ASSESSMENT OF

BOTANICAL RESOURCES

of the Turbine Areas

Kaheawa Pastures Wind Energy Project

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Pacific Analytics, L.L.C.

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Prepared for

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ASSESSMENT OF BOTANICAL RESOURCES

of the Turbine Areas

Kaheawa Pastures Wind Energy Project

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II. EXECUTIVE SUMMARY

Kaheawa Wind Power, LLC is developing the island of Maui's first commercial wind energy generation facility. The Hawai'i State Board of Land and Natural Resources approved a Conservation District Use Application for the proposed facility, situated on State conservation lands on West Maui in an area near Ukumehame Gulch locally referred to as Kaheawa Pastures.

The project access road and turbine sites are located in an area of predominantly non-native dry grasslands that have been grazed for many years. Despite the grazing, there are some areas where Hawaiian native plants are abundant and comprise a large portion of the flora.

In compliance with permit conditions, additional botanical surveys are being conducted to evaluate the status of Hawaiian native plants that would be disturbed during on-site construction and installation of the roads and turbines. This assessment is one of those surveys.

The purpose of this assessment is to evaluate the botanical resources in the planned Turbine Areas and along the String Road that will be disturbed by on-site construction and installation of the KWP project. The assessment will be used to guide mitigation measures and habitat restoration activities that will be implemented as part of the Habitat Conservation Plan and in compliance with the permit conditions that require removing, relocating, and replanting Hawaiian native plants that would be disturbed by the project.

This report includes a description of the KWP project site, clearly defined objectives, a description of the methods used to survey the KWP project site, and the results of the survey. With the results are recommendations about how many plants of each Hawaiian native species should be salvaged before the Turbine Areas are developed. The results also include a list of Hawaiian native plant species for each of the Turbine Areas surveyed.

III. INTRODUCTION

Kaheawa Wind Power, LLC is developing the island of Maui's first commercial wind energy generation facility. The Kaheawa Wind Power (KWP) project will consist of 20 GE Wind Energy 1.5 MW 60 Hertz wind turbine generators and related equipment. The Hawai'i State Board of Land and Natural Resources approved a Conservation District Use Application for the proposed facility, situated on State conservation lands on West Maui in an area near Ukumehame Gulch locally referred to as Kaheawa Pastures. The KWP project site is particularly suitable for wind farm development, having a Class 1 diurnal wind regime, which is driven largely by prevailing trade winds and daily temperature inversions on Maui.

The project access road and turbine sites are located in an area of predominantly non-native dry grasslands that have been grazed for many years. Despite the grazing, there are some areas where Hawaiian native plants are abundant and comprise a large portion of the flora. Four botanical surveys (Medeiros 1996,

1999, Hobdy 2004a, 2004b) that were conducted for the project during the permitting process reported no federally endangered or threatened plant species; however, some native plants that occur in construction areas are important components of the native flora and thus worthy of protection.

In compliance with permit conditions, additional botanical surveys are being conducted to evaluate the status of Hawaiian native plants that would be disturbed during on-site construction and installation of the roads and turbines. This assessment is one of those surveys.

***'A'ali'i* is abundant on some of the Turbine areas and occurs on all the main islands throughout the state.**

The previous botanical surveys have found that native plant species occur throughout the KWP project site. Some species are abundant within the KWP project site, while others are less common. In the context of adjacent ridges and other locations on Maui and throughout the state, none of the plant species have distributions limited to the project site, and are thus not considered rare, threatened, or endangered.

Native plants have important ecological and cultural significance, and efforts are being made to protect native species and mitigate for impacts on native natural resources.

Kaheawa Wind Power, LLC has proposed to protect native plants and enhance their habitats on the KWP site to mitigate potential disturbance by on-site construction, installation, and operation of the wind farm. To that end they have prepared a protocol for removing, relocating, and replanting Hawaiian native plants. The goal is to avoid damaging native plants, relocating those individuals that would be disturbed by on-site construction and operation, and reintroducing appropriate native plants species to the KWP project site.

The purpose of this assessment is to evaluate the botanical resources in the planned Turbine Areas and along the String Road that will be disturbed by on-site construction and installation of the KWP project. The assessment will be used to guide mitigation measures and habitat restoration activities that

will be implemented as part of the Habitat Conservation Plan and in compliance with the permit conditions that require removing, relocating, and replanting Hawaiian native plants that would be disturbed by the project.

'Ilima **(Sida fallax) is common in many of the Turbine areas.**

IV. SITE DESCRIPTION

The Kaheawa Pastures Wind Energy Project is located along a ridge of the West Maui Mountains, at the southern tip of West Maui. The West Maui Mountains are volcanic in origin. The most common geologic formation in West Maui is basaltic ʻaʻā and pāhoehoe lava flows of the Wailuku Volcanic Series with selected cinder cones, friable vitric tuff and weathered andesitic lava.

There are two main soil associations in the Kaheawa Pastures region: Honolua-Olelo and Rock land-Rough mountainous land (USDA 1972). The Honolua-Olelo association is defined as deep, gently sloping to moderately steep and well-drained soils with fine textured subsoil that is typically situated on intermediate uplands, such as on West Maui. The predominant vegetation in this association includes guava (Psidium sp.), Hilo grass (Paspalum conjugatum), *koa* (Acacia koa), lantana (Lantana camara), *ʻohiʻa lehua* (Metrosideros polymorpha), *pukiawe* (Styphelia tameiameiae), and ferns.

The Rock land-Rough mountainous land soil association is defined as very shallow, steep and very steep, rock land and rough mountain land. The predominant vegetation on Rock land is *kiawe* (Prosopis pallida), *klu* (Acacia farnesiana), *pili* grass (Heteropogon contortus) and *ʻilima* (Sida fallax) in the lower, drier areas, and guava, *pukiawe* and molasses grass (Melinus minutiflora) in the higher, wetter areas. Rough mountainous land is thickly vegetated with ferns, guava, Hilo grass, *kukui* (Aleurites moluccana) and *ʻohiʻa lehua*.

Weathered rock outcroppings near Turbine Area 20.

Average annual rainfall in West Maui varies from 20 inches at the coast to 400 inches in the higher elevations (WSB-Hawaiʻi 1999). The annual rainfall on the proposed wind energy generation facility site is estimated to be between 50 inches at 2,000 ft elevation and 80 inches at 3,200 ft elevation.

A general botanical survey over the entire project area was conducted prior

to installation of the six meteorological monitoring stations (Medeiros 1996). The vegetation on the proposed site was found to be a mixed grassland/shrubland type dominated by non-native plants.

Native vegetation occurs within the predominantly non-native pasture.

According to Medeiros (1996), the site vegetation is predominately composed of nonnative species, mostly pasture grasses and cattle-resistant shrubs. No plant species listed as threatened or endangered by the USFWS or the State of Hawai'i were encountered at or near any of the six meteorological station sites. The meteorological stations at the four uppermost elevation sites were dominated by non-native pasture species, especially grasses such as rattail grass (Sporobolus africanus) and kikuyu grass (Pennisetum clandestinum).

The two lower most meteorological station sites contained more native vegetation than the uppermost sites. The native plants included an endemic grass (Trisetum inadequale), the indigenous herb, *'uhaloa* (Waltheria indica) and several endemic or indigenous shrubs: *'a'ali'i* (Dodonaea viscosa), sandalwood, *'iliahialo'e* (Santalum ellipticum), *'ilima* (Sida fallax), and *'ulei* (Osteomeles anthyllidifolia).

A second botanical survey conducted in November 1998 along the proposed access roadway corridor (Medeiros 1998) found similar vegetation as the first survey. In 2004, further botanical surveys were conducted along the existing access road and along a proposed alternate spur route designed to provide more direct, environmentally friendly access to the site (Hobdy 2004b).

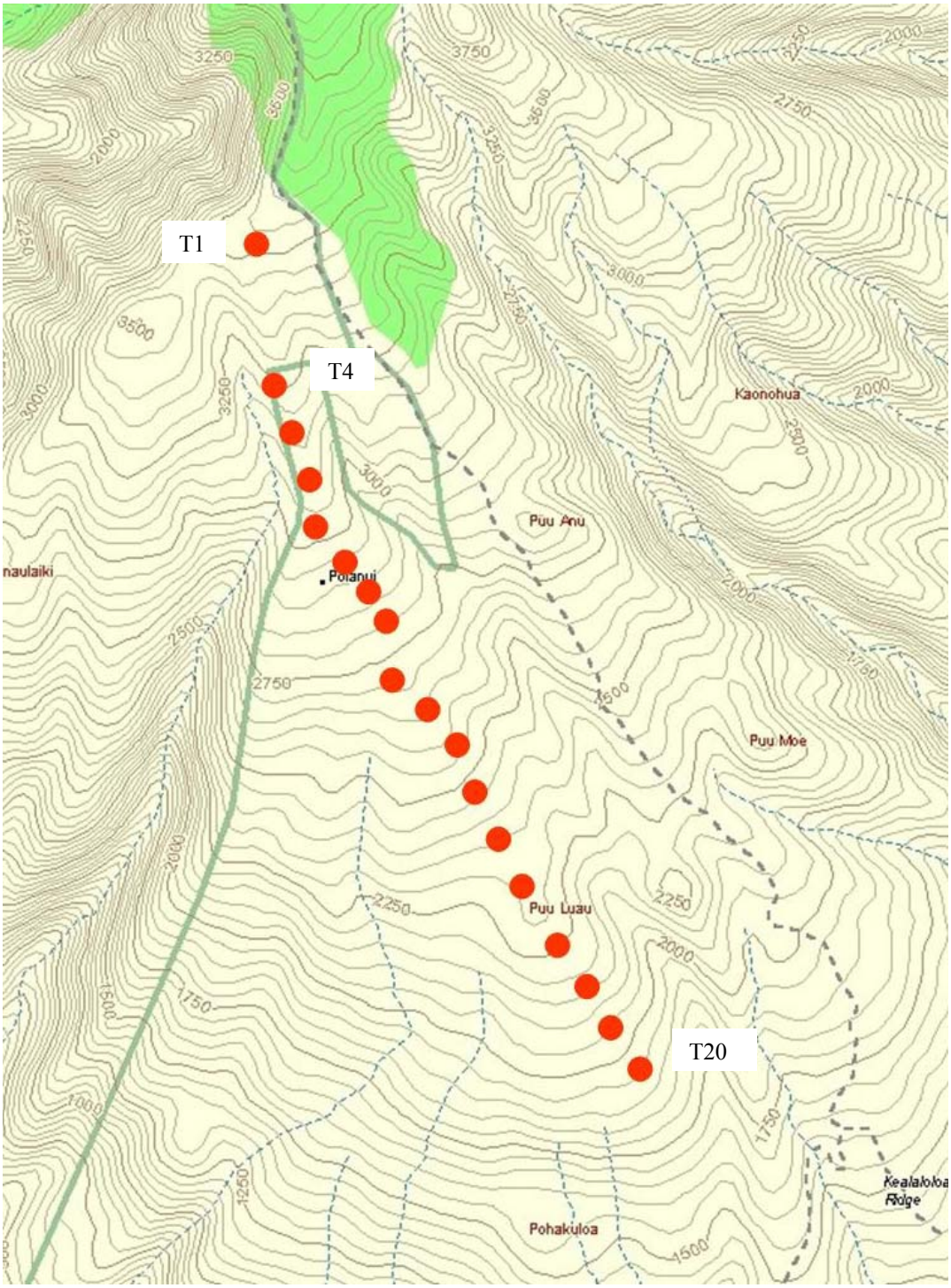
Surveys by Hobdy (2004a and 2004b) also found no federally endangered or threatened plant species along the existing or proposed access road routes, nor were any plants proposed as candidates for such status or any other native species of concern identified. All native plant species recorded as rare within the project corridor are, in fact, more common in the context of Maui or the State in general. Four somewhat less than common native plant species were noted: *'iliahialo'e* (Santalum ellipticum),

orange flowered *naupaka* (Scaevola gaudichaudii), *kolokolo kuahiwi* (Lysimachia hillebrandii) and an endemic grass Trisetum inadequale.

Hobdy (2004a and 2004b) reported that the existing access road between 1,036 to 1,097 m (3,400 to 3,600 ft) passes through some native plant habitat that contains three of the four species mentioned above, although in general the area is dominated by non-native species. This area, however, would be avoided by using a new spur road. The new spur diverges from the existing road at approximately 457 m (1,500 ft) elevation and connects with the project site at 884 m (2,900 ft) elevation.

The twenty Turbine Areas are located along the 3.2-km (2-mi) proposed String Road at an elevation that ranges from about 580-m to 1,100-m (1,900-ft to 3,600-ft).

***Koʻokoʻolau* (Bidens micrantha) at Turbine area T11.**



Approximate locations of Turbine Areas T4 – T20 surveyed for this assessment. T1 is the uppermost Turbine Area.

V. OBJECTIVES

The general purpose of this assessment is to evaluate the botanical resources in the planned Turbine Areas and along the String Road that will be disturbed by on-site construction and installation of the KWP project. The assessment will be used to guide mitigation measures and habitat restoration activities that will be implemented as part of the Habitat Conservation Plan and in compliance with the permit conditions that require removing, relocating, and replanting Hawaiian native plants that would be disturbed by the project.

***'Akia* (Wilkstroemea oahuensis), an uncommon native plant that occurs in many of the Turbine Areas.**

Specific objectives include:

1) Document Hawaiian native plant species that occur in each of the Turbine Areas (T4 – T20) and along the String Road;

2) Provide a qualitative estimate of the relative abundance of the native species;

3) Locate and identify species that are Federally listed as threatened or endangered;

4) Describe any special habitats or Hawaiian native plant community assemblages of particular interest that would be impacted by the KWP project;

5) Make recommendations about which species would most likely survive removal, relocating, and replanting, and how many plants of each species should be salvaged;

6) Evaluate the consistency of the botanical survey of Turbine Areas T1 – T3 (Oppenheimer 2005) with the existing vegetation.

VI. METHODS

Each of the twenty Turbine Areas was visually surveyed, noting Hawaiian native plant species that were present, and qualitatively assessing their relative abundance. Turbine Area surveys encompassed a circular area of about 0.8-ha (2-ac), with a radius of about 46-m (150-ft) around the "pins". "Pins" are located approximately at the center of each of the proposed Turbine Areas.

Surveying a mid-elevation Turbine Area.

The surveys were conducted by walking through each of the Turbine Areas, locating habitats where Hawaiian native species were likely to occur. Notes about the quality of the native plant community were also recorded.

Photographs were taken from the "pin" locations in each Turbine Area in the four Cardinal Directions corresponding to the following degrees of a compass: North: 0 (= 360) degrees, East: 90 degrees, South: 180 degrees and West: 270 degrees.

A flagged "pin" is located at the center of each of the proposed Turbine Areas.

The String Road was surveyed on foot along its entire 3.2-km (2-mi) length by following flagged stakes that mark the proposed route. The occurrence and relative abundance of Hawaiian native plants that occurred within 9-m (30-ft) on either side of the flagged stakes were recorded.

VII. RESULTS and RECOMMENDATIONS

The Results and Recommendations section includes the coordinates of each Turbine Area, the photographic documentation of the vegetation in the Cardinal Directions from the pins, a list of Hawaiian native plant species that were found in Turbine Areas T4 through T20 and the proposed String Road nearby, a qualitative assessment of species' abundance, a subjective evaluation of the quality of the native plant communities, and recommendations for plant salvage.

Turbine Area 3

N 20° 49.537′
W 156° 33.483′

North

East

The vegetation cover and Hawaiian native species that were found on this site were consistent with the botanical survey conducted by Oppenheimer (2005). That report also covers Turbine Areas T1 and T2. A visual survey of those sites found that the vegetation there was also consistent with the Oppenheimer report. The vegetation on the upper two sites is predominatly Hawaiian native species, while the T3 site is largely non-indigenous. Table VII-1 is a list of the Hawaiian native species found in Turbine Area 3, with qualitative estimates of their abundance, and recommendations for the number of individuals to salvage.

Table VII-1. Plant List of Hawaiian Native Species in Turbine Area 3

SCIENTIFIC NAME	COMMON NAME	STATUS	SITE ABUNDANCE	SALVAGE
FERNS				
DENNSTAEDTIACEAE (Bracken Family)				
Pteridium aquilinum (L.) Kuhn. var. decompositum (gaudich.) R.M. Tryon	kilau	endemic	common	10-20%
MONOCOTS				
CYPERACEAE (Sedge Family)				
Carex wahuensis C. A. Mey.	----------	endemic	uncommon	75-100%
DICOTS				
EPACRIDACEAE (Epacris Family)				
Styphelia tameiameiae (Cham.& Schletend.) F.V.Muell.	pukiawe	indigenous	common	10-20%
MYRTACEAE (Myrtle Family)				
Metrosideros polymorpha Gaud.	ohi'a lehua	endemic	common	seeds
ROSACEAE (Rose Family)				
Osteomeles anthyllidifolia (Sm.) Lindl.	'ulei	indigenous	common	10-20%
THYMELAEACEAE ('Akia Family)				
Wikstroemea oahuensis (A.Gray) Rock	'akia	endemic	scarce	75-100%

Turbine Area 4

N 20° 49.475′
W 156° 33.455′

South

West

Turbine Area 4 is about 1000-m (3,300-ft) in elevation. The vegetation cover in this area is largely non-native grasses, mostly kikuya (Pennisetum clandestinum), with the non-native trees and shrubs, ironwood (Casuarina equisetifolia), Christmas berry (Schinus terebinthifolius), lantana (Lantana camara), and guava (Psidium guajava) found throughout the site in low abundance. The Hawaiian native plants, *ʻohiʻa* (Metrosideros polymorpha) and *pukiawe* (Styphelia tameiameiae) are abundant on the site as is *pili* grass (Heteropogon contortus). Other native plants, *kilau* (Pteridium aquilinum), *ʻulei* (Osteomeles anthyllidifolia), *koʻokoʻolau* (Bidens micrantha), *ʻaʻaliʻi* (Dodonaea viscose), and *pukamole* (Lythrum maritimum), occur in lower abundance. All of the Hawaiian native plant species that occur here also occur on other main islands in Hawaiʻi, and are not considered rare.

Many of the Hawaiian native plants that occur here are likely to survive transplanting. *Pukiawe* is abundant on the site and about 10-20% of the individuals of this species should be selected for salvage. K*ilau*, *ʻulei*, *ʻaʻaliʻi* are less abundant and about 25% of the individual plants of these species should be selected for salvage. *Koʻokoʻolau* and *pukamole* are not common on this site and all individuals should be considered for salvage. Large native plants are not likely to survive transplanting, therefore small to mid-sized individuals should be selected for salvage. Seeds may be gathered from *ʻohiʻa* , *pukiawe*, *ʻaʻaliʻi*, and *pili* grass for future out-planting. Propagation of *ʻohiʻa* via seed is recommended. Table VII-2 is a list of the Hawaiian native species found on this site, with qualitative estimates of their abundance, and recommendations for the number of individuals to salvage.

Table VII-2. Plant List of Hawaiian Native Species in Turbine Area 4

SCIENTIFIC NAME	COMMON NAME	STATUS	SITE ABUNDANCE	SALVAGE
FERNS				
DENNSTAEDTIACEAE (Bracken Family)				
Pteridium aquilinum (L.) Kuhn. var. decompositum (gaudich.) R.M. Tryon	kilau	endemic	common	25%
MONOCOTS				
POACEAE (Grass Family)				
Heteropogon contortus (L.) P. Beauv. Ex Roem & Schult.	pili	indigenous	abundant	seed
DICOTS				
ASTERACEAE (Sunflower Family)				
Bidens micrantha Gaud.	ko'oko'olau	endemic	uncommon	75-100%
EPACRIDACEAE (Epacris Family)				
Styphelia tameiameiae (Cham.& Schletend.) F.V.Muell.	pukiawe	indigenous	abundant	10-20%
LYTHRACEAE (Loosestrife Family)				
Lythrum maritimum Kunth	pukamole	indigenous	common	75-100%
MYRTACEAE (Myrtle Family)				
Metrosideros polymorpha Gaud.	ohi'a lehua	endemic	abundant	seed
ROSACEAE (Rose Family)				
Osteomeles anthyllidifolia (Sm.) Lindl.	'ulei	indigenous	common	25%
SAPINDACEAE (Soapberry Family)				
Dodonaea viscosa Jacq.	'a'ali'i	indigenous	common	25%

Turbine Area 5

N 20° 49.409′
W 156° 33.416′

South

North

Turbine Area 5 is about 975-m (3,200-ft) in elevation. The vegetation cover in this area is largely non-native grasses, mostly kikuya (Pennisetum clandestinum), with the non-native trees and shrubs, koa haole (Leucaena leucocephala), lantana (Lantana camara), and guava (Psidium guajava) found throughout the site in low abundance. Christmas berry (Schinus terebinthifolius) is abundant on the site. The Hawaiian native plants, *kilau* (Pteridium aquilinum), *ʻulei* (Osteomeles anthyllidifolia), *koʻokoʻolau* (Bidens micrantha), and *ʻaʻaliʻi* (Dodonaea viscose) occur in relatively low abundance. P*ukiawe* (Styphelia tameiameiae) is abundant, and *ʻakia* (Wilkstroemea oahuensis) is scarce. All of the Hawaiian native plant species that occur here also occur on other main islands in Hawaiʻi, and are not considered rare.

Many of the Hawaiian native plants that occur here are likely to survive transplanting. See Table VII-3 for salvage recommendations. Seeds may also be gathered from *pukiawe*, *ʻaʻaliʻi* for future out-planting. *ʻAkia* is not common here and all individuals of this species should be considered candidates for salvage. Large native plants are not recommended as candidates for transplanting. Select only the smaller to mid-sized individuals for salvage.

Table VII-3. Plant List of Hawaiian Native Species in Turbine Area 5

SCIENTIFIC NAME	COMMON NAME	STATUS	SITE ABUNDANCE	SALVAGE
FERNS				
DENNSTAEDTIACEAE (Bracken Family)				
Pteridium aquilinum (L.) Kuhn. var. decompositum (gaudich.) R.M. Tryon	kilau	endemic	common	10-20%
DICOTS				
ASTERACEAE (Sunflower Family)				
Bidens micrantha Gaud.	ko'oko'olau	endemic	common	25-50%
EPACRIDACEAE (Epacris Family)				
Styphelia tameiameiae (Cham.& Schletend.) F.V.Muell.	pukiawe	indigenous	abundant	10-20%
ROSACEAE (Rose Family)				
Osteomeles anthyllidifolia (Sm.) Lindl.	'ulei	indigenous	common	25-50%
SAPINDACEAE (Soapberry Family)				
Dodonaea viscosa Jacq.	'a'ali'i	indigenous	uncommon	50-75%
THYMELAEACEAE ('Akia Family)				
Wikstroemea oahuensis (A.Gray) Rock	'akia	endemic	scarce	75-100%

Turbine Area 6

N 20° 49.345′
W 156° 33.383′

East

West

North

Turbine Area 6 is about 945-m (3,100-ft) in elevation. The vegetation cover in this area is largely non-native grasses, mostly molasses grass (Melinus minutiflora) and kikuya (Pennisetum clandestinum), with the non-native trees and shrubs, Christmas berry (Schinus terebinthifolius), silk oak (Grevillea robusta), kiawe (Prosopis pallida), koa haole (Leucaena leucocephala), lantana (Lantana camara), and guava (Psidium guajava) found throughout the site in low abundance. The Hawaiian native plants, *kilau* (Pteridium aquilinum), *ʻulei* (Osteomeles anthyllidifolia), *koʻokoʻolau* (Bidens micrantha), and *ʻaʻaliʻi* (Dodonaea viscose) occur in relatively low abundance, and *ʻilima* (Sida fallax) is scarce. All of the Hawaiian native plant species that occur here also occur on other main islands in Hawaiʻi, and are not considered rare.

Many of the Hawaiian native plants that occur here are likely to survive transplanting. See Table VII-4 for salvage recommendations. Seeds may be gathered from *ʻaʻaliʻi* for future out-planting. *ʻAkia* and *ʻaʻaliʻi* are not common here and all individuals of these species should be considered candidates for salvage. Large native plants are not recommended as candidates for transplanting. Select only the smaller to mid-sized individuals for salvage.

Table VII-4. Plant List of Hawaiian Native Species in Turbine Area 6

SCIENTIFIC NAME	COMMON NAME	STATUS	SITE ABUNDANCE	SALVAGE
FERNS				
DENNSTAEDTIACEAE (Bracken Family)				
Pteridium aquilinum (L.) Kuhn. var. decompositum (gaudich.) R.M. Tryon	kilau	endemic	common	10-20%
DICOTS				
ASTERACEAE (Sunflower Family)				
Bidens micrantha Gaud.	ko'oko'olau	endemic	common	10-20%
MALVACEAE (Mallow Family)				
Sida fallax Walp.	'ilima	indigenous	scarce	75-100%
ROSACEAE (Rose Family)				
Osteomeles anthyllidifolia (Sm.) Lindl.	'ulei	indigenous	common	10-20%
SAPINDACEAE (Soapberry Family)				
Dodonaea viscosa Jacq.	'a'ali'i	indigenous	uncommon	75-100%

Turbine Area 7

N 20° 49.292′
W 156° 33.322′

East

South

Turbine Area 7 is about 915-m (3,000-ft) in elevation. The vegetation cover in this area is largely non-native grasses, mostly molasses grass (Melinus minutiflora) and kikuya (Pennisetum clandestinum), with the non-native trees and shrubs, Christmas berry (Schinus terebinthifolius), silk oak (Grevillea robusta), and guava (Psidium guajava) found throughout the site in low abundance. The Hawaiian native plants, *kilau* (Pteridium aquilinum), and *'ulei* (Osteomeles anthyllidifolia) occur in relatively low abundance, and *pukiawe* (Styphelia tameiameiae) is scarce. All of the Hawaiian native plant species that occur here also occur on other main islands in Hawai'i, and are not considered rare.

Many of the Hawaiian native plants that occur here are likely to survive transplanting. See Table VII-5 for salvage recommendations. Seeds may be gathered from *pukiawe* for future out-planting. *Pukiawe* is not common here, and all individuals of this species should be considered candidates for salvage. Large native plants are not recommended as candidates for transplanting. Select only the smaller to mid-sized individuals for salvage.

Table VII-5. lant List of Hawaiian Native Species in Turbine Area 7

SCIENTIFIC NAME	COMMON NAME	STATUS	SITE ABUNDANCE	SALVAGE
FERNS				
DENNSTAEDTIACEAE (Bracken Family)				
Pteridium aquilinum (L.) Kuhn. var. decompositum (gaudich.) R.M. Tryon	kilau	endemic	common	10-20%
DICOTS				
EPACRIDACEAE (Epacris Family)				
Styphelia tameiameiae (Cham.& Schletend.) F.V.Muell.	pukiawe	indigenous	uncommon	75-100%
ROSACEAE (Rose Family)				
Osteomeles anthyllidifolia (Sm.) Lindl.	'ulei	indigenous	common	10-20%

Turbine Area 8

N 20° 49.204′
W 156° 33.340′

North

South

West

Turbine Area 8 is about 885-m (2,900-ft) in elevation. The vegetation cover in this area is largely non-native grasses, mostly molasses grass (Melinus minutiflora) and kikuya (Pennisetum clandestinum). The Hawaiian native plants, *ʻaʻaliʻi* (Dodonaea viscose), *pukiawe* (Styphelia tameiameiae), *kilau* (Pteridium aquilinum), *koʻokoʻolau* (Bidens micrantha), and *ʻulei* (Osteomeles anthyllidifolia) occur in relatively low abundance. All of the Hawaiian native plant species that occur here also occur on other main islands in Hawaiʻi, and are not considered rare.

Many of the Hawaiian native plants that occur here are likely to survive transplanting. See Table VII-6 for salvage recommendations. Seeds may be gathered from *ʻaʻaliʻi* and *pukiawe* for future out-planting. Large native plants are not

recommended as candidates for transplanting. Select only the smaller to mid-sized individuals for salvage.

Table VII-6. lant List of Hawaiian Native Species in Turbine Area 8

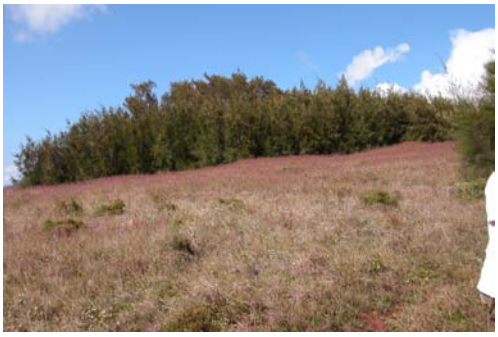
SCIENTIFIC NAME	COMMON NAME	STATUS	SITE ABUNDANCE	SALVAGE
FERNS				
DENNSTAEDTIACEAE (Bracken Family)				
Pteridium aquilinum (L.) Kuhn. var. decompositum (gaudich.) R.M. Tryon	kilau	endemic	common	10-20%
DICOTS				
ASTERACEAE (Sunflower Family)				
Bidens micrantha Gaud.	ko'oko'olau	endemic	uncommon	25-50%
EPACRIDACEAE (Epacris Family)				
Styphelia tameiameiae (Cham.& Schletend.) F.V.Muell.	pukiawe	indigenous	uncommon	25-50%
ROSACEAE (Rose Family)				
Osteomeles anthyllidifolia (Sm.) Lindl.	'ulei	indigenous	common	10-20%
SAPINDACEAE (Soapberry Family)				
Dodonaea viscosa Jacq.	'a'ali'i	indigenous	common	10-20%

Turbine Area 9

N 20° 49.141′
W 156° 33.283′

South

East



North

West

Turbine Area 9 is about 885-m (2,900-ft) in elevation. The vegetation cover in this area is largely non-native grasses, mostly molasses grass (Melinus minutiflora), with the non-native shrub lantana (Lantana camara) in low abundance. The Hawaiian native plants, *ʻilima* (Sida fallax), *koʻokoʻolau* (Bidens micrantha), *pukiawe* (Styphelia tameiameiae), *kilau* (Pteridium aquilinum), *ʻuhaloa* (Waltheria indica), *kawelu* (Eragrostis sp.), and *ʻulei* (Osteomeles anthyllidifolia) occur in relatively low abundance, and *ʻohiʻa* (Metrosideros polymorpha) and *ʻaʻaliʻi* (Dodonaea viscose) are scarce. All of the Hawaiian native plant species that occur here also occur on other main islands in Hawaiʻi, and are not considered rare.

Many of the Hawaiian native plants that occur here are likely to survive transplanting. See Table VII-7 for salvage recommendations. Seeds may be gathered

from *'a'ali'i*, *'ohi'a*, *kawelu*, and *pukiawe* for future out-planting. Large native plants, such as *'ohi'a*, are not recommended as candidates for transplanting. Select only the smaller to mid-sized individuals for salvage.

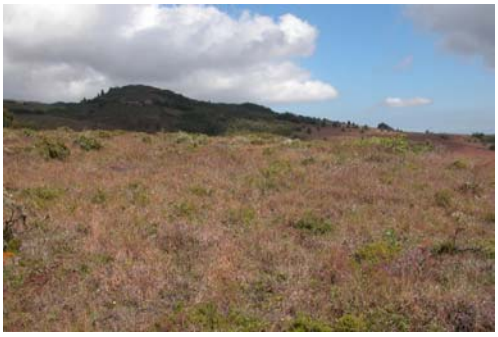
Table VII-7. lant List of Hawaiian Native Species in Turbine Area 9

SCIENTIFIC NAME	COMMON NAME	STATUS	SITE ABUNDANCE	SALVAGE
FERNS				
DENNSTAEDTIACEAE (Bracken Family)				
Pteridium aquilinum (L.) Kuhn. var. decompositum (gaudich.) R.M. Tryon	kilau	endemic	common	10-20%
MONOCOTS				
POACEAE (Grass Family)				
Eragrostis variabilis (Gaud.) Steud.	kawelu	endemic	common	25%
DICOTS				
ASTERACEAE (Sunflower Family)				
Bidens micrantha Gaud.	ko'oko'olau	endemic	common	10-20%
EPACRIDACEAE (Epacris Family)				
Styphelia tameiameiae (Cham.& Schletend.) F.V.Muell.	pukiawe	indigenous	common	10-20%
MALVACEAE (Mallow Family)				
Sida fallax Walp.	'ilima	indigenous	common	10-20%
MYRTACEAE (Myrtle Family)				
Metrosideros polymorpha Gaud.	ohi'a lehua	endemic	uncommon	seeds
ROSACEAE (Rose Family)				
Osteomeles anthyllidifolia (Sm.) Lindl.	'ulei	indigenous	common	10-20%
SAPINDACEAE (Soapberry Family)				
Dodonaea viscosa Jacq.	'a'ali'i	indigenous	uncommon	50-75%
STERCULIACEAE (Cacao Family)				
Waltheria indica L.	'uhaloa	indigenous	common	25-50%

Turbine Area 10

N 20° 49.084′
W 156° 33.238′

South



East

North

West

Turbine Area 10 is about 855-m (2,800-ft) in elevation. The vegetation in this area is moderately covered by non-native grasses, mostly molasses grass (Melinus minutiflora), with the non-native tree, silk oak (Grevillea robusta), in very low abundance. The Hawaiian native plants, *ʻilima* (Sida fallax), *pukiawe* (Styphelia tameiameiae), *ʻuhaloa* (Waltheria indica), *kawelu* (Eragrostis sp.), and *ʻulei* (Osteomeles anthyllidifolia) occur in moderate abundance. *ʻOhiʻa* (Metrosideros polymorpha) and *ʻaʻaliʻi* (Dodonaea viscose) are scarce. All of the Hawaiian native plant species that occur here also occur on other main islands in Hawaiʻi, and are not considered rare.

Many of the Hawaiian native plants that occur here are likely to survive transplanting. See Table VII-8 for salvage recommendations. Seeds may be gathered from *ʻaʻaliʻi*, *ʻohiʻa*, *kawelu,* and *pukiawe* for future out-planting. *ʻAʻaliʻi* is not common

here, and all individuals of this species should be considered candidates for salvage. Large native plants, such as *ʻohiʻa*, are not recommended as candidates for transplanting. Select only the smaller to mid-sized individuals for salvage.

The vegetation along the route for the proposed String Road east of this site has a high proportion of Hawaiian native plant species, in a relatively intact community. It would be desirable to re-route the String Road to the west of the site if practical.

Table VII-8. lant List of Hawaiian Native Species in Turbine Area 10

SCIENTIFIC NAME	COMMON NAME	STATUS	SITE ABUNDANCE	SALVAGE
MONOCOTS				
POACEAE (Grass Family)				
Eragrostis variabilis (Gaud.) Steud.	kawelu	endemic	abundant	25%
DICOTS				
EPACRIDACEAE (Epacris Family)				
Styphelia tameiameiae (Cham.& Schletend.) F.V.Muell.	pukiawe	indigenous	common	10-20%
MALVACEAE (Mallow Family)				
Sida fallax Walp.	'ilima	indigenous	common	25%
MYRTACEAE (Myrtle Family)				
Metrosideros polymorpha Gaud.	ohi'a lehua	endemic	uncommon	seeds
ROSACEAE (Rose Family)				
Osteomeles anthyllidifolia (Sm.) Lindl.	'ulei	indigenous	abundant	10-20%
SAPINDACEAE (Soapberry Family)				
Dodonaea viscosa Jacq.	'a'ali'i	indigenous	uncommon	75-100%
STERCULIACEAE (Cacao Family)				
Waltheria indica L.	'uhaloa	indigenous	common	25-50%

Turbine Area 11

N 20° 49.038′
W 156° 33.196′

South

East

North

West

Turbine Area 11 is about 825-m (2,700-ft) in elevation. The vegetation cover in this area is generally non-native grasses, mostly molasses grass (Melinus minutiflora), with the non-native trees and shrub, ironwood (Casuarina equisetifolia), Christmas berry (Schinus terebinthifolius), and lantana (Lantana camara), in very low abundance. The Hawaiian native plants, *ʻilima* (Sida fallax), *pukiawe* (Styphelia tameiameiae), and *ʻulei* (Osteomeles anthyllidifolia) are very abundant. *ʻOhiʻa* (Metrosideros polymorpha), *kawelu* (Eragrostis sp.), *kilau* (Pteridium aquilinum), occur in low abundance, and *ʻakia* (Wilkstroemea oahuensis), *koʻokoʻolau* (Bidens micrantha), and *ʻaʻaliʻi* (Dodonaea viscose) are scarce. All of the Hawaiian native plant species that occur here also occur on other main islands in Hawaiʻi, and are not considered rare.

Many of the Hawaiian native plants that occur here are likely to survive transplanting. See Table VII-9 for salvage recommendations. Seeds may be gathered

from *'a'ali'i*, *'ohi'a*, *kawelu*, and *pukiawe* for future out-planting. *'A'ali'i* and *'akia* are not common here, and all individuals of these species should be considered as candidates for salvage. Large native plants, such as *'ohi'a*, are not recommended as candidates for transplanting.

The vegetation along the route for the proposed String Road east of this site has a high proportion of Hawaiian native plant species, in a relatively intact community. It would be desirable to re-route the String Road to the west of the site if practical.

Table VII-9. lant List of Hawaiian Native Species in Turbine Area 11

SCIENTIFIC NAME	COMMON NAME	STATUS	SITE ABUNDANCE	SALVAGE
FERNS				
DENNSTAEDTIACEAE (Bracken Family)				
Pteridium aquilinum (L.) Kuhn. var. decompositum (gaudich.) R.M. Tryon	kilau	endemic	scarce	57-75%
MONOCOTS				
POACEAE (Grass Family)				
Eragrostis variabilis (Gaud.) Steud.	kawelu	endemic	common	25%
DICOTS				
ASTERACEAE (Sunflower Family)				
Bidens micrantha Gaud.	ko'oko'olau	endemic	scarce	75-100%
EPACRIDACEAE (Epacris Family)				
Styphelia tameiameiae (Cham.& Schletend.) F.V.Muell.	pukiawe	indigenous	common	10-20%
MALVACEAE (Mallow Family)				
Sida fallax Walp.	'ilima	indigenous	common	25%
MYRTACEAE (Myrtle Family)				
Metrosideros polymorpha Gaud.	ohi'a lehua	endemic	common	seeds
ROSACEAE (Rose Family)				
Osteomeles anthyllidifolia (Sm.) Lindl.	'ulei	indigenous	common	10-20%
SAPINDACEAE (Soapberry Family)				
Dodonaea viscosa Jacq.	'a'ali'i	indigenous	scarce	75-100%
THYMELAEACEAE ('Akia Family)				
Wilkstroemea oahuensis (A.Gray) Rock	'akia	endemic	scarce	75-100%

Turbine Area 12

N 20° 48.935′
W 156° 33.132′

South

East

North

West

Turbine Area 12 is about 800-m (2,625-ft) in elevation. The vegetation cover in this area is largely non-native grasses, mostly molasses grass (Melinus minutiflora), with the non-native shrub, lantana (Lantana camara), in low abundance. The Hawaiian native plants, *ʻilima* (Sida fallax), *ʻulei* (Osteomeles anthyllidifolia), *kilau* (Pteridium aquilinum), and *ʻuhaloa* (Waltheria indica) occur in relatively low abundance, and *pukiawe* (Styphelia tameiameiae) is scarce. All of the Hawaiian native plant species that occur here also occur on other main islands in Hawaiʻi, and are not considered rare.

Many of the Hawaiian native plants that occur here are likely to survive transplanting. See Table VII-10 for salvage recommendations. Seeds may be gathered

from *'uhaloa, 'ilima* and *pukiawe* for future out-planting. *Pukiawe* is not common here, and all individuals of this species should be considered as candidates for salvage.

Table VII-10. Plant List of Hawaiian Native Species in Turbine Area 12

SCIENTIFIC NAME	COMMON NAME	STATUS	SITE ABUNDANCE	SALVAGE
FERNS				
DENNSTAEDTIACEAE (Bracken Family)				
Pteridium aquilinum (L.) Kuhn. var. decompositum (gaudich.) R.M. Tryon	kilau	endemic	common	10-20%
DICOTS				
EPACRIDACEAE (Epacris Family)				
Styphelia tameiameiae (Cham.& Schletend.) F.V.Muell.	pukiawe	indigenous	uncommon	75-100%
MALVACEAE (Mallow Family)				
Sida fallax Walp.	'ilima	indigenous	common	25%
ROSACEAE (Rose Family)				
Osteomeles anthyllidifolia (Sm.) Lindl.	'ulei	indigenous	common	10-20%
STERCULIACEAE (Cacao Family)				
Waltheria indica L.	'uhaloa	indigenous	common	25%

Turbine Area 13

N 20° 48.869′
W 156° 33.094′

South

East

North

West

Turbine Area 13 is about 785-m (2,575-ft) in elevation. The vegetation cover in this area is largely non-native grasses, mostly molasses grass (Melinus minutiflora), with the non-native shrub, lantana (Lantana camara), in low abundance. The Hawaiian native plants, *ʻilima* (Sida fallax), *ʻulei* (Osteomeles anthyllidifolia), *kilau* (Pteridium aquilinum), *ʻaʻaliʻi* (Dodonaea viscose), and *ʻuhaloa* (Waltheria indica) occur in relatively low abundance. All of the Hawaiian native plant species that occur here also occur on other main islands in Hawaiʻi, and are not considered rare.

Many of the Hawaiian native plants that occur here are likely to survive transplanting. See Table VII-11 for salvage recommendations. Seeds may be gathered from *ʻuhaloa, ʻilima* and *ʻaʻaliʻi* for future out-planting. All the *ʻilima* and *ʻuhaloa* plants should be considered for salvage.

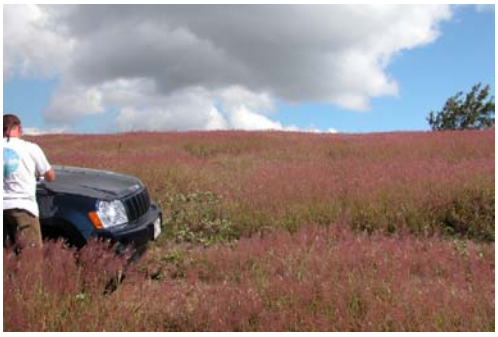
Table VII-11. Plant List of Hawaiian Native Species in Turbine Area 13

SCIENTIFIC NAME	COMMON NAME	STATUS	SITE ABUNDANCE	SALVAGE
FERNS				
DENNSTAEDTIACEAE (Bracken Family)				
Pteridium aquilinum (L.) Kuhn. var. decompositum (gaudich.) R.M. Tryon	kilau	endemic	uncommon	25-50%
DICOTS				
MALVACEAE (Mallow Family)				
Sida fallax Walp.	'ilima	indigenous	uncommon	75-100%
ROSACEAE (Rose Family)				
Osteomeles anthyllidifolia (Sm.) Lindl.	'ulei	indigenous	uncommon	50-75%
SAPINDACEAE (Soapberry Family)				
Dodonaea viscosa Jacq.	'a'ali'i	indigenous	uncommon	50-75%
STERCULIACEAE (Cacao Family)				
Waltheria indica L.	'uhaloa	indigenous	uncommon	75-100%

Turbine Area 14

N 20° 48.797′
W 156° 33.060′

South



East

North

West

Turbine Area 14 is about 765-m (2,500-ft) in elevation. The vegetation cover in this area is largely non-native grasses, mostly molasses grass (Melinus minutiflora), with the non-native tree and shrub, silk oak (Grevillea robusta) and lantana (Lantana camara), in low abundance. The Hawaiian native plant, *ʻilima* (Sida fallax) is very abundant. Another native plant, *ʻulei* (Osteomeles anthyllidifolia) is moderately abundant. The natives, *kilau* (Pteridium aquilinum), *ʻaʻaliʻi* (Dodonaea viscose), *ʻuhaloa* (Waltheria indica), and *pukiawe* (Styphelia tameiameiae) occur in relatively low abundance. All of the Hawaiian native plant species that occur here also occur on other main islands in Hawaiʻi, and are not considered rare.

Many of the Hawaiian native plants that occur here are likely to survive transplanting. See Table VII-12 for salvage recommendations. Seeds may be gathered from *ʻaʻaliʻi, ʻuhaloa, ʻilima* and *pukiawe* for future out-planting.

Table VII-12. Plant List of Hawaiian Native Species in Turbine Area 14

SCIENTIFIC NAME	COMMON NAME	STATUS	SITE ABUNDANCE	SALVAGE
FERNS				
DENNSTAEDTIACEAE (Bracken Family)				
Pteridium aquilinum (L.) Kuhn. var. decompositum (gaudich.) R.M. Tryon	kilau	endemic	uncommon	50-75%
DICOTS				
EPACRIDACEAE (Epacris Family)				
Styphelia tameiameiae (Cham.& Schletend.) F.V.Muell.	pukiawe	indigenous	uncommon	75%
MALVACEAE (Mallow Family)				
Sida fallax Walp.	'ilima	indigenous	abundant	25-50%
ROSACEAE (Rose Family)				
Osteomeles anthyllidifolia (Sm.) Lindl.	'ulei	indigenous	common	10-20%
SAPINDACEAE (Soapberry Family)				
Dodonaea viscosa Jacq.	'a'ali'i	indigenous	uncommon	75-100%
STERCULIACEAE (Cacao Family)				
Waltheria indica L.	'uhaloa	indigenous	uncommon	75-100%

Turbine Area 15

N 20° 48.726′
W 156° 33.033′

South

East

North

West

Turbine Area 15 is about 765-m (2,500-ft) in elevation. The vegetation in this area has a low abundance of non-native grasses, mostly molasses grass (Melinus minutiflora), with a few individual plants of the non-native trees Christmas berry (Schinus terebinthifolius) and silk oak (Grevillea robusta), and the shrub, lantana (Lantana camara). Hawaiian native plants account for about 60-75% of the vegetation cover at the site. *ʻIlima* (Sida fallax) is very abundant. *ʻulei* (Osteomeles anthyllidifolia), *ʻaʻaliʻi* (Dodonaea viscose), *ʻuhaloa* (Waltheria indica), and *pili* grass (Heteropogon contortus) are common. *Pukiawe* (Styphelia tameiameiae), *ʻakia* (Wilkstroemea oahuensis) occur in relatively low abundance, and *koʻokoʻolau* (Bidens micrantha) is scarce. All of the Hawaiian native plant species that occur here also occur on other main islands in Hawaiʻi, and are not considered rare.

Many of the Hawaiian native plants that occur here are likely to survive transplanting. See Table VII-13 for salvage recommendations. Seeds may be gathered from *ʻaʻaliʻi, ʻuhaloa, ʻilima* and *pili* grass for future out-planting.

The plant community here is mostly Hawaiian natives and disturbance to this site should be minimized.

Table VII-13. Plant List of Hawaiian Native Species in Turbine Area 15

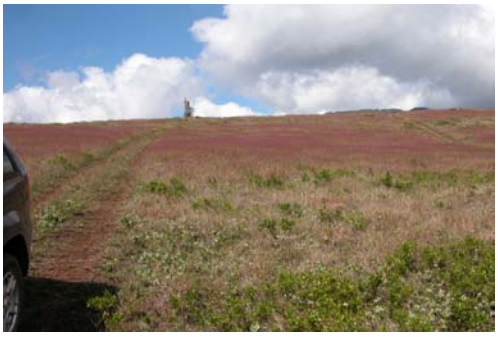
SCIENTIFIC NAME	COMMON NAME	STATUS	SITE ABUNDANCE	SALVAGE
MONOCOTS				
POACEAE (Grass Family)				
Heteropogon contortus (L.) P. Beauv. Ex Roem & Schult.	pili	indigenous	common	25%
DICOTS				
ASTERACEAE (Sunflower Family)				
Bidens micrantha Gaud.	ko'oko'olau	endemic	scarce	75-100%
EPACRIDACEAE (Epacris Family)				
Styphelia tameiameiae (Cham.& Schletend.) F.V.Muell.	pukiawe	indigenous	uncommon	75-100%
MALVACEAE (Mallow Family)				
Sida fallax Walp.	'ilima	indigenous	abundant	10-20%
ROSACEAE (Rose Family)				
Osteomeles anthyllidifolia (Sm.) Lindl.	'ulei	indigenous	common	10-20%
SAPINDACEAE (Soapberry Family)				
Dodonaea viscosa Jacq.	'a'ali'i	indigenous	common	10-20%
STERCULIACEAE (Cacao Family)				
Waltheria indica L.	'uhaloa	indigenous	common	25-50%
THYMELAEACEAE ('Akia Family)				
Wikstroemea oahuensis (A.Gray) Rock	'akia	endemic	uncommon	75-100%

Turbine Area 16

N 20° 48.657′
W 156° 32.996′

South

East



North

West

Turbine Area 16 is about 745-m (2,450-ft) in elevation. The vegetation in this area has a low abundance of non-native grasses, mostly molasses grass (Melinus minutiflora), with a few individual plants of the non-native shrub, lantana (Lantana camara). Hawaiian native plants account for >75% of the vegetation cover at this site. *'Ilima* (Sida fallax), *'ulei* (Osteomeles anthyllidifolia), *'a'ali'i* (Dodonaea viscose), and *kawelu* (Eragrostis sp.) are common here. *Pukiawe* (Styphelia tameiameiae), *'uhaloa* (Waltheria indica), and *'akia* (Wilkstroemea oahuensis) occur in relatively low abundance. All of the Hawaiian native plant species that occur here also occur on other main islands in Hawai'i, and are not considered rare.

Many of the Hawaiian native plants that occur here are likely to survive transplanting. See Table VII-14 for salvage recommendations. Seeds may be gathered from *ʻuhaloa, ʻilima, pukiawe, ʻaʻaliʻi* for future out-planting.

The plant community here is mostly Hawaiian natives and disturbance to this site should be minimized.

Table VII-14. Plant List of Hawaiian Native Species in Turbine Area 16

SCIENTIFIC NAME	COMMON NAME	STATUS	SITE ABUNDANCE	SALVAGE
MONOCOTS				
POACEAE (Grass Family)				
Eragrostis variabilis (Gaud.) Steud.	kawelu	endemic	common	25%
DICOTS				
EPACRIDACEAE (Epacris Family)				
Styphelia tameiameiae (Cham.& Schletend.) F.V.Muell.	pukiawe	indigenous	uncommon	50-75%
MALVACEAE (Mallow Family)				
Sida fallax Walp.	'ilima	indigenous	common	25%
ROSACEAE (Rose Family)				
Osteomeles anthyllidifolia (Sm.) Lindl.	'ulei	indigenous	common	10-20%
SAPINDACEAE (Soapberry Family)				
Dodonaea viscosa Jacq.	'a'ali'i	indigenous	common	10-20%
STERCULIACEAE (Cacao Family)				
Waltheria indica L.	'uhaloa	indigenous	uncommon	25%
THYMELAEACEAE ('Akia Family)				
Wikstroemea oahuensis (A.Gray) Rock	'akia	endemic	uncommon	75-100%

Turbine Area 17

N 20° 48.590′
W 156° 32.964′

South

East

North

West

Turbine Area 17 is about 730-m (2,400-ft) in elevation. The vegetation in this area has a moderate abundance of non-native grasses, mostly molasses grass (Melinus minutiflora), with a few individual plants of the non-native shrub, lantana (Lantana camara). Hawaiian native plants account for about 40-60% of the vegetation cover at this site. *ʻIlima* (Sida fallax), *ʻulei* (Osteomeles anthyllidifolia), and *ʻaʻaliʻi* (Dodonaea viscose) are abundant here. *ʻUhaloa* (Waltheria indica) is less common and *ʻakia* (Wilkstroemea oahuensis) is scarce. All of the Hawaiian native plant species that occur here also occur on other main islands in Hawaiʻi, and are not considered rare.

Many of the Hawaiian native plants that occur here are likely to survive transplanting. See Table VII-15 for salvage recommendations. Seeds may be gathered from *ʻuhaloa, ʻilima*, and *ʻaʻaliʻi* for future out-planting.

Table VII-15. Plant List of Hawaiian Native Species in Turbine Area 17

SCIENTIFIC NAME	COMMON NAME	STATUS	SITE ABUNDANCE	SALVAGE
DICOTS				
MALVACEAE (Mallow Family)				
Sida fallax Walp.	'ilima	indigenous	common	25-50%
ROSACEAE (Rose Family)				
Osteomeles anthyllidifolia (Sm.) Lindl.	'ulei	indigenous	common	10-20%
SAPINDACEAE (Soapberry Family)				
Dodonaea viscosa Jacq.	'a'ali'i	indigenous	common	25-50%
STERCULIACEAE (Cacao Family)				
Waltheria indica L.	'uhaloa	indigenous	common	25-50%
THYMELAEACEAE ('Akia Family)				
Wikstroemea oahuensis (A.Gray) Rock	'akia	endemic	uncommon	75-100%

Turbine Area 18

N 20° 48.507′
W 156° 32.961′

South

East

North

West

Turbine Area 18 is about 700-m (2,300-ft) in elevation. The vegetation in this area has a moderate abundance of non-native grasses, mostly molasses grass (Melinus minutiflora), with a few individual plants of the non-native shrub, lantana (Lantana camara). Hawaiian native plants account for about 50-75% of the vegetation cover at this site. *ʻIlima* (Sida fallax), *ʻulei* (Osteomeles anthyllidifolia), *ʻuhaloa* (Waltheria indica), and *ʻaʻaliʻi* (Dodonaea viscose) are abundant here. *ʻAkia* (Wilkstroemea oahuensis), *pukiawe* (Styphelia tameiameiae), and *koʻokoʻolau* (Bidens micrantha) is uncommon. ʻ*Akoko* (Chamaesyce multiformis) also occurs on this site, on bare ground amongst weathered boulders in rock outcroppings (see photo below). This uncommon species occurs on many of Hawaiʻi's main islands in low abundance but is not considered a threatened or endangered species. All of the other Hawaiian

native plant species that occur here also occur on other main islands in Hawai'i, and are not considered rare.

Rock outcropping with weathered boulders and bare soil where *'akoko* plants occur.

Many of the Hawaiian native plants that occur here are likely to survive transplanting. See Table VII-16 for salvage recommendations. Seeds may be gathered from *'uhaloa, 'ilima*, *pukiawe*, and *'a'ali'i* for future out-planting.

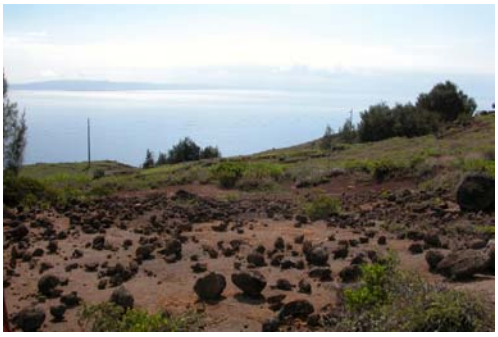
The rock outcroppings here provide this site with a unique habitat with species that are not common elsewhere. Care should be taken duing the development of Turbine Area 18 to reduce the disturbance of these habitats. It is recommended that the rock outcroppings of weathered boulders that occur within the buffer area around the turbine pad be left intact.

Table VII-16. Plant List of Hawaiian Native Species in Turbine Area 18

SCIENTIFIC NAME	COMMON NAME	STATUS	SITE ABUNDANCE	SALVAGE
DICOTS				
ASTERACEAE (Sunflower Family)				
Bidens micrantha Gaud.	ko'oko'olau	endemic	uncommon	75-100%
EPACRIDACEAE (Epacris Family)				
Styphelia tameiameiae (Cham.& Schletend.) F.V.Muell.	pukiawe	indigenous	uncommon	75-100%
EUPHORBIACEAE (Spurge Family)				
Chamaesyce multiformis (Hook. & Arnott) Croizat & Degener	'akoko	endemic	patchy	75-100%
MALVACEAE (Mallow Family)				
Sida fallax Walp.	'ilima	indigenous	common	50-75%
ROSACEAE (Rose Family)				
Osteomeles anthyllidifolia (Sm.) Lindl.	'ulei	indigenous	common	10-20%
SAPINDACEAE (Soapberry Family)				
Dodonaea viscosa Jacq.	'a'ali'i	indigenous	common	25-50%
STERCULIACEAE (Cacao Family)				
Waltheria indica L.	'uhaloa	indigenous	common	25-50%
THYMELAEACEAE ('Akia Family)				
Wikstroemea oahuensis (A.Gray) Rock	'akia	endemic	uncommon	75-100%

Turbine Area 19

N 20° 48.499′
W 156° 32.882′



South

East

North

West

Turbine Area 19 is about 640-m (2,100-ft) in elevation. The vegetation in this area has a low abundance of non-native grasses, mostly molasses grass (Melinus minutiflora), with a few individual plants of the non-native shrub, lantana (Lantana camara), and a stand of ironwood trees (Casuarina equisetifolia). Hawaiian native plants account for about 60-75% of the vegetation cover at this site. *ʻIlima* (Sida fallax), *ʻulei* (Osteomeles anthyllidifolia), *ʻuhaloa* (Waltheria indica), and *ʻaʻaliʻi* (Dodonaea viscose) are abundant here. *ʻAkia* (Wilkstroemea oahuensis), orange *naupaka* (Scaevola gaudichaudii), and *koʻokoʻolau* (Bidens micrantha) are uncommon. *ʻAkoko* (Chamaesyce multiformis) also occurs on this site, on bare ground amongst weathered boulders in rock outcroppings (see photo below). This uncommon species occurs on many of Hawaiʻi's main islands in low abundance but is not considered a

threatened or endangered species. All of the other Hawaiian native plant species that occur here also occur on other main islands in Hawai'i, and are not considered rare.

Rock outcropping with weathered boulders and bare soil where *'akoko* plants occur.

Many of the Hawaiian native plants that occur here are likely to survive transplanting. See Table VII-17 for salvage recommendations. Seeds may be gathered from *'uhaloa, 'ilima,* and *'a'ali'i* for future out-planting.

The rock outcroppings here provide this site with a unique habitat with species that are not common elsewhere. Care should be taken duing the development of Turbine Area 19 to reduce the disturbance of these habitats. It is recommended that the rock outcroppings of weathered boulders that occur within the buffer area around the turbine pad be left intact.

Table VII-17. Plant List of Hawaiian Native Species in Turbine Area 19

SCIENTIFIC NAME	COMMON NAME	STATUS	SITE ABUNDANCE	SALVAGE
DICOTS				
ASTERACEAE (Sunflower Family)				
Bidens micrantha Gaud.	ko'oko'olau	endemic	uncommon	75-100%
EUPHORBIACEAE (Spurge Family)				
Chamaesyce multiformis (Hook. & Arnott) Croizat & Degener	'akoko	endemic	patchy	75-100%
GOODENIACEAE (Goodenia Family)				
Scaevola gaudichaudii Hook. & Arnott	orange naupaka	endemic	patchy	75-100%
MALVACEAE (Mallow Family)				
Sida fallax Walp.	'ilima	indigenous	common	50-75%
ROSACEAE (Rose Family)				
Osteomeles anthyllidifolia (Sm.) Lindl.	'ulei	indigenous	common	10-20%
SAPINDACEAE (Soapberry Family)				
Dodonaea viscosa Jacq.	'a'ali'i	indigenous	common	25-50%
STERCULIACEAE (Cacao Family)				
Waltheria indica L.	'uhaloa	indigenous	common	25-50%
THYMELAEACEAE ('Akia Family)				
Wikstroemea oahuensis (A.Gray) Rock	'akia	endemic	uncommon	75-100%

Turbine Area 20

N 20° 48.423′
W 156° 32.838′

South

East

North

West

Turbine Area 20 is about 580-m (1,900-ft) in elevation. The vegetation in this area has a low abundance of non-native grasses, mostly molasses grass (Melinus minutiflora), with a few individual plants of the non-native shrub, lantana (Lantana camara), and a stand of ironwood trees (Casuarina equisetifolia). Hawaiian native plants account for >75% of the vegetation cover at this site. *ʻIlima* (Sida fallax), *ʻulei* (Osteomeles anthyllidifolia), *ʻuhaloa* (Waltheria indica), and *ʻaʻaliʻi* (Dodonaea viscose) are abundant here. *ʻAkia* (Wilkstroemea oahuensis), *naupaka* (Scaevola gaudichaudii), *ʻiliahialoʻe* (Santalum ellipticum), and *koʻokoʻolau* (Bidens micrantha) are uncommon. ʻ*Akoko* (Chamaesyce multiformis) also occurs on this site, on bare ground amongst weathered boulders in rock outcroppings (see photo below). This uncommon species occurs on many of Hawaiʻi's main islands in low abundance but is not considered a

threatened or endangered species. All of the other Hawaiian native plant species that occur here also occur on other main islands in Hawai'i, and are not considered rare.

Rock outcropping with weathered boulders and bare soil where *'akoko* plants occur.

Many of the Hawaiian native plants that occur here are likely to survive transplanting. See Table VII-18 for salvage recommendations. Seeds may be gathered from *'uhaloa, 'ilima*, *'iliahialo'e,* and *'a'ali'i* for future out-planting. *'iliahialo'e* may also be propagated from cuttings.

The rock outcroppings here provide this site with a unique habitat with species that are not common elsewhere. Care should be taken duing the development of Turbine Area 20 to reduce the disturbance of these habitats. It is recommended that the rock outcroppings of weathered boulders that occur within the buffer area around the turbine pad be left intact.

Table VII-18. Plant List of Hawaiian Native Species in Turbine Area 20

SCIENTIFIC NAME	COMMON NAME	STATUS	SITE ABUNDANCE	SALVAGE
DICOTS				
ASTERACEAE (Sunflower Family)				
Bidens micrantha Gaud.	ko'oko'olau	endemic	uncommon	75-100%
EUPHORBIACEAE (Spurge Family)				
Chamaesyce multiformis (Hook. & Arnott) Croizat & Degener	'akoko	endemic	patchy	75-100%
MALVACEAE (Mallow Family)				
Sida fallax Walp.	'ilima	indigenous	common	75-100%
ROSACEAE (Rose Family)				
Osteomeles anthyllidifolia (Sm.) Lindl.	'ulei	indigenous	common	50-75%
SANTALACEAE (Sandalwood Family)				
Santalum ellipticum Gaud.	'iliahi alo'e	endemic	uncommon	10-20%
SAPINDACEAE (Soapberry Family)				
Dodonaea viscosa Jacq.	'a'ali'i	indigenous	common	25-50%
STERCULIACEAE (Cacao Family)				
Waltheria indica L.	'uhaloa	indigenous	common	25-50%
THYMELAEACEAE ('Akia Family)				
Wilkstroemea oahuensis (A.Gray) Rock	'akia	endemic	uncommon	75-100%

VIII. DISCUSSION

Sixteen Hawaiian native plant species were recorded in Turbine Areas T4 through T20, and along the route of the proposed String Road that connects these areas. All of the species identified also occur on other main islands in Hawai'i. More than twenty-six Hawaiian native species have been recorded from the general area, most in the upper mesic sites above Turbine Area 4, or in the nearby Manawainui Plant Sanctuary. The Hawaiian native plant species that were found in Turbine Area 3 match those recorded from the previous botanical survey of that area (Oppenheimer 2005).

No Federally Endangered or Threatened plant species (USFWS 1999) were identified during the course of this assessment. None of the plant species that were found to occur in the assessment area are proposed candidates for such status, or are species of concern. Four of the species encountered in the assessment area are somewhat uncommon. The species are *ʻakoko* (Chamaesyce multiformis), *ʻiliahialoʻe* (Santalum ellipticum), orange *naupaka* (Scaevola gaudichaudii), and *koʻokoʻolau* (Bidens micrantha). While some individual plants of these species may be disturbed during development of the Turbine Areas and String Raod, most will be salvageable, or can be propogated by other means, such as cuttings or seed.

The only unique habitat that would be disturbed is that in rock outcroppings with bare soil that is found in Turbine Areas T18, T19, and T20. Full development of these Turbine areas will displace most of this habitat, however, selective avoidance of the rock outcroppings in buffer areas around the turbine pads would conserve most of this habitat. This kind of sensitive approach will reduce the negative impact on Hawaiian native plants within the project area.

The Hawaiian native plant species that were identified in locations along the proposed route of the String Road were similar to those found in the adjacent Turbine Area. At only two locations would it be considered advantageous to relocate the proposed route, near Turbine Area 10 and Turbine Area 11. The route at these two locations enters an area that has a relatively larger proportion of Hawaiian native plants. Re-routing the String Road to the west of these Areas would reduce the impacts to the native vegetation.

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