed project, including the alternatives under consideration. Please note that an Alternatives Analysis and a draft Environmental Impact Statement, pursuant to the National Environmental Policy Act and Chapter 343 of the Hawaii Revised Statutes, will be prepared for this project.

Study Area

The proposed project study area is the travel corridor between Kapolei and the University of Hawaii at Manoa (UH Manoa) and Waikiki (see attachment).



Mr. Paul Conry
3/30/2006
Page 2 of 3

Purpose of and Need for the Proposed Project

The intent of the project is to provide improved mobility in this highly congested corridor. A high-capacity improvement project would serve areas designated for urban growth, provide an alternative to private automobile travel, and improve linkages between Kapolei, Honolulu's Urban Center, UH Manoa, Waikiki, and urban areas between these points.

Alternatives

The alternatives currently under study were developed through a screening process that included NEPA scoping activities, and subsequently identified the best reasonable alternatives from the range of possible alternatives. The current alternatives are:

1. No Build Alternative, which would include existing transit and highway facilities, and most committed transportation projects anticipated to be operational by the year 2030.
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- Maps of Alternative 3 and Alternative 4 are enclosed.

Potential Interactions with Protected Species

Technical studies are being prepared for this project. We will ensure that those studies address potential impacts on the species and important habitats that you identify.



**Parsons
Brinckerhoff
Quade &
Douglas, Inc.**
American Savings Bank Tower
1001 Bishop Street, Suite 2400
Honolulu, HI 96813
808-531-7094
Fax: 808-528-2368

March 30, 2006

Dr. Dan Polhemus, Administrator
State of Hawaii Department of Land and Natural Resources
Division of Aquatic Resources
1151 Punchbowl Street, Room 330
Honolulu, Hawaii 96813

Subject: Proposed High-Capacity Transit Improvements From Kapolei to the
University of Hawaii at Manoa
Island of Oahu
Protected species information request

Dear Dr. Polhemus,

The City and County of Honolulu, Department of Transportation Services (DTS), in cooperation with the Federal Transit Administration (FTA), intends to propose public transit improvements in a 2.3-mile travel corridor between Kapolei and the University of Hawaii at Manoa, which may include an extension to Waikiki (see enclosed project study area). Parsons Brinckerhoff Quade & Douglas, Inc. is assisting DTS with this project.

I am writing to request your assistance with developing a list of those species in the study area, which are protected by Hawaii Revised Statutes Chapter 195D, Hawaii's endangered species law. In addition, we request your input on any relevant habitat of importance to such species. Please note that a similar "species list" request is being sent to the National Marine Fisheries Service, the U.S. Fish and Wildlife Service, and DLNR's Division of Forestry and Wildlife.

For your information, the following is a brief overview of the proposed project, including the alternatives under consideration. Please note that an Alternatives Analysis and a draft Environmental Impact Statement, pursuant to the National Environmental Policy Act and Chapter 343 of the Hawaii Revised Statutes, will be prepared for this project.

Study Area

The proposed project study area is the travel corridor between Kapolei and the University of Hawaii at Manoa (UH Manoa) and Waikiki (see attachment).



Mr. Paul Conry
3/30/2006
Page 3 of 3

We would appreciate receiving a species list within 30 days from the receipt of this letter. If you have any questions about this request, please call or email me at 808-566-2239, or ontomo@pbworld.com.

Sincerely yours,

Nami Ohtomo
Environmental Planner

Attachments: Study Area map
Alternative 3 maps (2 pages)
Alternative 4 maps (5 pages)

- c. City and County of Honolulu, Department of Transportation Services (Ms. Faith Miyamoto) – w/o attachments
United States Fish and Wildlife Services, Pacific Islands Office (Mr. Patrick Leonard) – w/o attachments



1430
VALE
6

Dr. Dan Polhemus
3/30/2006
Page 2 of 3

Purpose of and Need for the Proposed Project

The intent of the project is to provide improved mobility in this highly congested corridor. A high-capacity improvement project would serve areas designated for urban growth, provide an alternative to private automobile travel, and improve linkages between Kapolei, Honolulu's Urban Center, UH Mānoa, Waikiki, and urban areas between these points.

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The alternatives currently under study were developed through a screening process that included NEPA scoping activities, and subsequently identified the best reasonable alternatives from the range of possible alternatives. The current alternatives are:

1. No Build Alternative, which would include existing transit and highway facilities, and most committed transportation projects anticipated to be operational by the year 2030.
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 4. Fixed-Guideway Alternative, which would include the construction and operation of a fixed transit guideway system between Kapolei and UH Mānoa and Waikiki on one of several possible alignments.
- Maps of Alternative 3 and Alternative 4 are enclosed.

Potential Interactions with Protected Species

Technical studies are being prepared for this project. We will ensure that those studies address potential impacts on the species and important habitats that you identify.

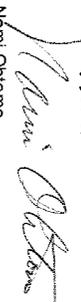


1430
VALE
6

Dr. Dan Polhemus
3/30/2006
Page 3 of 3

We would appreciate receiving a species list within 30 days from the receipt of this letter. If you have any questions about this request, please call or email me at 808-566-2239, or ohiomc@dotworld.com.

Sincerely yours,


Nami Ohimoto
Environmental Planner

Attachments: Study Area map
Alternative 3 maps (2 pages)
Alternative 4 maps (5 pages)

- c. City and County of Honolulu, Department of Transportation Services (Ms. Faith Miyamoto) – w/o attachments
National Marine Fisheries Service, Pacific Islands Area Office (Ms. Margaret Akamine) – w/o attachments

Road. This license is valid until July 31, 2021. It appears that the proposed activities of the City and County of Honolulu DTS overlap with the North-South Road project. We recommend that DTS secure a certificate of inclusion from the State DOT for impacts to *Abutilon menziesii* resulting from the proposed high capacity transit improvements.

The remaining two species (Hawaiian hoary bat and Hawaiian gallinule) may need special consideration before, during and after the execution of your project. We appreciate your efforts to conserve endangered species. If you have questions, please contact Assistant Field Supervisor Gina Shultz (phone: 808/792-9400; fax: 808/792-9581).

Sincerely,

Patrick Leonard
Field Supervisor

Enclosure (1)

A-16



United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122, Box 50088
Honolulu, Hawaii 96850



In Reply Refer To:
1-2-2006-SP-260

APR 12 2006

Nami Ohtomo
Environmental Planner
Parsons, Brinkerhoff, Quade & Douglas, Inc
American Savings Bank Tower
1001 Bishop Street, Suite 2400
Honolulu Hawaii 96813

Dear Mr. Ohtomo:

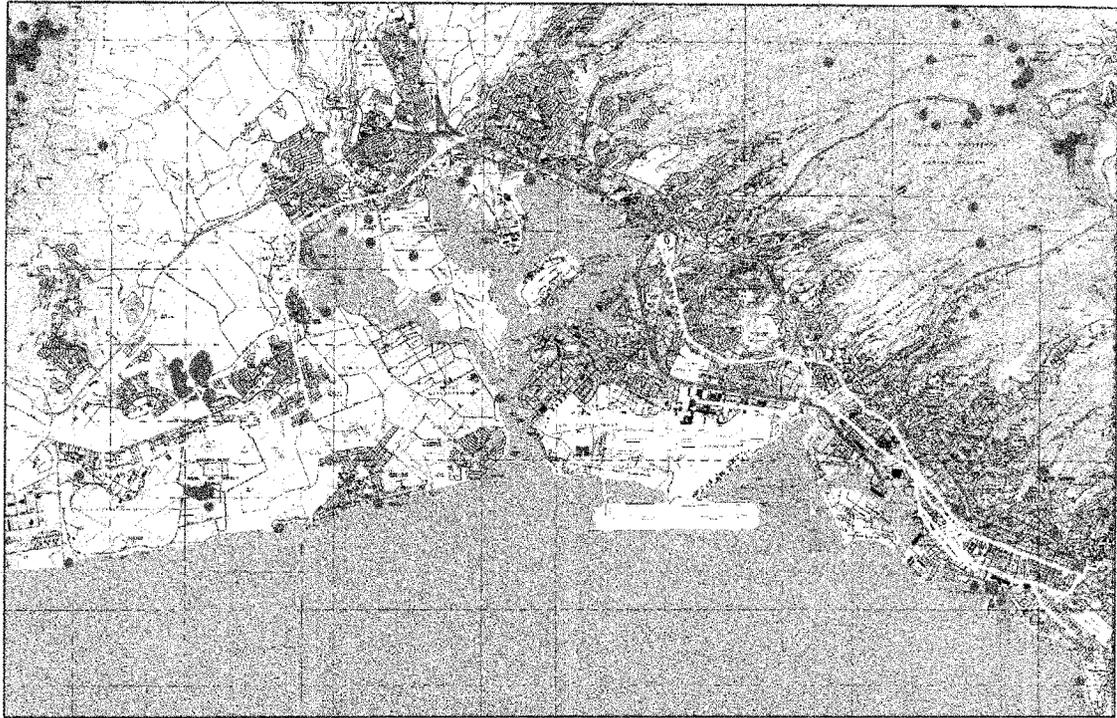
Thank you for your letter dated March 30, 2006, requesting a list of threatened and endangered species that may occur in the vicinity of the proposed high-capacity transit improvements from Kapolei to the University of Hawai'i at Mānoa on the island of O'ahu. Your letter was received in our office on April 3, 2006. The proposed project is to improve public transit in a 23-mile corridor and may include an extension into Waikāī. Your letter states that it is the intent of the City and County of Honolulu, Department of Transportation Services (DTS) to propose these improvements, in cooperation with the Federal Transit Administration (FTA).

We reviewed the information you provided as well as pertinent information in our files, including data compiled by the Hawai'i Biodiversity and Mapping Program. Information from these sources show no designated critical habitats in or near the proposed project area. However, there are records of three species that are federally listed as endangered in or near (within one-third mile) the proposed project area: *Lasturus cinereus semotus* ('ōpe'ape'a; Hawaiian hoary bat); *Gallinula chloropus sandvicensis* ('alae 'ula; common moorhen, Hawaiian gallinule) and *Abutilon menziesii* (ko'oloa'ula, red lima). The general locations of these and other federally listed species are shown in the attached map.

These endangered species may occur at numerous locations within or near the proposed action area, and they are not restricted to the point locations indicated on the enclosed map. The records for the Hawaiian hoary bat are most likely incidental occurrences of transient individuals. The Hawaiian gallinule is restricted to wetlands. Construction and operational impacts from the North-South Road upon the entire population or red lima at Kapolei have been adequately addressed in a Habitat Conservation Plan with the State of Hawai'i in 2004. On March 18, 2005, a State incidental take license was issued to the State Department of Transportation (DOT) for incidental take of the entire plant population, associated with construction of the North-South

TAKE PRIDE
IN AMERICA
A-16

A-17



- *Abutilon menziesii* — Alternative 3
- *Lasiurus cinereus semotus* — Alternative 4
- *Gallinula chloropus sandvicensis* — Alternatives 3 and 4
- Other listed species

0 1 2 Kilometers
0 0.5 1.5 Miles
1:136,111
UTM Zone 4, Nad83
Map produced by U.S. Fish & Wildlife Service, April 7, 2006.



United States Department of the Interior

FISH AND WILDLIFE SERVICE

Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122, Box 50088
Honolulu, Hawaii 96850



APR 17 2006

In Reply Refer To:
1-2-2006-SP-260

Nami Ohtomo
Environmental Planner
Parsons, Brinkerhoff, Quade & Douglas, Inc
American Savings Bank Tower
1001 Bishop Street, Suite 2400
Honolulu Hawaii 96813

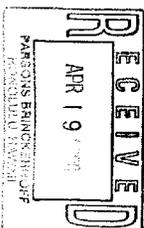
Dear Mr. Ohtomo:

Please add the attached map to our previous letter regarding the proposed high-capacity transit improvements from Kapolei to the University of Hawaii 1 at Manoa on the island of Oahu. If you have questions, please contact Assistant Field Supervisor Gina Shultz (phone: 808/792-9400; fax: 808/792-9581).

Enclosure (1)

Stephen E. Miller
STEPHEN E. MILLER

TAKE PRIDE
IN AMERICA



HAWAII MARINE PROTECTED SPECIES
National Marine Fisheries Service, Pacific Islands Regional Office

MARINE MAMMALS

All marine mammals are protected under the Marine Mammal Protection Act. Those in *ITALICIZED CAPITALS* are also listed as endangered under the Endangered Species Act.

| | |
|----------------------------|-----------------------------------|
| Common Name | Scientific Name |
| HAWAIIAN MONK SEAL | <i>Monachus schauinslandi</i> |
| HUMPBACK WHALE | <i>Megaptera novaeangliae</i> |
| SPERM WHALE | <i>Physeter macrocephalus</i> |
| BLUE WHALE | <i>Balaenoptera musculus</i> |
| FIN WHALE | <i>Balaenoptera physalus</i> |
| Common Dolphin | <i>Delphinus delphis</i> |
| Northern Elephant Seal | <i>Mirounga angustirostris</i> |
| Rough-Toothed Dolphin | <i>Seno bredanensis</i> |
| Risso's Dolphin | <i>Grampus griseus</i> |
| Bottlenose Dolphin | <i>Tursiops truncatus</i> |
| Panropical Spotted Dolphin | <i>Stenella attenuata</i> |
| Spinner Dolphin | <i>Stenella longirostris</i> |
| Striped Dolphin | <i>Stenella coeruleoalba</i> |
| Melon-Headed Whale | <i>Peponocephala electra</i> |
| Pygmy Killer Whale | <i>Feresa attenuata</i> |
| False Killer Whale | <i>Pseudorca crassidens</i> |
| Killer Whale | <i>Orcinus orca</i> |
| Short-Finned Pilot Whale | <i>Globicephala macrorhynchus</i> |
| Blainville's Beaked Whale | <i>Mesoplodon densirostris</i> |
| Cuvier's Beaked Whale | <i>Ziphius cavirostris</i> |
| Dwarf Sperm Whale | <i>Kogia breviceps</i> |
| Bryde's Whale | <i>Kogia sima</i> |
| Fraser's Dolphin | <i>Balaenoptera edeni</i> |
| | <i>Lagenodelphis hosei</i> |

SEA TURTLES

All sea turtles are protected under the Endangered Species Act. Those in *italics* are listed as endangered, while those in normal lettering are listed as threatened.

| | |
|----------------------------|-------------------------------|
| Common Name | Scientific Name |
| LEATHERBACK TURTLE | <i>Dermochelys coriacea</i> |
| HAWKBILL TURTLE | <i>Eretmochelys imbricata</i> |
| GREEN TURTLE | <i>Chelonia mydas</i> |
| OLIVE RIDLEY TURTLE | <i>Lepidochelys olivacea</i> |
| LOGGERHEAD TURTLE | <i>Caretta caretta</i> |

Last updated July 2004



U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Pacific Islands Regional Office
1601 Kapolianni Blvd., Suite 1110
Honolulu, Hawaii 96814-4700
(808) 944-2200 • Fax (808) 973-2941

APR 1 2 2006

Ms. Nami Ohtomo
Environmental Planner
Parsons, Brinckerhoff, Quade & Douglas, Inc.
American Savings Bank Tower
1001 Bishop Street, Suite 2400
Honolulu, HI 96813

Dear Ms. Ohtomo:

This letter responds to your letter received April 3, 2006, regarding the City and County of Honolulu, Department of Transportation Services (DTS), in cooperation with the Federal Transit Administration's (FTA) intent to propose public transit improvements in a 23-mile travel corridor between Kapolei and the University of Hawaii at Manoa, which may include an extension to Waikiki. You requested information on the species under our jurisdiction that may be affected by the project. We provide the following information under our statutory authorities under the Endangered Species Act of 1973 (ESA), as amended (16 U.S.C. §1531 *et seq.*), and the Marine Mammal Protection Act of 1972, as amended (16 U.S.C. 1361 *et seq.*). Attached is a complete list of all protected species under NOAA Fisheries' (NMFS) jurisdiction that may occur in waters or shorelines around the project area.

Thank you for working with NMFS to protect our nation's living marine resources. Should you have any other questions regarding this project or the consultation process, please contact Krista Graham on my staff at (808) 944-2238, or at the email address krista.graham@noaa.gov. Please refer to consultation # I-PI-06-494-CY.

Sincerely,

Chris E. Yates
Chris E. Yates
Assistant Regional Administrator
For Protected Resources



LINDA LINGLE
GOVERNOR OF HAWAII



PETER T. YOUNG
BOARD OF LAND AND NATURAL RESOURCES

ROBERT K. MASUDA
DEPUTY DIRECTOR FOR LAND
DEAN NAKANO, Acting
DEPUTY DIRECTOR FOR
WATER RESOURCE MANAGEMENT

STATE OF HAWAII

DEPARTMENT OF LAND AND NATURAL RESOURCES

DIVISION OF FORESTRY AND WILDLIFE

1161 PINCHBOWL STREET
HONOLULU, HAWAII 96813

April 10, 2006

AGRICULTURE RESOURCES
BOTANICAL AND SYSTEMS RESEARCH
CIVIL ENGINEERING
CONSERVATION AND RESTORATION
CONSTRUCTION AND CONSTRUCTION LINES
COUNSELING AND PLANNING
ELECTRICITY AND WATERS
ENVIRONMENTAL SCIENCE
HONOLULU, HAWAII
LAND AND NATURAL RESOURCES
COMMISSION
STATE PARKS



Ms. Nami Ohmoto
Environmental Planner
Parsons, Brinckerhoff, Quade
And Douglas, Inc.
American Savings Bank Tower
1001 Bishop Street, Suite 2400
Honolulu, Hawaii 96813

Dear Ms. Ohmoto:

Subject: Proposed High-Capacity Transit Improvements From Kapolei to the University of Hawaii at Manoa, Island of Oahu, Protected Species Information Request.

We appreciate the opportunity to comment on your subject request. DOFAW does not develop botanical surveys for consultants requesting information on endangered species. The Ewa-Kapolei-Kalaheo region is known to have endangered plants scattered throughout this area. The endangered plants are: 1) *Achyrocline splendens* spp. *rotundata* 2) *Chamaesyce skottsbergii* and 3) *Abutilon menziesii*. We recommend that a biological plant survey be included in an Environmental Impact Statement along the proposed transportation corridor by a trained Botanist. Following a review of the EIS, DOFAW will provide recommendations for mitigating endangered plants along this corridor. Thank you for allowing us to comment on your project. Any questions regarding the endangered species listed here can be requested by calling Ms. Vickie Caraway, State Botanist at 587-0165.

Sincerely yours,

Paul J. Conry
Paul J. Conry
Administrator

C: OEQC
Vickie Caraway, DOFAW Administration

A-21

LINDA LINGLE
GOVERNOR OF HAWAII



PETER T. YOUNG
BOARD OF LAND AND NATURAL RESOURCES
COMMISSIONER OF WATER RESOURCE MANAGEMENT

ROBERT K. MASUDA
DEPUTY DIRECTOR FOR LAND
DEAN NAKANO, Acting
DEPUTY DIRECTOR FOR
WATER

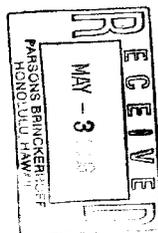
AGRICULTURE RESOURCES
BOTANICAL AND SYSTEMS RESEARCH
CIVIL ENGINEERING
CONSERVATION AND RESTORATION
CONSTRUCTION AND CONSTRUCTION LINES
COUNSELING AND PLANNING
ELECTRICITY AND WATERS
ENVIRONMENTAL SCIENCE
HONOLULU, HAWAII
LAND AND NATURAL RESOURCES
COMMISSION
STATE PARKS

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

DIVISION OF AQUATIC RESOURCES

1161 PINCHBOWL STREET
HONOLULU, HAWAII 96813

May 1, 2006



Nami Ohmoto, Environmental Planner
Parsons, Brinckerhoff, Quade, and Douglas, Inc.
American Savings Bank Tower
1001 Bishop Street, Suite 2400
Honolulu, HI 96813

Dear Ms. Nami,

The only species that Division of Aquatic Resources have any concerns about that are listed in Hawaii Revised Statutes Chapter 195D are whales, marine turtles and monk seals.

Although the City & County Study Area Maps describes briefly the proposed project, we suggest the forthcoming DEIS discuss in detail potential short term impacts and propose specific means for averting or minimizing adverse effects, and provide possible mitigation for unavoidable damage to natural resource values such as Best Management Practices and Water Quality Monitoring.

All proposed stream, shoreline and seaward activities in the vicinity should be adequately described in the DEIS and the Department should have the opportunity to review all project related effects to the aquatic environment. Crossings of drainageways or perennial freshwater streams necessary for the project should be adequately described in the DEIS

Specific impacts from some of the projects described cannot be identified at this time. Many previous transportation proposals have been reviewed by our Division and comments have been provided. We do not expect any significant adverse effects on the aquatic environment from the future activities anticipated. However, when additional information about the projects becomes available, we would appreciate further opportunity to address any potential aquatic resources concerns. We will review the DEIS when it is completed and comment on any significant impacts adverse to aquatic resource values at a later date.

Sincerely,
Dan Polhemus
Dan Polhemus, Administrator
Division of Aquatic Resources

A-22

Appendix B Preliminary Tree Survey Field Data

Honolulu High Capacity Transit Corridor Preliminary Tree Survey

Alternative 3 Managed Lanes Route Location: Kam Hwy/Waiawa Interchange to Nimitz Hwy/River St

| STREET | COMMON NAME | BOTANICAL NAME | LOCATION (on street) | QUANTITY | HEIGHT/SPREAD | TREE CLASS. | COMMENTS: |
|--|---------------|-------------------------|----------------------|----------|---------------|-------------|--------------------------------------|
| <u>KAM HWY:</u> | | | | | | | |
| Waiawa Interchange to Salt Lake Blvd | Monkeypod | Samanea saman | Mauka | 1 | 40'/30' | Good | |
| | Mango | Mangifera indica | Mauka | 2 | 30'/30' | Good | |
| | Monkeypod | Samanea saman | Makai side | 13 | 40'/40' | Good | Blaisdell Park and Hawaiian Electric |
| | Fiddleleaf | Ficus lyrata | Mauka | 1 | 40'/50' | Good | |
| | Monkeypod | Samanea saman | Mauka | 3 | 45'/50' | Good | Fronting Pearl Ridge Shopping Center |
| | Keawe Opiuma | Prosopis pallida | Makai side | 5 | 35'/30' | Good | |
| | | Pithecellobium dulce | Makai side | 2 | 30'/30' | Good | Near freeway entry overpass. |
| Salt Lake Blvd to Elliot St | Fan Palm | Prichardia sp. | Median | 5 | 10' | Fair | Along Arizona Memorial area. |
| | Shower | Cassia sp. | Mauka side | 4 | 20'/20' | Good | Along Arizona Memorial area. |
| | Opiuma | Pithecellobium dulce | Mauka | 20 | | Good | Along Arizona Memorial area. |
| | Banyan | Ficus sp. | Makai side | 3 | | Good | Along Arizona Memorial area. |
| <u>NIMITZ HWY:</u> | | | | | | | |
| Elliot St to Middle St Interchange | Queen Palm | Syagrus romanzoffiana | Mauka | 10 | 30' | Good | |
| | African Tulip | Spathodea | Mauka | 15 | 45'/20' | Good | |
| | Opiuma | Pithecellobium dulce | Mauka | 1 | 45'/35' | Good | |
| | Brassia | Schefflera actinophylla | Mauka | 55 | 35'/20' | Good | |
| | Banyan | Ficus sp. | Mauka | 2 | 35'/30' | Good | |
| | | | | | | | |

B-3

1

Honolulu High Capacity Transit Corridor Preliminary Tree Survey

Alternative 3 Managed Lanes (Cont.) Route Location: Kam Hwy/Waiawa Interch. to Nimitz Hwy/River St.

| STREET | COMMON NAME | BOTANICAL NAME | LOCATION (on street) | QUANTITY | HEIGHT/SPREAD | TREE CLASS. | COMMENTS: |
|---|---------------|-------------------------|----------------------|----------|---------------|-------------|--|
| <u>NIMITZ HWY:</u> | | | | | | | |
| Middle St Interchange to Waikamilo Rd | Kiawe | Prosopis | Makai | 40 | 25'/20' | Good | Scrub growth. |
| | Monkeypod | Samanea saman | Makai | 5 | 40'/40' | Notable | Traffic island near Sand Island Road intersection. |
| | Norfolk Pine | Araucaria heterophylla | Makai | 8 | 30' | Good | |
| | Kou | Cordia subcordata | Mauka | 20 | 15'/10' | Good | |
| | Fan Palm | Prichardia sp. | Makai | 1 | 35' | Good | |
| | Scrubld Egg | Senna alata | Median | 20 | 15'/10' | Good | |
| | Brassia | Schefflera actinophylla | Mauka | 2 | 35'/20' | Good | |
| | Coconut | Cocos nucifera | Makai | 2 | 35' | Good | |
| | | | Mauka | 7 | 35' | Good | |
| | | | Median | 3 | 35' | Good | |
| | | | Mauka | 20 | 25' | Good | |
| | | | Makai | 2 | 35'/20' | Good | Inside Port Authority car storage area. |
| | | | Makai | 6 | 45'/30' | Good | Inside Port Authority car storage area. |
| | | | cyclocarpum | | | | |
| Waikamilo Rd to River St | Fan Palm | Prichardia sp. | Makai | 1 | 25' | Good | |
| | Plumeria | Plumeria acuminata | Mauka | 20 | 15'/15' | Good | |
| | Shower | Cassia sp. | Median | 6 | 25'/20' | Good | Near Zippy's. |
| | African Tulip | Spathodea | Mauka | 1 | 35'/20' | Good | |
| | Kou | Cordia subcordata | Median | 2 | 15'/15' | Good | Near Sam Choy's restaurant |
| | Pink Tecoma | Tabebuia heterophylla | Mauka | 1 | 35'/20' | Good | |
| | Manila Palm | Veitchia merrillii | Median | 20 | 15' | Good | |
| | | | Mauka | 30 | 15' | Good | Near Brewer Environmental. |
| | | | Median | 3 | 50'/50' | Notable | |
| | | | Median | 2 | 50'/50' | Notable | |
| | | | Mauka | 1 | 40'/20' | Good | |
| | | Median | 20 | 25'/40' | Good | | |

B-4

2

Honolulu High Capacity Transit Corridor Preliminary Tree Survey

Section: **1** Route Location: **Kamokila Blvd – Farrington Hwy** Route Color: **Yellow**

| STREET | COMMON NAME | BOTANICAL NAME | LOCATION (on street) | QUANTITY | HEIGHT/SPREAD | TREE CLASS. | COMMENTS: |
|---|--------------|------------------------|----------------------|----------|---------------|-------------|---|
| <u>KAPOLEI PARKWAY:</u> Starting Point to Kamokila Blvd | Monkeypod | Samanea saman | Makai | 5 | 15'/20' | Good | New planting along side of the Advertiser building. |
| | Indian Coral | Erythrina variegata | Median | 27 | 35'/40' | Fair-Poor | Gall Wasp infestation. |
| <u>KAMOKILA BLVD / FARRINGTON HWY:</u> Kapolei Pkwy to Ft Barrette Rd | Shower | Cassia sp. | Mauka | 106 | 35'/20' | Good | |
| | Shower | Cassia sp. | Makai | 112 | 35'/20' | Good | |
| | Kamani | Calophyllum inophyllum | Median | 76 | 30'/20' | Good | |
| <u>FARRINGTON HWY:</u> Ft Barrette Rd to Ft Weaver Rd | Shower | Cassia sp. | Mauka | 116 | 15'/10' | Good | |
| | Shower | Cassia sp. | Makai | 110 | 15'/10' | Good | |
| | Kiawe | Prosopis pallida | Mauka | 5 | 30'/20' | Fair | Scrub trees. |
| | Kiawe | Prosopis pallida | Makai | 3 | 30'/20' | Fair | Scrub trees. |

B-5

1

Honolulu High Capacity Transit Corridor Preliminary Tree Survey

Section: **1** Route Location: **Kapolei Parkway – North-South Rd** Route Color: **Blue**

| STREET | COMMON NAME | BOTANICAL NAME | LOCATION (on street) | QUANTITY | HEIGHT/SPREAD | TREE CLASS. | COMMENTS: |
|---|--------------|---------------------|----------------------|----------|---------------|-------------|---|
| <u>KAPOLEI PARKWAY:</u> Starting Point to Kamokila Blvd | Monkeypod | Samanea saman | Makai side | 5 | 15'/20' | Good | New planting along side of the Advertiser building. |
| | Indian Coral | Erythrina variegata | Median | 27 | 35'/40' | Fair-Poor | Gall Wasp infestation. |
| Kamokila Blvd to Fort Barrette Rd | | | | | | | Kamokila Blvd. to Fort Barrette Rd. is open scrub land. |
| Fort Barrette Rd to Kapolei Pkwy Bridge | Monkeypod | Samanea saman | Median | 7 | 30'/20' | Fair | Near Kama'aha St. |
| Kapolei Pkwy Bridge to North-South Rd | | | | | | | Kapolei Parkway Bridge to North-South Rd is scrub land. |

B-6

2

**Honolulu High Capacity Transit Corridor
Preliminary Tree Survey**

Section: 1 Route Location: **Kapolei Parkway – North-South Rd (Continued)** Route Color: **Blue**

| STREET | COMMON NAME | BOTANICAL NAME | LOCATION (on street) | QUANTITY | HEIGHT/SPREAD | TREE CLASS. | COMMENTS: |
|--|----------------|--------------------------------------|----------------------|----------|--------------------|--------------|--|
| <u>NORTH-SOUTH RD:</u> Kapolei Pkwy to Farrington Hwy | | | | | | | North-South Road is under construction. Street trees planned for this section is unknown at this time. |
| <u>FARRINGTON HWY:</u> North-South Rd to Fort Weaver Rd | Kiawe Kiawe | Prosopis pallida Prosopis pallida | Mauka Makai side | 2 1 | 30'/20' 30'/20' | Fair Fair | Scrub trees. Scrub trees. |
| | | | | | | | |

B-7

3

**Honolulu High Capacity Transit Corridor
Preliminary Tree Survey**

Section: 1 Route Location: **Saratoga Rd – North-South Rd** Route Color: **Green**

| STREET | COMMON NAME | BOTANICAL NAME | LOCATION (on street) | QUANTITY | HEIGHT/SPREAD | TREE CLASS. | COMMENTS: |
|---|---------------------------|--------------------------------------|----------------------|----------|--------------------|-------------------|--|
| <u>KAPOLEI PKWY:</u> Starting Point to Kamokila Blvd | Monkeypod Indian Coral | Samanea saman Erythrina variegata | Makai side Median | 5 27 | 15'/20' 35'/40' | Good Fair-Poor | New planting along side of the Advertiser building. Gall Wasp infestation. |
| Kamokila Blvd to Wakea St | | | | | | | Kapolei Pkwy. from Kamokila Blvd to Wakea St. is open scrub land. |
| <u>WAKEA ST:</u> Kapolei Pkwy to Renton Rd | | | | | | | Wakea St. from Kapolei Pkwy. to Renton Rd. is open scrub land. |
| Renton Rd to Saratoga Ave | | | | | | | Wakea St. from Renton Rd. to Saratoga Ave. is abandoned subdivision with scattered Monkeypod, Banyan, and Kiawe. |

B-8

4

**Honolulu High Capacity Transit Corridor
Preliminary Tree Survey**

Section: 1 Route Location: **Saratoga Rd – North-South Rd (Continued)** Route Color: **Green**

| STREET | COMMON NAME | BOTANICAL NAME | LOCATION (on street) | QUANTITY | HEIGHT/SPREAD | TREE CLASS. | COMMENTS: |
|--|-------------|------------------|----------------------|----------|---------------|-------------|---|
| SARATOGA: | | | | | | | |
| Wakea St to Coral Sea Rd | Kiawe | Prosopis palida | Makai side | 3 | 40'/30' | Fair | Scrub trees. |
| | Kiawe | Prosopis palida | Mauka | 2 | 40'/30' | Fair | Scrub trees. |
| Coral Sea Rd to North-South Rd | | | | | | | Saratoga Ave. from Coral Sea Rd. to North-South Rd. is abandoned area with scrub trees. |
| NORTH-SOUTH RD: Saratoga to Farrington Hwy | | | | | | | North-South Rd. from Saratoga Ave. to Farrington Hwy is open scrub and farm land. |
| FARRINGTON HWY: | | | | | | | |
| North-South Rd to Fort Weaver Rd | Kiawe | Prosopis pallida | Mauka | 2 | 30'/20' | Fair | Scrub trees. |
| | Kiawe | Prosopis pallida | Makai side | 1 | 30'/20' | Fair | Scrub trees. |

B-9

5

**Honolulu High Capacity Transit Corridor
Preliminary Tree Survey**

Section: 1 Route Location: **Geiger Rd – Fort Weaver Road** Route Color: **Orange**

| STREET | COMMON NAME | BOTANICAL NAME | LOCATION (on street) | QUANTITY | HEIGHT/SPREAD | TREE CLASS. | COMMENTS: |
|---|--------------|---------------------|----------------------|----------|---------------|-------------|---|
| KAPOLEI PKWY: | | | | | | | |
| Starting Point to Kamokila Blvd | Monkeypod | Prosopis pallida | Makai side | 5 | 15'/20' | Good | New planting along side of the advertiser building. |
| | Indian Coral | Erythrina variegata | Median | 27 | 35'/40' | Fair-Poor | Gall Wasp infestation. |
| Kamokila Blvd to Waikea St | | | | | | | Kapolei Pkwy. from Kamokila Blvd to Wakea St. is open scrub land. |
| WAKEA ST: Kapolei Pkwy to Renton Rd | | | | | | | Wakea St. from Kapolei Pkwy. to Renton Rd. is open scrub land. |
| Renton Rd to Saratoga Ave | | | | | | | Wakea St. from Renton Rd. to Saratoga Ave. is abandoned sub-division with scattered Monkeypod, Banyan, and Kiawe. |

B-10

6

**Honolulu High Capacity Transit Corridor
Preliminary Tree Survey**

Section: 1 Route Location: **Geiger Rd – Fort Weaver Road (Continued)** Route Color: **Orange**

| STREET | COMMON NAME | BOTANICAL NAME | LOCATION (on street) | QUANTITY | HEIGHT/SPREAD | TREE CLASS. | COMMENTS: |
|--|--|--------------------------------------|--|----------------------------------|--|--|--|
| SARATOGA: | | | | | | | |
| Waieka St to Coral Sea Rd | Kiawe Kiawe | Prosopis pallida Prosopis pallida | Makai side Mauka | 3 2 | 40'/30' 40'/30' | Fair Fair | Scrub trees. Scrub trees. |
| Coral Sea Rd to Geiger Rd | | | | | | | The area from Coral Sea Rd. to the point where the proposed route joins Geiger Rd. is abandoned land with scrub trees. |
| GEIGER RD: | | | | | | | |
| E. Hanson Rd to Fort Weaver Rd | Fern Trees | | Makai side | 12 | 15'/10' | Fair | |
| Fort Weaver Rd to Farrington Hwy | False Kou Buttonwood Manila Palm Banyan Gold Tree Monkeypod | | Median Median Median Median Median Diamond Head side | 58 66 50 1 11 100 | 10'/5' 15'/10' 10' 60'/60' 15'/5' 40'/40' | Fair F-G Fair Notable Fair Good | Near <u>old</u> Fort Weaver Rd. 30 feet off roadway. |

B-11

7

**Honolulu High Capacity Transit Corridor
Preliminary Tree Survey**

Section: 2 Route Location: **Farrington Hwy – Kamehameha Hwy** Route Color: **Yellow**

| STREET | COMMON NAME | BOTANICAL NAME | LOCATION (on street) | QUANTITY | HEIGHT/SPREAD | TREE CLASS. | COMMENTS: |
|--|---|---|--|---|--|--|--|
| FARRINGTON HWY: | | | | | | | |
| Fort Weaver Rd to Waiawa Interchange | Banyan Kou Fan Palm Shower Shower Monkeypod Shower Fan Kou Shower Monkeypod | Ficus sp. Cordia subcordata Prichardia sp. Cassia sp. Cassia sp. Samanea Saman Cassia sp. Prichardia sp. Cordia subcordata Cassia sp. Samanea saman | Mauka Median Median Median Median Makai side Median Median Median Median Mauka | 2 10 48 22 30 4 11 41 24 32 6 | 30'/40' 10'/5' 25' 20'/10' 20'/10' 40'/40' 20'/10' 25' 20'/10' 20'/10' 40'/40' | Good Good Good Good Good Good Good Good Good Good Good | Near Kahualii St. New planting. New planting. New planting. Planted on slope. Near Waipahu Depot Rd. New planting. New planting. New planting. New planting. Near Waipahu High School. |
| KAM HWY: | | | | | | | |
| Waiawa Interchange to Salt Lake Blvd | Monkeypod Mango Monkeypod Fiddleleaf Monkeypod Keawe Opiuma | Samanea saman Mangifera indica Samanea saman Ficus lyrata Samanea saman Prosopis pallida Pithecellobium dulce | Mauka Mauka Makai side Mauka Mauka Makai side Makai side | 1 2 13 1 3 5 2 | 40'/30' 30'/30' 40'/40' 40'/50' 45'/50' 35'/30' 30'/30' | Good Good Good Good Good Good Good | Blaisdell Park and Hawaiian Electric Fronting Pearl Ridge Shopping Center Near freeway entry overpass. |

B-12

8

Honolulu High Capacity Transit Corridor Preliminary Tree Survey

Section: 3 Route Location: **Salt Lake Blvd** Route Color: **Yellow**

| STREET | COMMON NAME | BOTANICAL NAME | LOCATION (on street) | QUANTITY | HEIGHT/SPREAD | TREE CLASS. | COMMENTS: |
|------------------------------------|----------------|-----------------------|----------------------|----------|---------------|-------------|---|
| SALT LAKE BLVD: | | | | | | | |
| Kam Hwy to Puuloa Rd | Silver Trumpet | Tabebuia aurea | Makai side | 25 | 15'/10' | Good | Near stadium. |
| | Silver Trumpet | Tabebuia aurea | Mauka | 15 | 15'/10' | Good | Near stadium. |
| | Monkeypod | Samanea saman | Makai side | 7 | 30'/30' | Good | Near Radford High School. |
| | Monkeypod | Samanea saman | Mauka | 1 | 30'/60' | Good | At Wanaka. |
| | Monkeypod | Samanea saman | Makai side | 1 | 40'/30' | Good | |
| | Banyan | Ficus sp. | Makai side | 1 | 40'/35' | Good | |
| | Monkeypod | Samanea saman | Mauka | 1 | 30'/40' | Good | At Salt Lake Shopping Center. |
| | Keawe | Prosopis pallida | Makai side | 12 | 45'/30' | Good | |
| | Indian Coral | Erythrina variegata | Median | 4 | 25'/15' | Fair-Poor | Near Ala Lilikoi. Gall Wasp infestation. |
| | Banyan | Ficus sp. | Makai side | 1 | 45'/35' | Good | Overhanging roadway. |
| PUKOLOA ST: | | | | | | | |
| Puuloa Rd | Monkeypod | Samanea saman | Mauka | 1 | 25'/30' | Good | |
| to Ahua St | Pink Tecoma | Tabebuia heterophylla | Mauka | 4 | 20'/15' | Fair | |
| Ahua St. to Nimitz Hwy | | | | | | | The proposed fork from Ahua St to Nimitz Hwy runs along a stream bank lined with Mangrove, Ironwood, and Keawe. |
| | | | | | | | |

B-13

9

Honolulu High Capacity Transit Corridor Preliminary Tree Survey

Section: 3 Route Location: **Salt Lake Blvd (Continued)** Route Color: **Yellow**

| STREET | COMMON NAME | BOTANICAL NAME | LOCATION (on street) | QUANTITY | HEIGHT/SPREAD | TREE CLASS. | COMMENTS: |
|---|------------------|-------------------------|----------------------|----------|---------------|-------------|--|
| KIKOWAENA ST: | | | | | | | |
| Ahua St to Middle St | Monkeypod | Samanea saman | Makai side | 2 | 35'/35' | Good | |
| | African Tulip | Spathodea campanulata | Mauka | 2 | 45'/15' | Good | |
| | Yellow Poinciana | Peltophorum pterocarpum | Mauka | 1 | 50'/40' | Good | |
| Ft Shafter W-bound Off-ramp and Overpass To Kikowaena | | | | | | | Fort Shafter ramps and Overpass present no visible tree obstacles. |
| | | | | | | | |

B-14

10

Honolulu High Capacity Transit Corridor Preliminary Tree Survey

Section: 3 Route Location: **Mauka side of Airport Viaduct** Route Color: **Orange**

| STREET | COMMON NAME | BOTANICAL NAME | LOCATION (on street) | QUANTITY | HEIGHT/SPREAD | TREE CLASS. | COMMENTS: |
|-----------------------------------|--|---|----------------------|----------|---------------|-------------|--|
| <u>KAM HWY:</u> | | | | | | | |
| Salt Lake Blvd to Elliot St | Fan Palm Shower Opiuma Banyan | Prichardia sp. Cassia sp. Pithecellobium dulce Ficus sp. | Median | 5 | 10' | Fair | Along Arizona Memorial area. Along Arizona Memorial area. Along Arizona Memorial area. Along Arizona Memorial area. |
| | | | Median | 4 | 20'/20' | Good | |
| | | | Makai side | 20 | | Good | |
| | | | Makai side | 3 | | Good | |
| <u>NIMITZ HWY:</u> | | | | | | | |
| Elliot St to Middle St | Queen Palm African Tulip Opiuma Brassia Banyan | Syagrus romanzoffiana Spathodea campanulata Pithecellobium dulce Schefflera actinophylla Ficus sp. | Mauka | 10 | 30' | Good | |
| | | | Mauka | 15 | 45'/20' | Good | |
| | | | Mauka | 1 | 45'/35' | Good | |
| | | | Mauka | 55 | 35'/20' | Good | |
| | | | Mauka | 2 | 35'/30' | Good | |

B-15

15

Honolulu High Capacity Transit Corridor Preliminary Tree Survey

Section: 3 Route Location: **Makai of the Airport Viaduct** Route Color: **Blue**

| STREET | COMMON NAME | BOTANICAL NAME | LOCATION (on street) | QUANTITY | HEIGHT/SPREAD | TREE CLASS. | COMMENTS: |
|---------------------------------------|---|--|----------------------|----------|-----------------|-------------|---|
| <u>KAM HWY:</u> | | | | | | | |
| Salt Lake Blvd to Elliot St | Fan Palm Shower Opiuma Banyan Monkeypod | Prichardia sp. Cassia sp. Pithecellobium dulce Ficus sp. Samanea saman | Median | 5 | 10' | Fair | Along Arizona Memorial area. Along Arizona Memorial area. Along Arizona Memorial area. Along Arizona Memorial area. |
| | | | Median | 4 | 20'/20' | Good | |
| | | | Makai side | 20 | | Good | |
| | | | Makai side | 3 | | Good | |
| | | | Makai side | 1 | 40'/30' | Good | |
| <u>NIMITZ HWY Makai of H1:</u> | | | | | | | |
| Elliot St to Middle St | Shower African Tulip | Cassia sp. Spathodea campanulata | Makai side | 18 | 20'-30'/ 20' | Good | The section that bypasses the interchange at Nimitz Hwy. passes through open park-like area with no obvious significant trees. Near the Main Post Office area. |
| | | | Makai side | 2 | 40'/15' | Good | |

B-16

13

Honolulu High Capacity Transit Corridor Preliminary Tree Survey

Section: 3 Route Location: **Aolele St** Route Color: **Magenta**

| STREET | COMMON NAME | BOTANICAL NAME | LOCATION (on street) | QUANTITY | HEIGHT/SPREAD | TREE CLASS. | COMMENTS: | | |
|--|---|--|----------------------|----------|---------------|-------------|--|--|--|
| KAM HWY: | | | | | | | | | |
| Salt Lake Blvd to Elliot St | Fan Palm Shower Opiuma Banyan Monkeypod | Prichardia sp. Cassia sp. Pithecellobium dulce Ficus sp. Samanea saman | Median | 5 | 10' | Fair | Along Arizona Memorial area. | | |
| | | | Median | 4 | 20'/20' | Good | Along Arizona Memorial area. | | |
| | | | Makai side | 20 | | Good | Along Arizona Memorial area. | | |
| | | | Makai side | 3 | | Good | Along Arizona Memorial area. | | |
| | | | Makai side | 1 | 40'/30' | Good | | | |
| AOLELE ST: | | | | | | | | | |
| Nimitz Hwy to Ke'ehi Lagoon Park | Banyan Coconut Hong Kong Orchid Fiddleleaf Fig Shower Indian Coral | Ficus sp. Cocos nucifera Bauhinia sp. Ficus lyrata Cassia sp. Erythrina variegata | Makai side | 2 | 40'/30' | Good | The section that bypasses the interchange at Nimitz Hwy. passes through open park-like area with no obvious significant trees. | | |
| | | | Mauka | 25 | 35'/50' | Good | Near the overpass. | | |
| | | | Makai side | 2 | 25'/20' | Good | | | |
| | | | Mauka | 2 | 25'/20' | Good | | | |
| | | | Makai side | 9 | 35'/35' | Good | | | |
| | | | Mauka | 36 | 35'/20' | Fair | Tightly planted along side of a building. | | |
| | | | Makai side | 32 | 35'/30' | Fair-Poor | Heavy Gall Wasp infestation. Inside Ke'ehi Lagoon Park. | | |
| | | | Mauka | 30 | 35'/30' | Fair-Poor | Heavy Gall Wasp infestation. Inside Ke'ehi Lagoon Park. | | |
| | | | | | | | | | |
| | | | | | | | | | |

B-17

14

Honolulu High Capacity Transit Corridor Preliminary Tree Survey

Section: 4 Route Location: **North King St** Route Color: **Yellow**

| STREET | COMMON NAME | BOTANICAL NAME | LOCATION (on street) | QUANTITY | HEIGHT/SPREAD | TREE CLASS. | COMMENTS: |
|--|---|---|----------------------|----------|---------------|-------------|-------------------------------------|
| MIDDLE ST: | | | | | | | |
| Dillingham Blvd to North King St | Fiddlewood | Citharexylum spinosum | Diam. Hd. side | 15 | 15'/10' | Good | New plantings. |
| NORTH KING ST: | | | | | | | |
| Middle St to Nuuanu Stream | Monkeypod Royal Poinciana Fiddlewood | Samanea saman Delonix regia Citharexylum spinosum | Mauka | 1 | 40'/60' | Notable | Near 1 st Hawaiian Bank. |
| | | | Makai side | 1 | 35'/25' | Notable | Near Kaiulani Elementary School. |
| | | | Makai side | 31 | 15'/10' | F - G | |
| | | | Mauka | 37 | 15'/10' | F - G | |

B-18

16

Honolulu High Capacity Transit Corridor Preliminary Tree Survey

Section: 4 Route Location: **Dillingham Blvd** Route Color: **Blue**

| STREET | COMMON NAME | BOTANICAL NAME | LOCATION (on street) | QUANTITY | HEIGHT/SPREAD | TREE CLASS. | COMMENTS: |
|--------------------------------|-------------|------------------------|----------------------|----------|---------------|-------------|--|
| <u>DILLINGHAM BLVD:</u> | | | | | | | |
| Middle St | Kamani | Calophyllum inophyllum | Mauka | 22 | 40'/35' | Notable | Prune heavily to clear the wire and trim to the edge of the sidewalk. Near Marukai store. McDonald's at Waikamilo Rd. Near Kalihi Kai School. |
| to | Monkeypod | Samanea saman | Makai side | 26 | 40'/20' | Notable | |
| | | | Mauka | 2 | 40'/40' | Good | |
| | | | Makai side | 1 | 40'/40' | Notable | |
| Nuuanu Stream | Banyan | Ficus sp. | Mauka | 1 | 50'/50' | Notable | |

B-19

17

Honolulu High Capacity Transit Corridor Preliminary Tree Survey

Section: 5 Route Location: **Beretania St - South King St** Route Color: **Yellow**

| STREET | COMMON NAME | BOTANICAL NAME | LOCATION (on street) | QUANTITY | HEIGHT/SPREAD | TREE CLASS. | COMMENTS: |
|--------------------------------------|-------------|--------------------------|----------------------|----------|---------------|-------------|---|
| <u>BERETANIA ST:</u> | | | | | | | |
| Dillingham Blvd | Shower | Cassia sp. | Mauka | 12 | 15'/10' | Good | Across from 1 st Hawaiian Bank. |
| to | Milo | Thespesia populnea | Mauka | 18 | 30'/20' | Good | Across from Aala Park. |
| | | | Makai side | 5 | 25'/20' | Good | |
| | | | Mauka | 3 | 25'/20' | Good | |
| | Coconut | Cocos nucifera | Makai side | 7 | 40' | Good | From Police Station to the Capitol. |
| Kealamakai St at Alapai Transfer Pt. | Monkeypod | Samanea saman | Makai side | 38 | 40'/40' | Notable | Large, spreading crowns. |
| | | | Mauka | 7 | 40'/40' | Notable | Large, spreading crowns. |
| <u>KING ST:</u> | | | | | | | |
| Kealamakai St at Alapai Transfer Pt. | Shower | Cassia sp. | Mauka | 93 | 35'/25' | Good | A notable street tree planting and one that is highly valued by The Outdoor Circle. |
| to | Earpod | Enterolobium cyclocarpum | Makai side | 98 | 35'/25' | Good | |
| | | | Mauka | 2 | 60'/60' | Notable | |
| University Ave | Banyan | Ficus sp. | Mauka | 6 | 50'/50' | Notable | |

B-20

26

**Honolulu High Capacity Transit Corridor
Preliminary Tree Survey**

Section: 5 Route Location: **Hotel St – Waimanu – Kapiolani Blvd** Route Color: **Blue**

| STREET | COMMON NAME | BOTANICAL NAME | LOCATION (on street) | QUANTITY | HEIGHT/SPREAD | TREE CLASS. | COMMENTS: |
|--|--------------|-----------------------|----------------------|----------|---------------|-------------|--|
| HOTEL ST: | | | | | | | |
| Nuuanu Stream to Richards St | Fiddlewood | Citharexylum spinosum | Mauka | 32 | 30'/15' | Fair | At the corner of River St. Both notable trees are near Bethel Park and the City Courthouse; planted back from the street. |
| | Tulipwood | Harpullia pendula | Makai side | 26 | 30'/15' | Fair | |
| | Formosan Koa | Acacia confusa | Mauka | 5 | 15'/10' | Fair | |
| | Monkeypod | Samanea saman | Makai side | 4 | 15'/10' | Fair | |
| | Coconut | Cocos nucifera | Mauka | 4 | 35'/20' | Good | |
| | | | Median | 9 | 50'/40' | Notable | |
| | | | Makai side | 4 | 50'/40' | Notable | |
| | | | Median | 6 | 35' | Good | |
| TUNNEL SEGMENT To WAIMANU ST | | | | | | | |
| WAIMANU ST: | | | | | | | |
| Drier St to Queen St Junction | Monkeypod | Samanea saman | Mauka | 1 | 60'/60' | Notable | At the Ewa/Mauka corner of Waimanu St. and Ward Ave. |
| KONA ST: | | | | | | | |
| Pensacola St to Kapiolani Blvd | Monkeypod | Samanea saman | Median | 10 | 40'/40' | Notable | |
| | Pink Tecoma | Tabebuia heterophylla | Mauka | 2 | 40'/40' | Notable | |
| | Coconut | | Mauka | 2 | 20'/10' | Good | |
| | | | Makai side | 16 | 20' - 30' | Good | |

B-21

20

**Honolulu High Capacity Transit Corridor
Preliminary Tree Survey**

Section: 5 Route Location: **Hotel St – Waimanu St – Kapiolani Blvd (Cont.)** Route Color: **Blue**

| STREET | COMMON NAME | BOTANICAL NAME | LOCATION (on street) | QUANTITY | HEIGHT/SPREAD | TREE CLASS. | COMMENTS: |
|------------------------|-------------|--------------------------|----------------------|----------|---------------|-------------|--|
| KAPIOLANI BLVD: | | | | | | | |
| Atkinson Dr | Monkeypod | Samanea saman | Mauka | 15 | 40'/40' | Notable | Mature, large crowned trees. Mature, large crowned trees. Mature, large crowned trees. |
| To | | | Makai side | 5 | 40'/40' | Notable | |
| | Satinleaf | Chrysophyllum oliviforme | Median | 15 | 40'/40' | Notable | |
| | | | Mauka | 6 | 30'/15' | Good | |
| | Fiddlewood | Citharexylum spinosum | Makai side | 5 | 30'/15' | Good | |
| University Ave | | | Makai | 5 | 30'/20' | Good | |
| UNIVERSITY AVE | | | | | | | |
| Kapiolani Blvd | Shower | Cassia sp. | Median | 27 | 15-20'/15' | Good | Newly planted. |
| to | Alibangbang | Bauhinia hookeri | Ewa | 10 | 20'/15' | Fair | Old, mature planting. |
| | | | Diam. Hd. | 15 | 20'/15' | Fair | Old, mature planting. |
| H-1 Overpass | Podocarpus | Podocarpus sp. | Diam. Hd. | 3 | 15'/10' | Good | |

B-22

21

**Honolulu High Capacity Transit Corridor
Preliminary Tree Survey**

Section: 5 Route Location: **Hotel St – Kawaiahaio St – Kapiolani Blvd** Route Color: **Green**

| STREET | COMMON NAME | BOTANICAL NAME | LOCATION (on street) | QUANTITY | HEIGHT/SPREAD | TREE CLASS. | COMMENTS: |
|--|------------------------|-------------------------|----------------------|----------|---------------|-------------|---|
| HOTEL ST: | | | | | | | |
| Nuuanu Stream to Richards St | Fiddlewood | Citharexylum spinosum | Mauka | 32 | 30'/15' | Fair | At the corner of River St. Both notable trees are near Bethel Park and the City Courthouse; planted back from the street. |
| | | | Makai side | 26 | 30'/15' | Fair | |
| | Tulipwood | Harpullia pendula | Mauka | 5 | 15'/10' | Fair | |
| | | | Makai side | 4 | 15'/10' | Fair | |
| | Formosan Koa Monkeypod | Acacia confusa | Mauka | 4 | 35'/20' | Good | |
| | | Samanea saman | Mauka | 9 | 50'/40' | Notable | |
| | Coconut | Cocos nucifera | Makai side | 4 | 50'/40' | Notable | |
| | | | Median | 6 | 35' | Good | |
| TUNNEL | SEGMENT To | KAWAIAHAIO ST | | | | | |
| KAWAIAHAIO ST: | | | | | | | |
| South St to Kamakee St | Monkeypod | Samanea saman | Makai side | 2 | 40'/40' | Notable | The proposed route then passes from the Kawaiahaio St/ Kamakee St intersection through an area of light industrial Warehouses, open paved areas, etc. and the route apparently crosses Waimanu St. through the building behind GASCO where it joins Kona St.. |
| | | | Mauka | 2 | 40'/40' | Notable | |
| | Yellow Poinciana | Peltophorum pterocarpum | Makai side | 1 | 60'/50' | Notable | |
| | Kou | Cordia subcordata | Mauka | 1 | 25'/20' | Good | |
| Kamakee St to Kona St | | | | | | | |

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**Honolulu High Capacity Transit Corridor
Preliminary Tree Survey**

Section: 5 Route Location: **Hotel St – Kawaiahaio St – Kapiolani Blvd (Cont.)** Route Color: **Green**

| STREET | COMMON NAME | BOTANICAL NAME | LOCATION (on street) | QUANTITY | HEIGHT/SPREAD | TREE CLASS. | COMMENTS: |
|--|-------------|--------------------------|----------------------|----------|---------------|-------------|--|
| KONA ST: | | | | | | | |
| Pensacola St to Kapiolani Blvd | Monkeypod | Samanea saman | Median | 10 | 40'/40' | Notable | Mature, large crowned trees. |
| | | | Mauka | 2 | 40'/40' | Notable | |
| | Pink Tacoma | Tabebuia heterophylla | Mauka | 2 | 20'/10' | Good | |
| | Coconut | Cocos nucifera | Makai side | 16 | 20' - 30' | Good | |
| KAPIOLANI BLVD | | | | | | | |
| Atkinson Dr to University Ave | Monkeypod | Samanea saman | Mauka | 15 | 40'/40' | Notable | Mature, large crowned trees. |
| | | | Makai side | 5 | 40'/40' | Notable | |
| | | | Median | 15 | 40'/40' | Notable | |
| | Satinleaf | Chrysophyllum oliviforme | Mauka | 6 | 30'/15' | Good | |
| | | | Makai side | 5 | 30'/15' | Good | |
| | Fiddlewood | Citharexylum spinosum | Makai | 5 | 30'/20' | Good | |
| UNIVERSITY AVE | | | | | | | |
| Kapiolani Blvd to H-1 Overpass | Shower | Cassia sp. | Median | 27 | 15-20'/15' | Good | Newly planted. Old, mature planting. Old, mature planting. |
| | Alibangbang | Bauhinia hookeri | Ewa | 10 | 20'/15' | Fair | |
| | | | Diam. Hd. | 15 | 20'/15' | Fair | |
| | Podocarpus | Podocarpus sp. | Diam. Hd. | 3 | 15'/10' | Good | |

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Honolulu High Capacity Transit Corridor Preliminary Tree Survey

Section: 5 Route Location: Nimitz Hwy – Queen St – Kapiolani Blvd Route Color: Orange

| STREET | COMMON NAME | BOTANICAL NAME | LOCATION (on street) | QUANTITY | HEIGHT/SPREAD | TREE CLASS. | COMMENTS: |
|-------------------------------------|-------------|-----------------------|----------------------|----------|---------------|-------------|---|
| <u>NIMITZ HWY:</u> | | | | | | | |
| Nuuanu Stream | | | | | | | |
| to | Fiddlewood | Citharexylum spinosum | Mauka | 1 | 35'/20' | Fair | |
| | Coconut | Cocos nucifera | Median | 1 | 35' | Fair | |
| | Monkeypod | Samanea saman | Mauka | 3 | 50'/40' | Notable | In the triangle park near Amfac Tower. |
| Queen St | Banyan | Ficus | Mauka | 4 | 50'/40' | Notable | In the triangle park near Amfac Tower. |
| <u>QUEEN ST:</u> | | | | | | | |
| Nimitz Hwy | | | | | | | |
| to | Monkeypod | Samanea saman | Makai side | 1 | 60'/60' | Notable | Fronting State Tax Office. |
| | Pink Tecoma | Tabebuia heterophylla | Mauka | 6 | 15'/10' | Good | |
| | Coconut | Cocos nucifera | Makai side | 15 | 50' | Good | Along Amfac Building. |
| | Shower | Cassia sp. | Mauka | 10 | 15'/10' | Good | New planting on new section of Queen St. |
| | | | Makai side | 16 | 15'/10' | Good | New planting on new section of Queen St. |
| Kamakee St | | | Median | 3 | 15'/10' | Good | New planting on new section of Queen St. |
| End of Queen St to Kona St Junction | | | | | | | From the intersection of Queen St. and Kamakee St. to the point where the proposed route joins Kona St. is an area of light industrial warehouses, open paved areas, etc. and the route apparently crosses Waimanu St. through the building behind GASCO. |
| <u>KONA ST:</u> | | | | | | | |
| Pensacola St | | | | | | | |
| to | Monkeypod | Samanea saman | Median | 10 | 40'/40' | Notable | Mature, large crowned trees. |
| | Pink Tecoma | Tabebuia heterophylla | Mauka | 2 | 40'/40' | Notable | Mature, large crowned trees. |
| | Coconut | Cocos nucifera | Mauka | 2 | 20'/10' | Good | |
| Kapiolani Blvd | | | Makai side | 16 | 20' - 30' | Good | |

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Honolulu High Capacity Transit Corridor Preliminary Tree Survey

Section: 5 Route Location: Nimitz Hwy – Queen St – Kapiolani Blvd (Cont.) Route Color: Orange

| STREET | COMMON NAME | BOTANICAL NAME | LOCATION (on street) | QUANTITY | HEIGHT/SPREAD | TREE CLASS. | COMMENTS: |
|-------------------------------|-------------|--------------------------|----------------------|----------|---------------|-------------|------------------------------|
| <u>KAPIOLANI BLVD:</u> | | | | | | | |
| Atkinson Dr | | | | | | | |
| To | Monkeypod | Samanea saman | Mauka | 15 | 40'/40' | Notable | Mature, large crowned trees. |
| | | | Makai side | 5 | 40'/40' | Notable | Mature, large crowned trees. |
| | Satinleaf | Chrysophyllum oliviforme | Median | 15 | 40'/40' | Notable | Mature, large crowned trees. |
| | | | Mauka | 6 | 30'/15' | Good | |
| | Fiddlewood | Citharexylum spinosum | Makai side | 5 | 30'/15' | Good | |
| University Ave | | | Makai | 5 | 30'/20' | Good | |
| <u>UNIVERSITY AVE</u> | | | | | | | |
| Kapiolani Blvd | | | | | | | |
| to | Shower | Cassia sp. | Median | 27 | 15-20'/15' | Good | Newly planted. |
| | Alibangbang | Bauhinia hookeri | Ewa | 10 | 20'/15' | Fair | Old, mature planting. |
| | | | Diam. Hd. | 15 | 20'/15' | Fair | Old, mature planting. |
| H-1 Overpass | Podocarpus | Podocarpus sp. | Diam. Hd. | 3 | 15'/10' | Good | |

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23

Honolulu High Capacity Transit Corridor Preliminary Tree Survey

Section: 5 Route Location: Nimitz Hwy – Halekauwila St – Kapiolani Blvd Route Color: Purple

| STREET | COMMON NAME | BOTANICAL NAME | LOCATION (on street) | QUANTITY | HEIGHT/SPREAD | TREE CLASS. | COMMENTS: |
|---|--|---|--|--------------------|--|------------------------------------|--|
| <u>NIMITZ HWY:</u> Nuuanu Stream to Richards St | Fiddlewood Coconut Monkeypod Banyan | Citharexylum spinosum Cocos nucifera Samanea saman Ficus sp. | Mauka Median Mauka Mauka | 1 1 3 4 | 35'/20' 35' 50'/40' 50'/40' | Fair Fair Notable Notable | In the triangle park near Amfac Tower. In the triangle park near Amfac Tower. |
| <u>HALEKAUWILA ST:</u> Richards St to Ward Ave End of Halekauwila St to Queen St | Monkeypod Shower | Samanea saman Cassia sp. | Mauka Makai side Mauka | 10 4 2 | 40'/30' 40'/30' 30'/15' | Notable Notable Good | Halekauwila St. ends at Ward Ave. The proposed route then passes through Sports Authority store and on to Queen St. near Cummins St. |
| Queen St to Kona St | | | | | | | The proposed route moves along Queen St. until it intersects Kamakee St. then passes through is an area of light industrial warehouses, open paved areas, etc. and the route apparently crosses Waimanu St. through the building behind GASCO. |
| <u>KONA ST:</u> Pensacola St to Kapiolani Blvd | Monkeypod Pink Tecoma Coconut | Samanea saman Tabebuia heterophylla Cocos nucifera | Median Mauka Mauka Makai side | 10 2 2 16 | 40'/40' 40'/40' 20'/10' 20' - 30' | Notable Notable Good Good | Mature, large crowned trees. Mature, large crowned trees. |

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24

Honolulu High Capacity Transit Corridor Preliminary Tree Survey

Section: 5 Route Location: Nimitz Hwy – Halekauwila St – Kapiolani Blvd (Cont.) Route Color: Purple

| STREET | COMMON NAME | BOTANICAL NAME | LOCATION (on street) | QUANTITY | HEIGHT/SPREAD | TREE CLASS. | COMMENTS: |
|--|--------------------------------------|--|---|------------------------------|--|---|--|
| <u>KAPIOLANI BLVD:</u> Atkinson Dr To University Ave | Monkeypod Satinleaf Fiddlewood | Samanea saman Chrysophyllum oliviforme Citharexylum spinosum | Mauka Makai side Median Mauka Makai side Makai | 15 5 15 6 5 5 | 40'/40' 40'/40' 40'/40' 30'/15' 30'/15' 30'/20' | Notable Notable Notable Good Good Good | Mature, large crowned trees. Mature, large crowned trees. Mature, large crowned trees. |
| <u>UNIVERSITY AVE</u> Kapiolani Blvd to H-1 Overpass | Shower Alibangbang Podocarpus | Cassia sp. Bauhinia hookeri Podocarpus sp. | Median Ewa Diam. Hd. Diam. Hd. | 27 10 15 3 | 15-20'/15' 20'/15' 20'/15' 15'/10' | Good Fair Fair Good | Newly planted. Old, mature planting. Old, mature planting. |

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25

**Honolulu High Capacity Transit Corridor
Preliminary Tree Survey**

Section: 5 Route Location: **Waikiki Spur** Route Color: **Red**

| STREET | COMMON NAME | BOTANICAL NAME | LOCATION (on street) | QUANTITY | HEIGHT/SPREAD | TREE CLASS. | COMMENTS: |
|---|--------------------------------|---|--|----------------------------------|---|--|--|
| KALAKAUA AVE: Kapiolani Blvd to Kuhio Ave | Mahogany Shower | Swietenia mahagoni Cassia sp. | Median Makai side Mauka | 10 10 30 | 50'/40' 25'/10' 25'/10' | See Note F - G F - G | Note: These trees are on the Exceptional Tree List. They have large crowns that are heavy over the Ewa side of Kalakaua Ave. |
| KUHIO AVE: Kalakaua Ave to Kapahulu Ave | Monkeypod Coconut Shower | Samanea saman Cocos nucifera Cassia sp. | Median Makai side Mauka Median Makai side Mauka | 9 108 41 13 70 70 | 30'/30' 20' - 35' 20' - 35' All 15'-30'/ 20' | Good Good Good Good Good Good | Kalakaua Ave. to Olohana and Liliuokalani St. to Kapahulu Ave. Newly planted. Newly widened sidewalks. Newly planted. Newly widened sidewalks. Newly planted. Newly widened sidewalks. Major street improvements by the City have made Kuhio Ave. much narrower than before. |

Appendix C Field Survey Results Description

Wildlife Survey

The following is a description of the wildlife noted along each alignment or area under consideration. The number of bird species sighted during the survey is provided to characterize wildlife diversity and abundance. However, unless otherwise noted, most species sighted are urban, introduced, and/or common species. A notable exception is in the Iwilei to UH-Mānoa section where white terns were observed. The locations where other protected species may occur, but were not observed, are noted in the descriptions below.

Field observations of wildlife along the Alternative 3 and 4 alignments within the project area were conducted primarily in the morning around 07:00 to 11:00 hours on February 19 through 21, 2006, and in the afternoon between 14:45 and 15:45 hours on February 21, 2006. Daytime field observations were made on May 19, 2006, at the 22 proposed sites for Alternative 4 maintenance facilities, park-and-rides, and transit centers.

Alternative 3: Managed Lane Alternative

The Managed Lane Alternative would travel primarily above existing highways, with heavy traffic and urbanization, and little to no sensitive habitat. Eleven bird species were present along the Managed Lane Alternative and all were common to the highly urbanized environment of Honolulu (Table 4-1). No white terns were observed along the Managed Lane alignment although some were observed along nearby Alternative 4 alignments. There were no other sensitive species present during the field survey.

Alternative 4: Fixed Guideway Alternative, Section I: Kapolei to Fort Weaver Road

Kamokila Boulevard/Farrington Highway

The alignment passes through open grass/koa haole scrub fields, cultivated croplands, roadside ruderal vegetation, and urbanized business and residential areas. Man-made water impoundments at golf courses were present in the vicinity. A total of 19 species of birds were observed along the alignment. Black francolins (*Francolinus francolinus*), gray francolins (*Francolinus pondicerianus*) and the ring-necked pheasant (*Phasianus colchicus*) were seen in this segment at count stations near cropland and open grass/haole koa scrub fields. Lesser Pacific golden plovers (*Pluvialis dominca*) were present on lawns of parks and residences.

Kapolei Parkway/North-South Road

This alignment is similar to the previous segment, however it does not pass through the urbanized business section along Kamokila Boulevard. There were 21 species of birds along this alignment. North-South Road runs through cropland, and the same game birds were seen here as noted above.

Saratoga Avenue/North-South Road

Saratoga Avenue is within the old Barbers Point Naval Air Station and runs through extant naval personnel housing. The prominent vegetation along this alignment is

primarily kiawe forest. A total of 19 species of birds occurred within this segment, which also includes North-South Road and adjoining cropland. Species typical of kiawe forests include spotted doves, zebra doves, Japanese white-eyes, and red-crested cardinals (*Paroaria coronata*). Flocks of common waxbills (*Estrilda troglodytes*) and chestnut mannikins (*Lonchura punctulata*) were present along the old railroad corridor, which contributed to the highest average number of birds per station. During the evening observations, a common barn owl was seen at the west end of Saratoga Avenue.

Geiger Road/Fort Weaver Road

Fort Weaver Road is highly developed. Residences line the road and there are some commercial areas. Monkeypod trees occur within urbanized sections of the segment. Kiawe trees are prominent along the Geiger Road section before entering the former Barbers Point Naval Air Station (Kalaeloa). This alignment also includes the same portion of Saratoga Avenue that was discussed in the previous segment. A total of 19 species of birds were recorded during the bird counts.

Alternative 4, Section II: Fort Weaver Road to Aloha Stadium

A total of 11 bird species was observed at seven count stations within this segment of Farrington and Kamehameha Highways. The alignment passes through Waipahu, Pearl City, Waiawa, and Waimalu, and ends at Aloha Stadium. Terrestrial wildlife habitat is typically urban. The alignment, however, does pass by Pearl Harbor Park, 'Aiea State Recreation Area, and Sumida Watercress Farm. Endangered waterbirds have been documented at this farm, but none were observed during this field survey. Water from springs feeding the watercress farm flows under Kamehameha Highway; suitable waterbird habitat exists along its course, but no waterbirds were seen.

Alternative 4, Section III: Aloha Stadium to Middle Street

Salt Lake Boulevard

Most of the alignment passes through residential areas. All species seen during counts along this alignment were associated with urbanized habitats, with a total of 11 species identified.

Makai of the Airport Viaduct

A total of 10 species was seen at stations occurring along this alignment. The makai side of the airport viaduct is virtually without vegetation. Some plantings occur as roadside landscape. Urban birds such as spotted doves, zebra doves, common myna, and English sparrows occur. The exception to this lack of vegetation is Veterans Memorial Park, which provides trees and water.

The Nimitz Highway median provides nesting and roosting habitat for feral pigeons (*Columba livia*) under the viaduct. Otherwise there were no other suitable habitat features for most other species.

Mauka of the Airport Viaduct

The mauka side of the viaduct is residential and the alignment also runs along a military golf course. Ten species were recorded, similar to those in other alignments within this section.

Aolele Street

Aolele Street runs between Honolulu International Airport (HNL) and the commercial area north of the airport. A drainage canal runs along Aolele Street, which provides water and creates a more suitable wildlife habitat than other segments in this section. Black-crowned night herons have been seen in this drainage canal, but none were present during the field investigation. Ten species were recorded along Aolele Street, with most occurring in the Post Office parking lot where they were being fed.

Alternative 4, Section IV: Middle Street to Iwilei

North King Street

Eight species occurred along this highly urbanized alignment. Kapālama Canal crosses this alignment, but it is highly modified and provides little or no suitable waterbird habitat that could be used for cover, nesting, or feeding.

Dillingham Boulevard

Dillingham Boulevard also crosses Kapālama Canal, and although people were seen crabbing in the canal, no suitable waterbird habitat lies within this segment. Eight species were recorded from the three count stations. The alignment runs through a busy commercial area where there is little habitat that would attract any but the most common introduced urban birds.

Alternative 4, Section V: Iwilei to UH Mānoa

Hotel Street/Kawaiaha'ō Street/Kapi'olani Boulevard

Nine species were recorded from eight stations. This section had three birds per count station, which was the lowest recorded during this field investigation. The low numbers may be due to high pedestrian traffic and the late morning period when most of these stations were counted. The alignment runs through heavily urbanized commercial areas of Honolulu. White terns have been reported in this area, although none were observed during the survey.

Hotel Street/Waimanu Street/Kapi'olani Boulevard

Eleven species were recorded from eight count stations along this urbanized segment. Four white terns were also recorded flying overhead. Large mature street trees were present providing nesting and roosting habitat for the terns.

Nimitz Highway/Queen Street/Kapi‘olani Boulevard

Ten species were recorded in this segment, all of which were typical of urban environments in Honolulu. Four white terns were recorded within this segment.

Nimitz Highway/Halekauwila Street/Kapi‘olani Boulevard

Eleven species were recorded along this alignment, all of which were typical of urban environments in Honolulu. Four white terns were observed along this alignment.

Beretania Street/South King Street

Although no white terns were observed during this survey, the segment is noted for having large trees that are suitable for white tern nesting (Vanderwerf, 2003). Ten species were recorded during the field counts.

Waikīkī Spur

This alignment runs along Kūhiō Avenue and ends at Kapahulu Avenue. Mature street trees were present and three white terns were seen flying over the busy street. A brown duck, which was probably an introduced feral mallard, was seen at a distance landing in the Ala Wai Canal, but no positive identification could be made. The Ala Wai Canal does not support native water birds.

Maintenance Facilities, Park-and-Ride Lots, and Transit Centers

Botanist Maya LeGrande made the following daytime field observations on May 19, 2006, at the 21 proposed sites for maintenance facilities, park-and-ride lots, and transit centers. Results of these site observations were similar to those found during the February 19-21, 2006, surveys. Locations of these facilities are shown in Figure 3.1. These sites would be developed only as parts of the Fixed Guideway Alternative (Alternative 4).

Section I: Kapolei/‘Ewa

Kapolei Parkway and Hanua Street Park-and-Ride Lot

The site for the proposed park-and-ride lot is a level open grassland/haole koa scrub field with ruderal vegetation dominated by buffleggrass, haole koa, and ‘ilima shrubs. Nineteen species of birds were observed along this segment of the alignment. A ring-necked pheasant was heard during the morning survey on February 19, 2006. Flocks of chestnut mannikins flew through the area during the dawn survey period from roost trees in more urbanized areas of Kamokila Boulevard. Seven common, introduced bird species were encountered at this particular site. In addition, a flock of 23 migratory ruddy turnstones were observed passing through the site.

Kapolei Parkway and Wākea Street Transit Center

The Kapolei Parkway and Wākea Street Transit Center site was similar to the previous site with more developed shrubs such as haole koa, castor beans, and kiawe trees. Nineteen species of birds were observed along this segment of the alignment. House

finches and common myna were observed on May 19, 2006. Species such as spotted doves, zebra doves, red-vented bulbuls, Japanese white eyes, northern mockingbird, red-crested cardinals, chestnut manikins, and the Pacific golden plover were also encountered on survey stations near the site in February 2006.

Saratoga Avenue and North-South Road Park-and-Ride Lot

The Saratoga Avenue and North-South Road park-and-ride lot is a baseball field with kiawe forests in the vicinity. Only one common myna was observed on May 19, 2006, at this site, but species typical of kiawe forests and open grasslands would be present. Species at this site would be the same as those encountered at the previous site. In addition, gray francolins were seen at a nearby survey station in February 2006.

Kalaeloa Maintenance Facility

This site is very similar to the Saratoga Avenue and North-South Road park-and-ride lot site, having a kiawe forest and buffleggrass understory. Species commonly associated with kiawe forests would occur at this site. On May 19, 2006, northern cardinals, common mynas, and house finches were observed.

Farrington Highway and UH West O'ahu Park-and-Ride Lot

The site is a cement baseyard with street trees along Farrington Highway. No birds were seen on May 19, 2006; however, in February 2006, seven species of common introduced birds were encountered at a survey station, which sampled the cropland and ruderal vegetation south of the site, directly across Farrington Highway from this site.

North-South Road and Farrington Highway Park-and-Ride Lot

The site is under cultivation with corn crops and fallow fields as well as ruderal areas with haole koa and buffleggrass. On May 19, 2006, zebra doves, common myna, and cattle egrets were present. In February 2006, at nearby survey stations, nine common introduced species were present.

Farrington Highway Maintenance Facility

This site is also under cultivation. During observations on May 19, 2006, the fields were fallow. Guinea grass, buffleggrass, and bulgar were present in the fields. A cattle egret and zebra doves were present. In February 2006, nine common introduced species were present at nearby survey stations.

Farrington Highway and Kunia Road Maintenance Facility

The proposed site is under cultivation with corn crops, fallow fields, and ruderal vegetation of Guinea grass and haole koa. Zebra doves and common myna were the only birds observed on May 19, 2006.

Fort Weaver Road and Renton Road Park-and-Ride Lot

This site was characterized as disturbed grassland dominated by buffleggrass with haole koa and tree tobacco. On May 19, 2006, zebra doves and common myna were observed.

In February 2006, 11 common introduced bird species and Pacific golden plovers were observed at nearby survey stations.

Section 2: Waipahu/Pearl City/'Aiea

Farrington Highway and Leokū Street Park-and-Ride Lot

The site is characterized as industrial/commercial along the busy Farrington Highway corridor. No vegetation was recorded. No birds were observed on May 19, 2006. Eight common introduced species were observed from a nearby survey station in February 2006.

Waiawa Maintenance Facility

The proposed site for the Waiawa Maintenance Facility is disturbed haole koa scrub with Guinea grass, Java plum, monkeypod, antigonon, and pluchea. On May 19, 2006, house finches and common myna were observed. During the February 2006 survey, eight common introduced species such as the feral pigeon, zebra dove, spotted dove, red-vented bulbul, common waxbill, and Java sparrows were also seen.

Kamehameha Highway and Kuala Street Park-and-Ride Lot (Waiawa)

The site is near Waiawa Stream and is characterized as disturbed haole koa scrub with Guinea grass, California grass, Java plum, and macarnaga. Spotted doves, red-vented bulbuls, Japanese white-eyes, common myna, and common waxbills were present at the site during the February 2006 survey.

Kamehameha Highway and Kaonohi Street Transit Center

The transit center site is a parking lot in a commercial/industrial area. Street trees such as hibiscus and tecoma were present. Birds common to this site are common urban species. Cattle egret, English sparrow, zebra dove, spotted dove, red-vented bulbul, and Japanese white-eyes were encountered at nearby survey stations in February 2006.

Section 3: Pearl Harbor/Salt Lake/Airport

Aloha Stadium Park-and-Ride Lot

The Aloha Stadium park-and-ride lot site serves as an overflow paved parking area and mowed grass borders for Aloha Stadium. On May 19, 2006, only two zebra doves were observed. Spotted doves, English sparrows, Java sparrows, and red-crested cardinals were also recorded on the site in the February 2006 survey.

Salt Lake Boulevard and Kahuapa 'ani Street Park-and-Ride

This site is a paved parking area for Aloha Stadium. Vegetation consists of street tree plantings. No birds were seen on May 19, 2006. The site is similar to the Aloha Stadium park-and-ride lot site having common introduced urban birds.

Section 4: Iwilei/Kalihi

Fort Shafter Maintenance Facility

The site is characterized as urban/industrial and is currently a parking lot. There were street tree plantings and mangrove along the canal. Cattle egrets were observed on May 19, 2006. Other common introduced urban birds would also occur at this site.

Dillingham Boulevard and Middle Street Park-and-Ride Lot

The Dillingham Boulevard and Middle Street park-and-ride lot site is characterized as industrial. Common introduced urban birds were present at nearby survey stations. No birds were seen on May 19, 2006.

Middle Street Transit Center

This site is similar to the proposed Dillingham Boulevard and Middle Street park-and-ride lot site, having common introduced urban birds such as zebra doves, spotted doves, red-vented bulbuls, Japanese white-eyes, common myna, and English sparrows. These birds were observed at nearby survey stations in February 2006. Zebra doves were observed on May 19, 2006.

Ka'aahi Street Transit Center

Land use at the Ka'aahi Street transit center site is commercial/industrial. No birds were seen on May 19, 2006, but at nearby survey stations, common introduced species (listed above for Middle Street Transit Center) were present in February 2006.

Section 5: Downtown/Ala Moana/UH Mānoa

Beretania Street and Alapa'i Street Transit Center

The Beretania Street and Alapa'i Street transit center is an existing bus transit center. Common myna and zebra doves were present at the site on May 19, 2006. The site would also have common introduced urban species such as spotted doves, English sparrows, red-vented bulbuls, and Japanese white-eyes.

Convention Center Transit Center

This proposed site near the Convention Center has commercial land uses with street trees, such as monkeypod and other shade tree species. White terns were observed at nearby survey stations in February 2006 and may use large trees to roost and nest. In addition, common introduced urban birds such as zebra doves, spotted doves, common myna, Japanese white-eyes, house finches, red-vented bulbuls, and English sparrows would use the site. No birds were observed on May 19, 2006.

Street Tree Survey

The following is a description of street trees noted along each alignment or area under consideration.

Section I: Kapolei to Fort Weaver Road

The Kapolei and 'Ewa regions are in the process of converting from open space and farmland to urban land uses. As a result, several areas are still undeveloped and are predominantly open and unmaintained trees, mostly Kiawe. Areas where streets have been developed have the types of plantings described below.

The Kapolei Parkway extension on the west end and Kamokila Boulevard has monkeypods, Indian coral, shower, and Kamani trees, which range in condition from poor to good. The Indian coral trees were in poor condition due to gall wasp infestation. In the built section of Kapolei Parkway between Fort Barrette Road and the eastern end of the road, just past Kapolei Middle School, there are seven monkeypods in fair condition.

In the makai portion of Kapolei and into Kalaeloa where no roads currently exist, trees in open scrub and abandoned subdivision areas included kiawe, monkeypod, and banyan. On the Koko Head side, along Geiger Road, there are about a dozen fern trees in fair condition.

In the mauka portion of the 'Ewa area, the undeveloped portion of Farrington Highway between North-South Road and Fort Weaver Road has only a limited number of kiawe trees owing to the use of surrounding land for farming.

In contrast, Fort Weaver Road has almost 300 street trees, including one notable banyan near Old Fort Weaver Road. A row of monkeypods on the Koko Head side is in good condition, and most other plantings are in fair condition. The other tree types on the median of Fort Weaver Road are newly planted false kou, buttonwood, Manila palm, and gold tree.

Section II: Fort Weaver Road to Aloha Stadium

Kamehameha Highway, from Fort Weaver Road to the Waiawa Interchange, has about 230 plantings, all in good condition. The median contains shower trees, loulou (fan) palms, and kou trees that are newly planted and contribute to the beautification of the community.

From the Waiawa Interchange to the vicinity of Aloha Stadium (beginning of Salt Lake Boulevard), Kamehameha Highway is characterized by monkeypod, mango, fiddleleaf, kiawe, and opiuma trees. All trees appear to be in good condition.

Section III: Aloha Stadium to Middle Street

In the mauka area, along Salt Lake Boulevard, street tree species include silver trumpet, monkeypod, banyan, kiawe, Indian coral, pink tecoma, African tulip, and yellow poinciana. Most of these trees are in fair to good condition. Part of the Moanalua Stream bank, before it empties into Ke'ehi Lagoon, also was surveyed. It is an undeveloped area with mangrove, ironwood, and kiawe growths.

Further makai, in the stretch of Kamehameha Highway from Aloha Stadium to the merge with Nimitz Highway, there are fan palms, shower trees, opiuma, banyan, and monkeypods ranging from fair to good condition, mostly near the Arizona Memorial.

As Kamehameha Highway merges onto Nimitz Highway, the Navy Marine Golf Course is on the mauka side of Nimitz Highway. A group of gold trees in the median around this area was recently recommended as Exceptional Trees.

The mauka side of Nimitz Highway, to the Middle Street area, is characterized by queen palms, African tulips, opiuma, brassia, and banyan. A total of 83 trees were observed, all in good condition.

The makai side of Nimitz Highway has considerably fewer trees than the mauka side, but similar tree species. All trees on the makai side were in good condition.

Further makai on Aolele Street, about 138 trees varying in condition from poor to good line Aolele Street. Species observed included banyan, coconut, Hong Kong orchid, fiddleleaf fig, shower, and Indian coral. The Indian coral trees were suffering from gall wasp infestation and were in fair to poor condition.

Section IV: Middle Street to Iwilei

Nimitz Highway, from Middle Street to River Street, had almost 250 street trees. Five notable monkeypods were at the Sand Island Access Road intersection, plus two other notable monkeypods and three notable banyans in the median closer to River Street.

Middle Street, between Dillingham Boulevard and North King Street, is lined with 15 young fiddlewood trees in good condition. North King Street, between Middle Street and River Street, is also predominantly lined with 68 young fiddlewoods. In addition, there is a notable monkeypod tree near First Hawaiian Bank and a notable royal poinciana tree near Ka‘iulani Elementary School.

Dillingham Boulevard has 52 mostly notable trees that consist primarily of kamani trees, but also includes a notable monkeypod and a banyan.

Section V: Iwilei to UH Mānoa

A small short segment of Nimitz Highway covered in this section had three notable monkeypods and four notable banyans, among other trees.

The Beretania Street corridor is lined with a combination of shower, milo, coconut, monkeypod, earpod, and Banyan trees. Several of these trees are notable or in good condition.

On Hotel Street, the roadway is lined mostly with fiddlewood, as well as tulipwood, Formosan koa, and coconut. Two areas have several notable monkeypods, but most of these appear to be set back from the street.

Queen Street and Halekauwila Street are characterized by monkeypods, tecoma, coconut, and shower trees. One notable monkeypod is in front of the State Department of Taxation Building on Queen Street, and 14 notable monkeypods front government

buildings on Halekauwila Street. Kawaiaha‘o Street contained four notable monkeypods and one notable yellow poinciana tree. Waimanu Street in the mauka part of Kaka‘ako had only one tree, but it was a notable monkeypod at the corner of Ward Avenue. Notable monkeypod trees line Kona Street, on the edge of Ala Moana Center. In addition, there are pink tecoma trees and coconut palms in good condition on this street.

Kapi‘olani Boulevard from Atkinson Drive to University Avenue has several large, notable monkeypods, on both sides of the street and in the median. There are also some satinleaf and fiddlewood trees in good condition.

University Avenue has a combination of shower trees, alibangbang, and podocarpus trees. The alibangbang are unusual plantings, but are in fair condition only. The shower trees are newly planted in the median and are in good condition.

Waikiki

On Kalākaua Avenue, ten mahogany trees in the median are on the Exceptional Tree list. Several shower trees are also within this alignment section. About 50 trees were observed in the stretch of Kalākaua Avenue from Kapi‘olani Boulevard to Kūhiō Avenue.

On Kūhiō Avenue, there are more than 300 trees, all of which are in good condition. Several of the 300 are shower trees that are newly planted by the City. Other tree types on Kūhiō Avenue included monkeypod and coconut.