



O'ahu Landfill Siting Study & Landfill Advisory Committee Recommendations

Final Report

City and County of Honolulu, Hawai'i

June 2022

Department of Environmental Services
Refuse Division
City and County of Honolulu

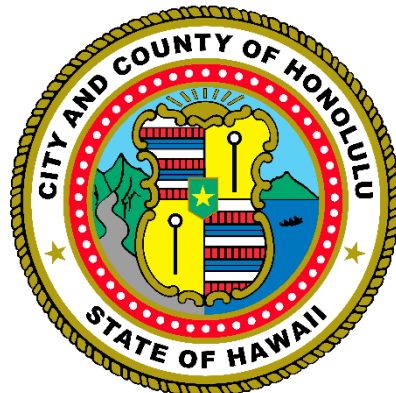


EXHIBIT "D"

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1 Executive Summary

1.1 Introduction

The City and County of Honolulu (City), Department of Environmental Services (ENV), is conducting a landfill siting study on the island of O'ahu as an initial step in replacing the existing Waimānalo Gulch Sanitary Landfill (WGSL), based on conditions added to the Special Use Permit (SUP) SP09-403 for extending the time of operation for WGSL by the State of Hawai'i Land Use Commission (LUC) on November 1, 2019, as follows:

Condition No. 1 – “The WGSL shall close by no later than March 2, 2028. The WGSL shall not accept any form of waste after March 2, 2028.”

Condition No. 5 – “By no later than December 31, 2022, the Applicant shall identify an alternative landfill site that may be used upon closure of WGSL. Upon identification of the alternative landfill site, the Applicant shall provide written notice to Planning Commission and the LUC.”

With the pending closure of the WGSL, it has become essential for the City to plan for sufficient future landfill capacity for continued management of municipal solid waste (MSW) diverted from H-POWER, ash and residue byproducts from H-POWER, and other special waste, non-recyclable waste, and disaster debris beyond 2028. Additionally, to compensate for the impending closure of PVT Landfill, the only construction and demolition landfill on O'ahu, the next City landfill must be planned to incorporate the addition of that waste stream.

This report documents the process of and includes recommendations from the Landfill Advisory Committee (LAC) appointed by the Mayor to assist in development of the landfill siting study. The LAC evaluated and scored potential new landfill sites. The O'ahu Landfill Siting Study & Landfill Advisory Committee Recommendations Report (report) is the initial step in identifying potential new landfill sites on O'ahu and allows ENV to prepare technical studies and analyses in support of future design and permitting efforts.

1.2 Role of the Landfill Advisory Committee

The Mayor appointed a nine-member LAC for the purpose of providing a representative community voice in assisting the City in completion of the landfill siting study (note: one member later resigned due to scheduling conflicts). The LAC assisted, in an advisory role, in evaluating, scoring, and ranking potential landfill sites under consideration with the understanding that the final determination on a final landfill site location will rest with the City.

LAC members attended a series of eight public meetings between October 2021 and June 2022 to help develop processes to evaluate and score potential landfill sites.

The meetings were conducted by City staff and the City's consultants to present information and answer questions, but they did not actively participate in the site evaluation or scoring process. The LAC process was conducted in compliance with the Sunshine Law. See Section 3 for discussion of the LAC's role and appointment, and overview of the LAC process.

1.3 Site Identification Process Overview

In 1991, the United States Environmental Protection Agency set forth regulations governing the design and operation of MSW landfills under the Resource Conservation and Recovery Act (RCRA). These regulations deal with MSW and are referred to as RCRA Subtitle D regulations.

The State of Hawai'i Department of Health Hawai'i Administrative Rules, which incorporated the RCRA Subtitle D regulations and additional state-specific requirements, includes restrictions on new MSW landfill locations that are specific to wetlands, floodplains, airport safety, fault areas, seismic impact zones, unstable areas, and tsunami zones; these restrictions are detailed in Section 4.1. In addition, state legislation was adopted through passage of State House Bill 2386 (Act 73) in September 2020, prohibiting location of a waste disposal facility in a conservation district and within one-half mile of residences, schools, and hospitals.

ENV established conceptual grading design criteria to evaluate potential site locations as discussed in Section 4, of which a minimum 20-year life cycle was of most importance.

1.3.1 GIS-Based Evaluation

ENV used a Geographical Information System (GIS)-based desktop-level evaluation of the island of O'ahu using readily available State of Hawai'i, City and County government agency data supplemented by consultation with technical experts. The GIS based approach is discussed in detail in Section 4.3.

1.3.2 Review of Previous Siting Studies

Individual base layers were developed in the GIS model using the regulatory restrictions discussed in Section 4.3.1. The 43 preliminary and 11 final potential landfill sites from the *2012 Report of the Mayor's Advisory Committee on Landfill Site Selection* (2012 MACLSS) and *2017 Assessment of Municipal Solid Waste Handling Requirements for the Island of Oahu* studies were added to the GIS model and compared against the regulatory restrictions. The majority of the previous study sites were eliminated as potential sites.

1.3.3 Development of Areas/Sites for Evaluation

ENV initially identified 12 areas that appeared to meet the regulatory restrictions using the GIS model. After additional review, eight of those areas were eliminated

and, from within the four remaining areas, six potential landfill sites meeting the minimum required waste disposal capacity were identified for evaluation by the LAC.

1.4 Site Evaluation and Recommendations

A methodology was developed to evaluate the six potential landfill sites using the following four steps:

- Develop objective and subjective evaluation criteria.
- Develop weighting, rating, scoring, and ranking method.
- Research and collect data to develop potential landfill site technical support information for rating and scoring.
- Apply weights, ratings, scoring, and final site rankings.

1.4.1 Evaluation Criteria Process

ENV used the 2012 MACLSS study as a basis to develop a draft list of site evaluation criteria for discussion with the LAC. ENV incorporated the LAC's comments, particularly their concerns related to protecting O'ahu's drinking water resources following the Board of Water Supply's presentation, into a revised final list of evaluation criteria consisting of 9 objective criteria and 8 subjective criteria, which are discussed in Section 5.2. The LAC scored and ranked the sites using the methodology described in Section 5.3.

1.4.2 Site Scoring and Ranking

The final site scoring and ranking was presented to the LAC in April 2022 for discussion. The final site rankings and total scores are shown in Table 1.1, and the LAC's observations and recommendations from that discussion are presented in Section 6.3.

Table 1.1 Final Site Scoring and Ranking			
Rank	Area, Site	Location	Score
1	Area 6, Site 1	Wahiawā near Kunia Road	4,200
2	Area 7, Site 1	Kapolei/Waipahu near Kunia Road	4,061
3	Area 3, Site 1	Wahiawā	3,841
4	Area 3, Site 2	Wahiawā	3,685
5	Area 3, Site 3	Wahiawā	3,634
6	Area 2, Site 1	Hale'iwa near Kawailoa Road	3,596

Note: The LAC ranked the sites but generally agreed that landfills should not be developed over drinking water resources.

1.4.3 LAC Recommendations

Evaluating and scoring potential landfill sites is an extremely challenging undertaking, especially in consideration of the fact that all proposed sites are in or near culturally, ecologically and/or environmentally sensitive areas, including the Board of Water Supply No Pass Zone. All LAC members expressed concerns related to the location of the proposed sites in the No Pass Zone and, consequently, the potential implications for O'ahu's drinking water resources. The LAC approved a motion not recommending any of the final landfill sites due to their location within the No Pass Zone and made additional recommendations for the City as follows:

- Explore amending Act 73 to allow more suitable sites outside of the No Pass Zone.
- Request more time from the LUC to explore amending Act 73, and thoroughly evaluate federal owned and leased land, and eminent domain options for parcels outside the No Pass Zone.

LAC members' concerns and objections related to the proposed landfill sites are captured in Section 6.3, individual member statements are provided in Appendix A, and meeting minutes are provided in Appendix B.

City administration will carefully evaluate the information, findings and opinions contained in the report as it proceeds with naming a new landfill site, pursuant to the 2019 Hawaii State Land Use Commission decision and order.

2 Introduction

This O'ahu Landfill Siting Study & Landfill Advisory Committee Recommendations Report (report) documents the activities of the City and County of Honolulu (City), Department of Environmental Services (ENV), in conducting a landfill siting study on the island of O'ahu and recommendations by the Landfill Advisory Committee (LAC) that evaluated, scored, and ranked potential new landfill sites. The LAC was appointed by the Mayor of the City for the purpose of providing a representative community voice to assist the City in completing the landfill siting study. The siting study is intended to be the initial step in identifying potential new landfill sites on O'ahu and to allow the ENV to move forward with technical studies and analyses in support of the design and permitting efforts, including the preparation of an environmental impact statement (EIS).

2.1 Need for a New Landfill Site

A municipal solid waste (MSW) landfill is an integral component of the City's solid waste management system and is a vital element for responsible management of MSW generated on O'ahu. Providing for and preserving future sufficient landfill capacity is necessary for the disposal of non-combustible MSW, construction and demolition (C&D) waste, Honolulu Program of Waste Energy Recovery (H-POWER)-related ash and residue, and other non-recyclable waste generated on O'ahu. A landfill provides a critical backup disposal site when H-POWER and other diversion facilities are unable to accept waste for processing (e.g., during periods of maintenance or repair). With the pending closure of the privately owned PVT Integrated Solid Waste Management Facility (PVT C&D Landfill), a City owned landfill becomes a critical component for the City's *Disaster Debris Management Plan*. Although the City will continue to develop and advance waste recycling and source reduction alternatives to reduce the need for a landfill, at present there are no alternative processes that do not generate waste by-products that cannot be further reused, recycled, or otherwise combusted. An MSW and ash monofill landfill remains, at this time, the most viable alternative for handling of refuse and by-products by the City and the residents it serves.

2.2 History and Lead Up to the LAC

ENV has completed several past landfill siting and environmental studies that led up to the permitting the Waimānalo Gulch Sanitary Landfill (WGSL) in the 1980s. Primary studies completed are listed below:

- *Inventory of Potential Sanitary and Demolition Landfill Sites*, August 1977.
- *Supplement to Inventory of Potential Sanitary and Demolition Landfill Sites*, November 1979.

- *Revised Environmental Impact Statement for Leeward Sanitary Landfill at Waimānalo Gulch Site and Ohikilolo Site*, 1984.
- *Final Supplemental Environmental Impact Statement for the Waimānalo Gulch Sanitary Landfill Expansion*, 2002.
- *Final Environmental Impact Statement for the Waimānalo Gulch Sanitary Landfill Lateral Expansion*, 2008.

In permitting WGSL, ENV was required under Hawai'i Administrative Rules (HAR) to obtain a Special Use Permit (SUP) from the State of Hawai'i Land Use Commission (LUC). HAR require an SUP to operate a landfill on Agricultural-zoned land. ENV operated WGSL under SUP No. 86/SUP-5 and SUP No. 2008/SUP-2 up until October 2009, whereupon the LUC granted the ENV SUP No. SP09-403 on October 22, 2009, authorizing a 92.5-acre lateral expansion and an extension of time to operate WGSL until July 31, 2012.

Condition No. 4 of SUP No. P09-403 required ENV to identify and develop one or more new landfill sites that shall either replace or supplement the existing WGSL on or before November 1, 2010. H-POWER ash and residue could continue to be accepted at WGSL beyond July 2012. The July 2012 date had been established by the LUC based on the estimated remaining MSW volume capacity at the WGSL and anticipated closure in 2012. In 2012, ENV completed the following site selection study to identify and rank potential landfill sites for consideration by the City in response to Condition No. 4:

- *Report of the Mayor's Advisory Committee on Landfill Site Selection (MACLSS)*, September 2012.

During the 2012 MACLSS process, ENV was instructed by the Mayor that the Committee was not to consider WGSL in their deliberations, as the current WGSL could not supplement or replace itself. ENV presented the Committee with the following instructions:

- The MACLSS's identification of landfill sites should include the provision for accepting MSW, C&D waste, and ash and residue from H-POWER.
- The City's intention is to utilize WGSL until its full capacity is reached. An important reason for this is that the City considers land a precious resource. Should a landfill site not be utilized to its full potential and capacity, it would represent an inefficient use of the land and public treasury since it would prematurely require the use of a new landfill site and involve new, major capital expenditures for development.
- The sites the Committee will evaluate and rank will be considered for future use by the City as it proceeds with its site selection and EIS process once the WGSL waste capacity is reached.

The 2012 MACLSS identified 11 potential landfill sites that were ranked based on community criteria developed by the Committee and ENV.

In 2017, ENV completed a study to assess the City's solid waste management system, materials requiring landfill disposal, the remaining lifespan of WGS�, and the year the City should begin development of a future MSW landfill. The study, listed below, also reviewed the 11 sites identified by the 2012 MACLSS selection study and examined them based on a technical and logistical review:

- *Assessment of Municipal Solid Waste Handling Requirements for the Island of Oahu*, November 2017.

The 2017 Assessment concluded that based on current waste projections, the WGS� would have capacity until 2038, and assuming a conservative timeline of 10 years to develop a new landfill, it was recommended to begin the siting process for a new landfill in 2028. It was also recommended that during the period between 2028 and 2037, the City should reanalyze the sites ranked in the report and investigate potential new landfill sites; conduct the site selection; undertake land acquisition (e.g., negotiation, condemnation, purchase); obtain environmental permits, land use permits, and operating permits; and conduct site planning, design, engineering, and construction.

Upon the granting of SUP SP09-403 on October 22, 2009, several appeals were filed by intervenors between 2009 and 2019 to inhibit the expansion and extension of time for WGS�. Additionally, over that period, ENV filed applications to extend or remove the July 2014 date requiring WGS� to cease accepting waste and close. The 2017 Assessment had shown that the remaining waste capacity of WGS� was estimated to extend well beyond 2014 due to the expansion of the H-POWER facility in 2012 and recycling efforts implemented by the City which significantly reduced the MSW volume being landfilled. After several hearings, the LUC granted revised conditions to SUP SP09-403 on November 1, 2019, that authorized an extension of time for WGS� to cease accepting waste and close. The revised conditions superseded the existing conditions of SUP SP09-403 while still allowing the 92.5-acre lateral expansion. Significant changes to conditions in revised SUP SP09-403 that "led up" to the appointment of the LAC and completion of this study are as follows:

Condition No. 1 – "The WGS� shall close by no later than March 2, 2028. The WGS� shall not accept any form of waste after March 2, 2028."

Condition No. 5 – "By no later than December 31, 2022, the Applicant shall identify an alternative landfill site that may be used upon closure of WGS�. Upon identification of the alternative landfill site, the Applicant shall provide written notice to Planning Commission and the LUC."

Copies of the documents listed in this section can be obtained at the ENV Refuse Division website: <https://www.honolulu.gov/opala/newlandfill.html>.

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3 Landfill Advisory Committee

As discussed in Section 2, the LAC was appointed by the Mayor for the purpose of providing a representative community voice in assisting the City in completion of the landfill siting study. This section further describes the LAC's role, appointment, and overview of the LAC process.

3.1 LAC Role

The members of the LAC were asked to assist in evaluating and scoring potential landfill sites under consideration by the City. The LAC was tasked with this undertaking with the understanding that its role is advisory and that the final determination on landfill site location will rest with the City. After the LAC completes its assignment, the committee will conclude. The City will then make its determination and begin the planning, permitting, and development process for a new landfill, which will involve preparation of an EIS and implementation of local community outreach programs.

LAC members were asked to attend scheduled meetings, review information, ask questions, and assist the City's technical consultants in the processes developed for evaluating and scoring a list of potential landfill sites. LAC members were asked to participate with an open mind and raise questions and concerns with the intent of working through any issues in a productive and respectful manner. As LAC members representing the residents of O'ahu, their participation was critical to ensure that the landfill site selection process is transparent and instill confidence in the results. It was discussed with the LAC that in order to maintain neutrality during the process, City staff would not actively participate in the site evaluation or scoring process, but would be present at LAC meetings only to assist the City's technical consultants in presenting information for discussion and answering questions from LAC members or the public.

3.2 Appointment of the LAC

After starting with a list of over 30 candidates and careful consideration of their backgrounds, availability, and potential willingness to serve, ENV prepared a list of 11 individuals approved by the Mayor to serve on the LAC. The individuals represented a wide range of professional backgrounds and community involvement, including government, University of Hawai'i affiliation, neighborhood boards, and industrial, construction, engineering, cultural, environmental, and other businesses. The intent was to select individuals within the community who could offer an understanding of issues and concerns from the community's point of view and whose voices would

add significant value to the LAC to ensure that the site selection process produced the best result for the residents of O'ahu.

ENV sent a letter to each of the 11 individuals informing them that they were selected as possible member candidates and inviting them to attend a planned Virtual Pre-LAC Meeting where detailed information about their involvement in the advisory committee and an overview of the site selection process would be shared. The meeting was held on August 30, 2021. Information presented and provided at the meeting is provided in Appendix A.

Following the meeting, the 11 individuals were contacted by ENV to confirm their desire to be members of the LAC. Nine of the contacted individuals confirmed their desire to be members, with one of those members resigning from the committee halfway through the process due to schedule conflicts. The final eight individuals who participated during the entire LAC process are listed in Table 3.1.

Table 3.1 LAC Members	
Member	Industry Affiliation
Steven Chang	Environmental Regulation
Suzanne Jones	Solid Waste/Recycling
Ken Kawahara	Professional Engineer/Civil Engineering
Trisha Kehaulani Watson	Environmental Justice/Cultural Resources
Emmett Kinney	General Contracting
Brennon Morioka	Professional Engineer/Civil Engineering
James Nakatani	Agribusiness Development
Cynthia Rezentes	Classical Electrical Engineering/Community Advocate

3.3 Overview of the LAC Process

The process utilized by the LAC was established by the City to follow a timeframe that included a pre-committee meeting and eight LAC meetings over a 9-month period. Meeting dates and topics discussed by the LAC are outlined in Table 3.2.

Table 3.2 Landfill Advisory LAC Meeting Summary

Meeting Number	Meeting Date	Meeting Topics
Pre-Committee Meeting	August 30, 2021	• Mayor and ENV Director welcome • Introduction of Project Team – ENV, Refuse Division, and Consultants • ENV Presentation – Introduction of LAC member expectations • ENV Presentation – Landfill history • ENV Presentation – Purpose of the LAC • ENV Presentation – Expectations of committee members & proposed meeting schedule/platform
1	October 4, 2021	• Introduction of LAC members and Project Team • ENV Presentation – LAC purpose, expectations, meeting process, role of the LAC, and anticipated LAC meeting schedule • City Department of Corporate Counsel Presentation – Sunshine Law • ENV Presentation – Overview of Existing Solid Waste Program • ENV Presentation – Regulatory Requirements for New Landfill Design and Operation • Discussion on Limited Meeting Requirements for Site Tours
2	October 25, 2021	• ENV Presentation and Adoption – LAC Rules • ENV Presentation and Approval – Limited Meeting #3 Site Tours
3	November 3, 2021 (Limited Meeting)	• Tour of PVT C&D Landfill, Waimānalo Gulch Sanitary Landfill, and H-POWER
4	December 14, 2021	• ENV Presentation – LAC Meeting #3 Recap • ENV Presentation – Results of Resident Landfill Survey • BWS Presentation – O'ahu's Groundwater Aquifer and Siting a New Landfill • ENV Presentation – Groundwater Protection

Table 3.3 Landfill Advisory LAC Meeting Summary Cont.		
Meeting Number	Meeting Date	Meeting Topics
		- Measures for Municipal Solid Waste Landfills - ENV Presentation – Site Evaluation Criteria
5	February 7, 2022	- Introduction of the New Director of the Department of Environmental Services - BWS Presentation – Board of Water Supply - ENV Presentation and Approval – Final Site Evaluation Criteria - ENV Presentation –Evaluation Scoring Methodology
6	March 7, 2022	- ENV Presentation – Landfill Location and Drinking Water Protection - ENV Presentation – Potential Landfill Sites - ENV Presentation – Subjective Evaluation and Scoring Methodology
7	April 4, 2022	- ENV Presentation – Objective Criteria Evaluation - ENV Presentation – Site Scores and Rankings - ENV Presentation ENV Presentation – Contents of the LAC Report - ENV Presentation – Potential Benefits for Landfill Host Community
8	June 6, 2022	- Draft Report Revisions and Potential Community Benefits - Conclusions

All meetings were conducted remotely using interactive conference technology except Meeting 7, which was held in person at Kapolei Hale, and Meeting 8, which was conducted both in person at Kapolei Hale and remotely using interactive conference technology. Remote virtual meetings were conducted pursuant to Governor David Y. Ige's Emergency Proclamations Related to the COVID-19 Response, issued and updated at various times during the LAC meeting schedule. Remote meetings using interactive conference technology were conducted to allow

LAC and public participation in a manner consistent with safe practices and social distancing requirements.

All LAC meetings were conducted in compliance with the Sunshine Law, which is Hawai'i's open meeting law as outlined in Hawai'i Revised Statutes (HRS), Part 1, Chapter 92 Public Agency Meetings and Records. The intent of the Sunshine Law is to establish policy that allows discussions, deliberations, decisions, and actions of governmental agencies to be conducted as openly as possible to public scrutiny and participation. The Sunshine Law was applicable to the LAC process because the LAC was an advisory body to the Mayor. The LAC received training on the Sunshine Law at LAC Meeting 1 from the City's Department of Corporate Counsel.

The LAC conducted one "Limited Meeting" in compliance with the Sunshine Law coordinated by ENV for three refuse facility tours on November 3, 2021. The on-site Limited Meeting was approved by the LAC due to health and safety requirements necessary to tour the facilities that would make it impracticable for the public to attend because of the practices and social distancing requirements of the COVID-19 Emergency Proclamations. Site tours were conducted at H-POWER, PVT C&D Landfill, and WGSF facilities.

In addition to complying with Sunshine Law requirements, LAC Rules were adopted by the LAC at Meeting 2 on October 25, 2021. The intent of the LAC Rules was to outline the framework under which the meetings will be conducted and the member participation and responsibilities that will allow the LAC to complete their assigned tasks.

The LAC Rules included the following items:

- Authority and Membership
- Purpose and Objective
- Quorum and Voting
- Meetings
- Agenda
- Public Testimony
- Correspondence
- Action by LAC
- Minutes
- Evaluation and Scoring of Landfill Sites
- Conflicts of Interest
- Amendment of Rules
- Effective Date

LAC meeting agendas, minutes, written public comment, and presentation materials are provided in Appendix B. LAC rules are provided in Appendix B-2.

3.4 Public Outreach and Incorporation into the LAC Process

The City informed O'ahu's residents about the landfill siting process and educated them about on-island solid waste management through multiple means. The City also encouraged residents to get involved in the process. A description of each of the various efforts follows.

3.4.1 Dedicated Webpage

The "New Landfill Siting" webpage was created on ENV's Refuse Division website during the early stages of the landfill siting process in Summer 2021. The page included information about the siting process, LAC members, and LAC meetings along with downloadable copies of the meeting materials. In addition, the page detailed the restrictions to the landfill siting process and included a link to an interactive map that overlaid the restrictions for an easy-to-use visual guide. An email address (newlandfill@honolulu.gov) was provided on the webpage for visitors to send any comments or questions to City staff involved with the project. Any comments from the public were shared with the LAC, when applicable. Questions received were presented on the Questions and Answers section of the site along with responses and related information. ENV staff updated the webpage as comments were received and as LAC meetings occurred. The webpage can be found at <https://www.honolulu.gov/opala/newlandfill.html>.

3.4.2 C&C of Honolulu ENV Refuse Division Resident Landfill Survey

The "C&C of Honolulu ENV Refuse Division Resident Landfill Survey" was formed to bring awareness to the public about the landfill siting process. The tool was also used to determine O'ahu residents' knowledge of the current solid waste program and to obtain input for consideration during the siting process. The survey utilized a user-friendly, online format for ease of dissemination and was promoted through the ENV Refuse Division website, advertisement posters displayed at City facilities, advertisements on the Department of Transportation Services' TheBus, Refuse Division social media platforms, and announcements at early LAC meetings. The survey was launched in August 2021 and was closed in January 2022. It received 561 responses and the results of the survey were presented in LAC Meeting 4. As an additional incentive for residents to complete the survey, ENV worked with the Honolulu Zoo to grant a one-year membership to an individual survey-taker by way of a randomized raffle.

3.4.3 Bus Advertisement Posters

ENV utilized the Department of Transportation Services' TheBus advertising agreement to display advertisement posters spreading awareness about the landfill siting process and to encouraging riders to participate in the "C&C of Honolulu ENV Refuse Division Resident Landfill Survey." The posters were displayed for a month, through October 2021, in 540 buses encompassing 100 bus routes that covered streets from Mākaha to Makapu'u and Waikīkī to Turtle Bay. According to TheBus' contracted advertisement agency, annual ridership is approximately 70 million, which averages to almost 6 million per month. The advertisement poster is provided in Appendix C.

3.4.4 Advertisement Posters at City Halls and Satellite City Halls

Advertisement posters were displayed at City facilities with high public foot traffic. These facilities included: Fasi Municipal Building, Honolulu Hale, Kapālama Driver Licensing Center, Kapālama Hale, Kapolei Driver Licensing Center, Kapolei Hale, Ko'olau Driver Licensing Center, Pearl City Commercial Driver Licensing Center, Wahiawā Driver Licensing Center, and Wai'anae Driver Licensing Center. The posters were intended to spread awareness about the landfill siting process and to encourage residents to participate in the "C&C of Honolulu ENV Refuse Division Resident Landfill Survey." They were displayed throughout the duration of the survey. The advertisement poster is provided in Appendix C.

3.4.5 Social Media

Social Media outlets were important tools that allowed ENV to engage with a large number of residents in a quick time frame for minimal to no cost. In addition, it allowed residents who are interested in solid waste issues to contact ENV easily and interact with ongoing topics.

ENV used Facebook, Twitter, and YouTube platforms to inform and educate followers about the landfill siting process and the current solid waste management program on O'ahu. There have been 59 posts, and outreach by this method will continue for the foreseeable future. Posts were created by ENV staff and were published on Facebook and Twitter routinely to maintain a steady source of information and updates. LAC meeting recordings were uploaded to YouTube for viewing. To further ENV's outreach, a Facebook post related to the "C&C of Honolulu ENV Refuse Division Resident Landfill Survey" was boosted to reach an extended audience. By boosting the post, it was made visible to Facebook users on O'ahu beyond those who already follow the Refuse Division page. The boosted post received 11,000 impressions, reached 5,100 people, and had 300 engagements. The boosted Facebook post is provided in Appendix C. ENV's Refuse Division

Facebook page is @HNL.Opala, and the ENV department-wide Twitter profile is @HNL_ENV.

3.4.6 Neighborhood Board Meetings

Messages with important updates on the LAC process were presented by the mayor's representatives at neighborhood board meetings.

3.4.7 Press releases

Four press releases were initiated for key points in the project. These included the announcement of the formation of the LAC, the release of the survey, a survey reminder and extension, and the announcement of the *Insights on PBS Hawai'i* broadcast (see Section 3.4.10).

3.4.8 City Council Presentations

A presentation regarding compliance with Act 73 and the remaining areas eligible for siting a landfill was provided to the City Council Joint Committee on Zoning and Planning and Transportation, Sustainability and Health on April 27, 2021, and another presentation on the formation of the LAC and updating the status of the landfill siting process was provided to the full City Council on August 26, 2021.

3.4.9 Council Member/State Representative/Senate Messages

Twenty different emails were sent to City Council, State Representative, and State Senators' offices to let them know about various updates to the landfill siting process, including topics such as announcement of the LAC, LAC meeting agendas and recordings, survey invitations, and the *Insights on PBS Hawai'i* broadcast (see Section 3.4.10).

3.4.10 Cable Broadcast Interview

In April 2022, *Insights on PBS Hawai'i* aired a special titled, "In Search for a New Landfill on O'ahu" that included ENV Director Roger Babcock, Jr. Ph.D., P.E. as one of the panelists to discuss the landfill siting process from the City's standpoint. ENV collaborated with *Empowered Hawai'i* for the "Earth Day: Trash to Treasure" episode in April 2022. The episode discussed the importance of reducing waste and recycling to prevent material ending up at the landfill.

3.4.11 Public Presentations

ENV Refuse Division, Recycling Branch and H-POWER conducted 28 educational presentations regarding refuse and recycling, including ties to the landfill, at schools and community group meetings from January 2021 through June 2022.

3.4.12 Tradeshow Event

Between January 2021 and June 2022, the ENV Refuse Division, Recycling Branch attended one tradeshow event to interest and educate the public about the Refuse Division's work.

3.4.13 Tours at Refuse Facilities

Between January 2021 and June 2022, the ENV Refuse Division, Recycling Branch and H-POWER hosted 20 tours at H-POWER, the landfill, and other Refuse facilities.

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4 Identification of Potential Landfill Sites

4.1 Restrictions and Parameters for Landfill Siting

4.1.1 Federal and State Solid Waste Management Rules

In 1991, under the federal Resource Conservation and Recovery Act (RCRA), the United States (U.S.) Environmental Protection Agency (EPA) promulgated regulations governing the design and operation of MSW landfills. These regulations pertained to RCRA Subtitle D, which deals with MSW, and are commonly referred to as Subtitle D regulations.

In January 1994, the State of Hawai'i Department of Health (DOH) adopted HAR, Title 11, Chapter 11, Solid Waste Management Control. These state rules incorporated the federal Subtitle D regulation requirements and additional state-specific requirements. As with the federal regulations, the Hawai'i rules include restrictions regarding new MSW landfill locations. These restrictions are summarized in Table 4.1. One listed siting restriction - Airport Safety - requires a specific setback distance, and one additional siting restriction - Tidal Wave (Tsunami) Zones - is exclusionary; both were applied directly in this siting study. The remaining restrictions are specific to the technical characteristics (e.g., geology, hydrogeology, seismic) of the site location. Until further technical analyses and field investigations can be completed for a selected site location, technical assumptions are made to determine whether these restrictions are met or if engineering measures can be incorporated in the design that meet the restrictions.

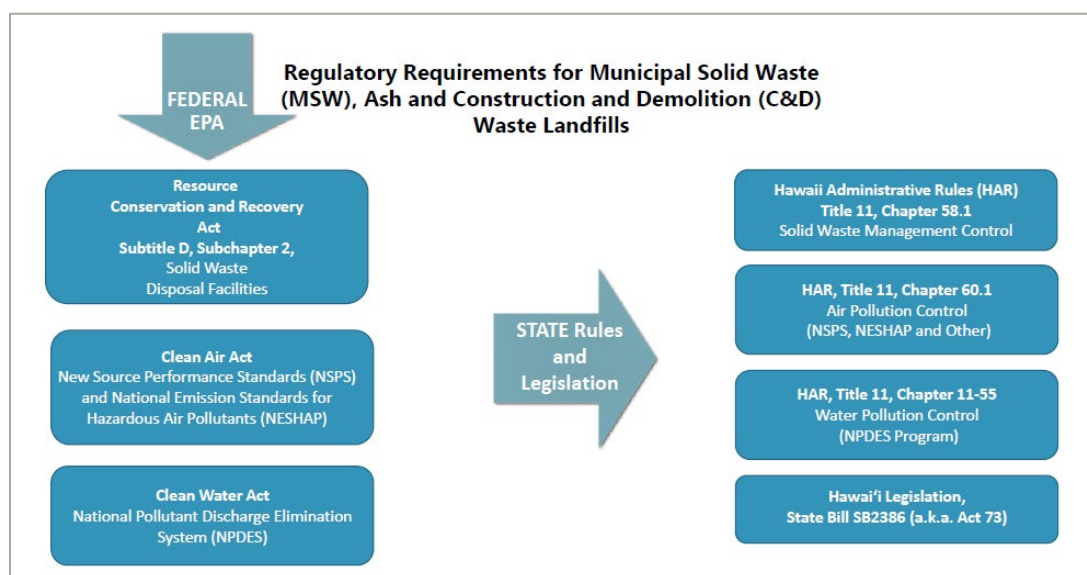
Table 4.1 Federal and State Landfill Site Analysis Restrictions

Restriction	Definition
Wetlands	Must not be located in wetlands or must demonstrate that the landfill will not cause violations to applicable state and federal water standards, including the Clean Water and Endangered Species Acts.
Floodplains	Must not be located in a 100-year floodplain or must demonstrate that the landfill will not restrict the flow of a 100-year flood, reduce the floodplain's temporary water storage capacity, or result in MSW washout.
Airport Safety	Must meet 10,000-foot setback requirements from airport runways used by turbojets or must demonstrate that the landfill will not pose a bird hazard to aircraft.

Table 4.1 Federal and State Landfill Site Analysis Restrictions Cont.	
Restriction	Definition
Fault Areas	Must not be located within 200 feet of a fault that has had displacement in Holocene time or must demonstrate that an alternative setback distance will maintain the landfill's structural integrity.
Seismic Impact Zones	Must not be located in seismic impact zones or must demonstrate that all liners, leachate collection systems, surface water controls, and other systems are designed to resist maximum horizontal accelerations.
Unstable Areas	Must not be located in an unstable area or must demonstrate that engineering measures have been incorporated in the design that will maintain the landfill's structural integrity.
Tidal Wave (Tsunami Zones)	Must not be located in a possible tsunami or extreme tsunami inundation area.

In addition to the federal and state-adopted Subtitle D rules, state legislation was adopted through passage of State House Bill (SB)2386 in September 2020. This bill, now known as Act 73, prohibits a waste disposal facility from being located in a conservation district and within one-half mile of residences, schools, and hospitals. Similar to the Airport Safety restriction described Table 4.1, setback distance requirements in Act 73 were applied directly in the siting evaluation. Figure 4.1 illustrates the federal and state regulations and rules related to solid waste management.

Figure 4.1 Federal and State Solid Waste Management Rules



4.1.2 City Ordinances and Resolutions

City ordinances are laws, or decrees, enacted by the City Council that typically regulate specific activities, whereas resolutions express the City Council's opinion or the City's policy on an issue or subject. Resolutions can also request an action by the City Administration or state government and, unlike ordinances, are not considered laws.

The City adopted Council Resolution 03-09, FD1, in April 2003, which established policy that MSW landfills should not be located anywhere above the DOH's Underground Injection Control (UIC) line, within the Board of Water Supply's (BWS) groundwater protection zone (No Pass Zone), or over any of the City's underground drinking water sources. In response to the City resolution, the BWS included the following definition of the No Pass Zone in their Rules and Regulations:

- No Pass Zone means areas in which the installation of waste disposal facilities, which may contaminate groundwater resources used or expected to be used for domestic water supplies, shall be prohibited.

The DOH UIC line per HAR, Title 11, Chapter 23, is defined as:

- UIC line or "the line" means the line on the DOH UIC maps that separates, in plain view, exempted aquifers and an underground drinking water source.

There are no City-adopted ordinances related to siting of MSW landfills on O'ahu.

4.1.3 Planning Horizon and Landfill Sizing

In managing a community solid waste management system, it is important to evaluate and develop a planning horizon, particularly for feasible and cost-effective options for MSW disposal. Section 2.1 describes, in more detail, why this step is crucial for the City. ENV established the goal early in the planning process to site a new landfill with a minimum life cycle of 20 years due to the time and effort required to complete the full siting, permitting, design, and development processes.

Estimating the minimum disposal capacity for 20 years required projecting future volumes of MSW, H-POWER ash and residue, asbestos, and C&D waste over the entire 20-year period. Additionally, current waste densities (airspace utilization factors) for the WGSF were used, and various recycling rates for C&D waste were assumed for the estimate. Current and projected waste volumes and population data were obtained from the City's *2019 Integrated Solid Waste Management Plan* (ISWMP) and estimated for the period 2028 through 2048. The period start date represents the date when a new landfill is fully operational. The volume estimates presented in Table 4.2 show that approximately 21.5 million cubic yards (mcy) of waste disposal capacity is needed for a minimum 20-year site life at a 25 percent recycling rate (75 percent disposal column).

Table 4.2 20 Year Waste Disposal Volume Estimates									
TOTAL ASSUMED DISPOSAL VOLUMES (TNS)						C&D DISPOSAL (% & TNS)			
Year	MSW/Ash/Residue	MSW	Ash	Residue	Asbestos	C&D 100%	C&D 75%	C&D 50%	C&D 25%
2028	287,500	67,083	172,500	47,917	5,000	338,835	254,126	169,417	63,531
2029	293,250	68,425	175,950	48,875	5,000	345,611	259,208	172,806	64,802
2030	299,115	69,794	179,469	49,853	5,000	352,523	264,393	176,262	66,098
2031	305,097	71,189	183,058	50,850	5,000	359,574	269,680	179,787	67,420
2032	311,199	72,613	186,720	51,867	5,000	366,765	275,074	183,383	68,769
2033	317,423	74,065	190,454	52,904	5,000	374,101	280,576	187,050	70,144
2034	323,772	75,547	194,263	53,962	5,000	381,583	286,187	190,791	71,547
2035	330,247	77,058	198,148	55,041	5,000	389,214	291,911	194,607	72,978
2036	336,852	78,599	202,111	56,142	5,000	396,999	297,749	198,499	74,437
2037	343,589	80,171	206,153	57,265	5,000	404,939	303,704	202,469	75,926
2038	350,461	81,774	210,277	58,410	5,000	413,037	309,778	206,519	77,445
2039	357,470	83,410	214,482	59,578	5,000	421,298	315,974	210,649	78,993
2040	364,620	85,078	218,772	60,770	5,000	429,724	322,293	214,862	80,573
2041	371,912	86,779	223,147	61,985	5,000	438,319	328,739	219,159	82,185
2042	379,350	88,515	227,610	63,225	5,000	447,085	335,314	223,543	83,828
2043	386,937	90,285	232,162	64,490	5,000	456,027	342,020	228,013	85,505
2044	394,676	92,091	236,806	65,779	5,000	465,147	348,860	232,574	87,215
2045	402,569	93,933	241,542	67,095	5,000	474,450	355,838	237,225	88,959
2046	410,621	95,812	246,372	68,437	5,000	483,939	362,954	241,970	90,739
2047	418,833	97,728	251,300	69,806	5,000	493,618	370,213	246,809	92,553
2048	427,210	99,682	256,326	71,202	5,000	503,490	377,618	251,745	94,404
Total (20 YR TNS)	7,412,704	1,729,631	4,447,622	1,235,451	105,000	8,736,279	6,552,210	4,368,140	1,638,052
Total (20 YR CYS)	8,276,766	2,162,039	4,360,414	1,544,313	210,000	17,472,559	13,104,419	8,736,279	3,276,105
Total Including C&D (20 YR TNS)						16,148,983	13,964,913	11,780,843	9,050,756
Total Including C&D (20 YR CYS)						25,749,324	21,591,185	17,013,045	11,552,871

1. Total assumed volumes at year 2028 are average 2020 volumes received at WGSL and reported PVT C&D volumes (inflated 2% annually to 2048 volumes).
2. MSW/Ash/Residual and C&D annual increase assumed at 2% (2019 ISWMP).
3. Density/airspace utilization factors (AUF) (tons/cy) from WGSL 2019 Annual Operating Report.
 - a. MSW and Residue = 0.80 TNS/CY
 - b. Ash and Asbestos = 1.02 TNS/CY
 - c. Asbestos = 0.50 TNS/CY
4. Airspace utilization factors (AUF) (tons/cy) from example mainland C&D facilities.
 - a. C&D = 0.50 TNS/CY

Although C&D waste recycling rates typically range between 50 percent and 75 percent nationally, ENV assumed a more conservative rate of 25 percent because of the uncertainty in PVT C&D Landfill's scheduled closure and the need to identify, fund, and develop C&D waste recycling programs that will achieve a higher recycling and diversion rate.

4.2 Prior Landfill Siting Studies

Prior landfill siting studies completed by the City and relevant to this study are the 2012 MACLSS and 2017 Assessment studies described in Section 2.3. The approach to this siting study utilized general information presented in the prior studies. This includes the evaluation of the 43 preliminary sites listed in the 2012 MACLSS study and the 11 proposed final sites listed in both the 2012 MACLSS and 2017 Assessment studies for conformance with Act 73. The evaluation's results are described in Section 4.3. The screening criteria and approach in ranking and scoring the landfill sites in the 2012 MACLSS study were also reviewed and were considered applicable for this study.

4.3 Geographic Information System Based Evaluation

This section describes ENV's methodology in using a Geographical Information System (GIS) based evaluation approach for this study. ENV selected the use of a GIS-based approach due to the capacity to evaluate the entirety of the island of O'ahu using readily available information resources maintained by the State of Hawai'i, City, and County government agencies. However, the GIS-based system was selected with the following understandings:

- A GIS-based analysis is not a substitute for a more formal evaluation of a landfill site, which would be performed by the City in an EIS. An EIS level of assessment and evaluation must be performed for the proper identification of any landfill site prior to it being developed.
- A GIS-based analysis involves a desktop level of study, meaning basic research will be performed using only existing data sources supplemented by consultation with experts in other technical fields, as applicable, to the nature of the study. Fieldwork, including site surveys and detailed investigations, are not usually performed.

GIS-based evaluation of the final ranked and scored landfill sites is described in the following sections.

4.3.1 Step 1 - Review of Previous Siting Studies

Individual base layers were developed in the GIS model for four restrictions (two setback and two exclusionary types):

- Act 73 – One-half mile setback from residences, schools, and hospitals.

- Airport Safety – 10,000-foot setback from airport runways used by turbojet aircraft.
- Tidal Wave (Tsunami Zones) – Not located within a tsunami or extreme tsunami zone.
- BWS No Pass Zone – Not located within the BWS No Pass Zone.

ENV consulted the City Department of Planning and Permitting (DPP) requesting feedback for parcels that were not listed as residential-zoned but did show assessed building values with residential classifications in the real property records maintained by the City Department of Budget and Fiscal Services, Real Property Assessment Division. ENV requested confirmation from DPP whether legally permitted residences were located on certain parcels and, if so, the one-half mile residential setback was updated accordingly in the GIS base layer.

The 43 preliminary and 11 final potential landfill sites described in Section 4.2 were added as base layers in the GIS model and compared with the four regulatory restrictions. The majority, if not all, of the sites were eliminated as potential landfill sites due to one or more of the listed restrictions. These sites are shown in Figures 4.2 and 4.3.

4.3.2 Step 2 – Development of Final Four Areas

Using information developed in Step 1 and shown in Figures 4.2 and 4.3, ENV established twelve unrestricted areas to further evaluate as the next step. The twelve areas are shown in Figure 4.4. After further review, ENV eliminated eight of the areas for the following reasons:

- Federal parcels in Area 1 were eliminated due to ongoing military activities and other structures present on the parcel that would make the siting process very difficult, if not unattainable. ENV also understands that the purchase and/or use of federal property would require U.S. Congressional approval, which they believed would likely hinder the ability to meet the 2028 deadline imposed by the LUC.
- ENV continued consideration of federally owned Area 10 because ENV had operated the Waipahu Ash Landfill on the parcel through the late 1980s. ENV anticipated siting a new landfill in the Area could be less onerous than other federal parcels due to past ash landfilling activities that occurred on the parcel and current, active lease agreements with the U.S. Government for the parcel. However, ENV consulted with DOH to confirm if the extreme tsunami zone would restrict the siting of a landfill in the area. DOH informed the ENV that the extreme tsunami zone boundary shown would be enforced in the State permitting process. ENV eliminated Area 10 from further consideration due to the position taken by DOH and the remaining unrestricted area would not accommodate a landfill meeting the minimum disposal capacity.

Figure 4.2 43 Potential Landfill Sites (2012 MACLLS Study)

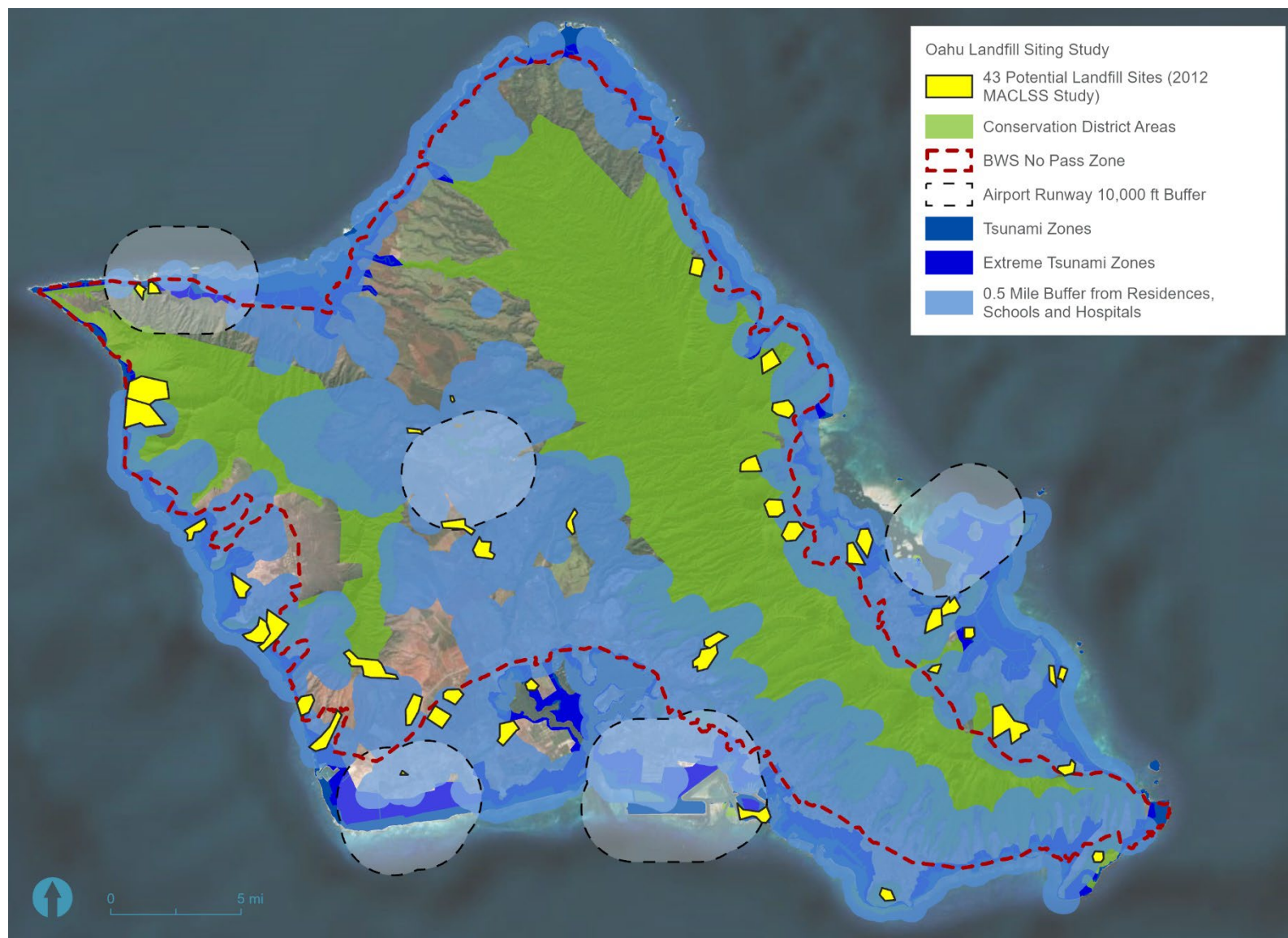


Figure 4.3 11 Final Landfill Sites (2012 MACLSS and 2017 Assessment Studies)

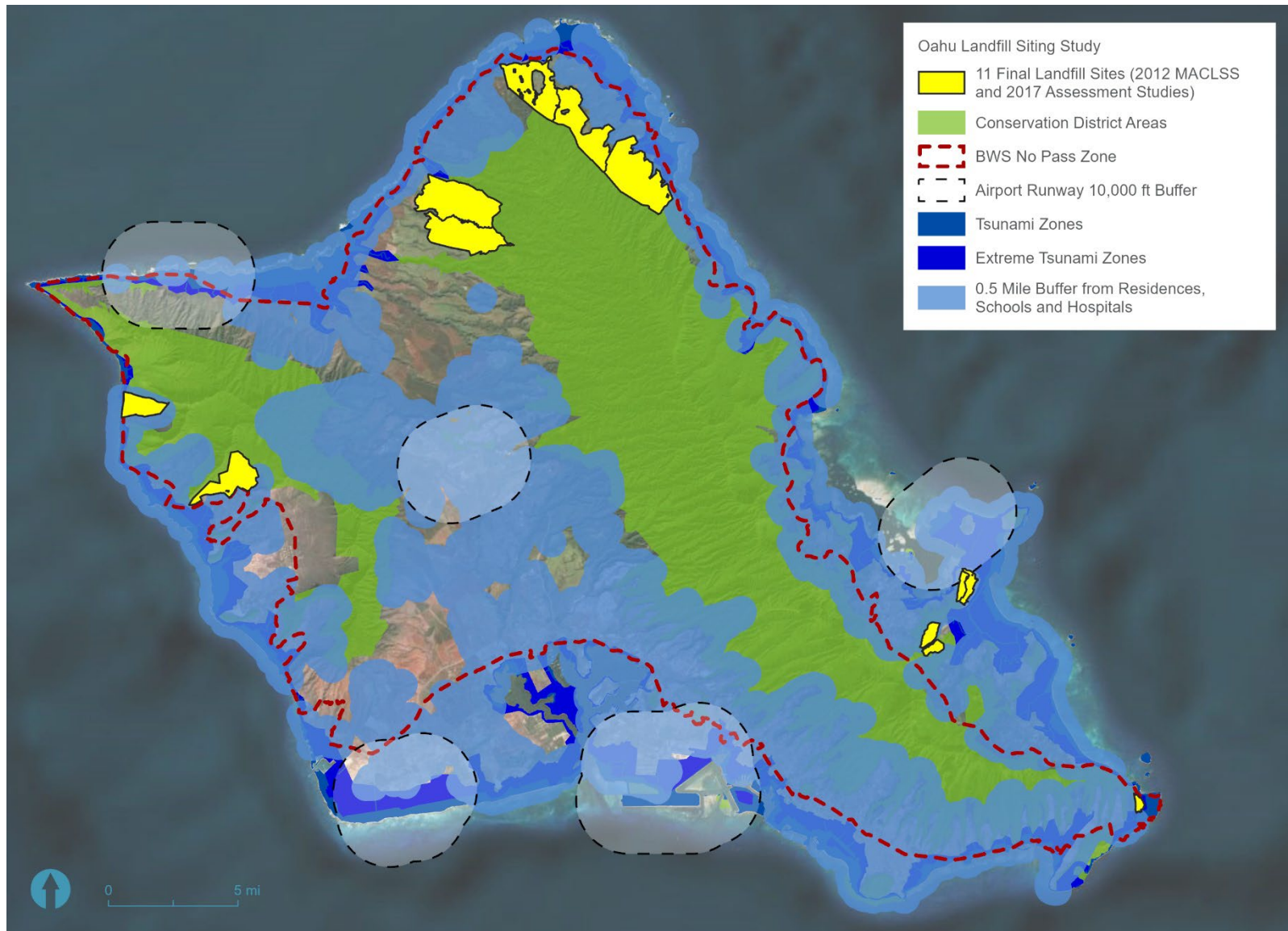
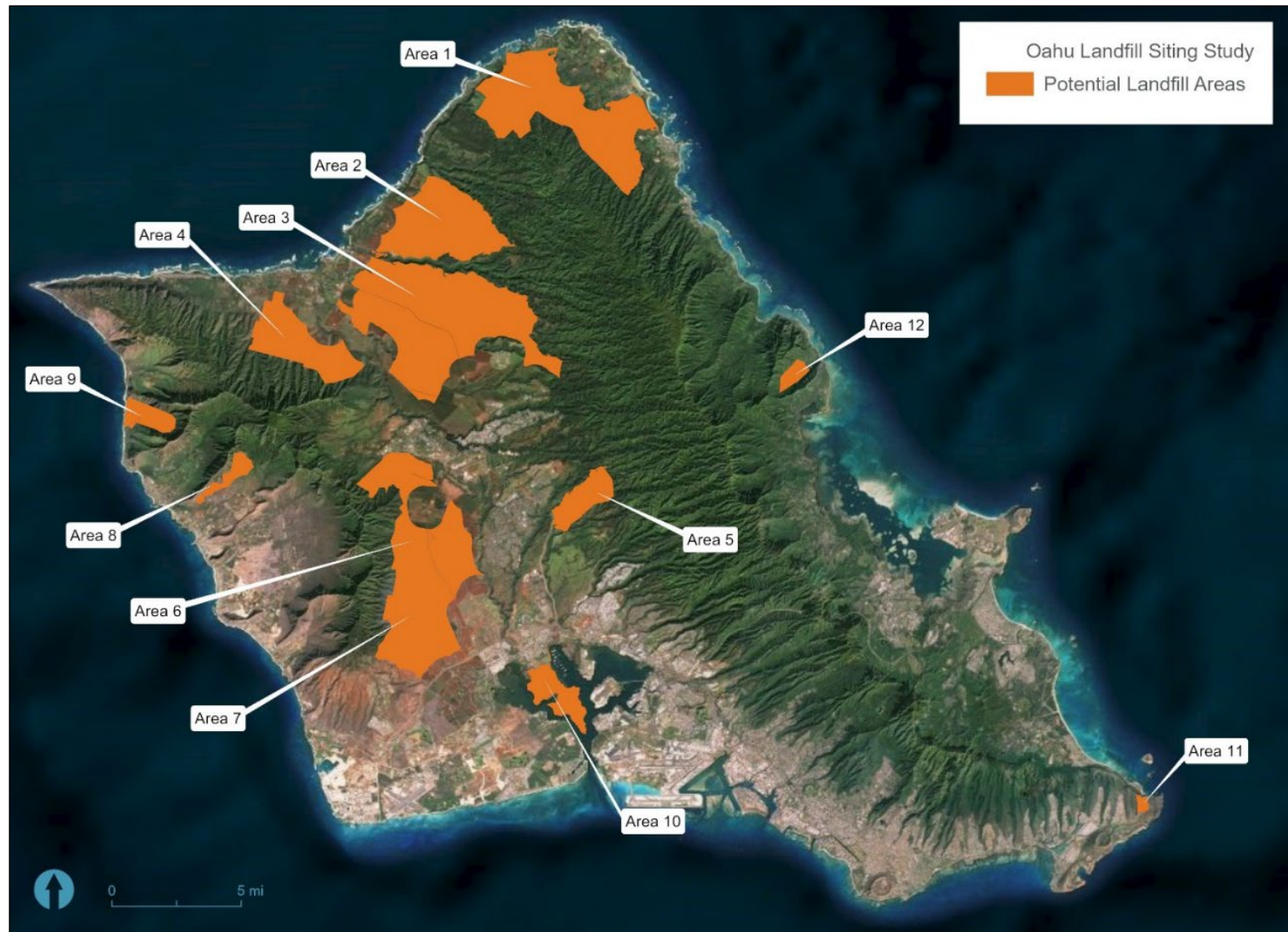


Figure 4.4 12 Areas for Potential Landfill Sites



- ENV eliminated all parcels that have a permitted residential structure in accordance with Act 73. ENV did not consider property condemnation to acquire and eliminate the residential structures. This decision eliminated Areas 9 and 12, and parcels in Areas 3, 4, and 7.
- ENV evaluated areas for access issues (e.g., limited or no access to available land); terrain issues (e.g., steep slopes); and planned, permitted, and existing developments that would make developing a parcel economically impractical. This effort eliminated Areas 8 and 11, and parcels in Areas 4, 5, and 6.

After eliminating the areas described above, the final four areas shown in Figure 4.5 became ENV's focus in completing the remaining steps for the study.

4.3.3 Step 3 - Landfill Site Locations and Conceptual Grading

During Step 3, ENV evaluated parcels in the final four areas to determine where potential landfill sites could be located that would meet the minimum waste disposal capacity described in Section 4.1.3. ENV established the following landfill design parameters to assist in evaluating landfill sites in the areas:

- 3:1 side slopes with 15-foot wide benches at 30-foot vertical intervals.
- 100-foot maximum height.
- 5 percent minimum sloped top area.
- 150-acre waste disposal footprint.
- 20-foot average excavation across entire footprint.
- Maintain one-half mile setback distance from residences.

The combined footprint area (plan view of disposal boundary), height, and other listed design parameters generally allow a minimum waste disposal capacity of 21.5 mcy, if located on flatter parcels. The parameters were adjusted, as necessary, to accommodate variations in terrain and for canyon type fills to achieve the minimum disposal capacity. A conceptual grading plan example is shown in Figure 4.6.

The evaluation and conceptual grading effort resulted in ENV selecting six potential landfill site locations, which are identified by area and site number. The final landfill sites selected by ENV and presented to LAC for scoring and final ranking are listed below and shown in Figures 4.7 through 4.12:

- | | |
|------------------|------------------|
| • Area 2, Site 1 | • Area 3, Site 3 |
| • Area 3, Site 1 | • Area 6, Site 1 |
| • Area 3, Site 2 | • Area 7, Site 1 |

Figure 4.5 Final Four Areas for Potential Landfill Sites

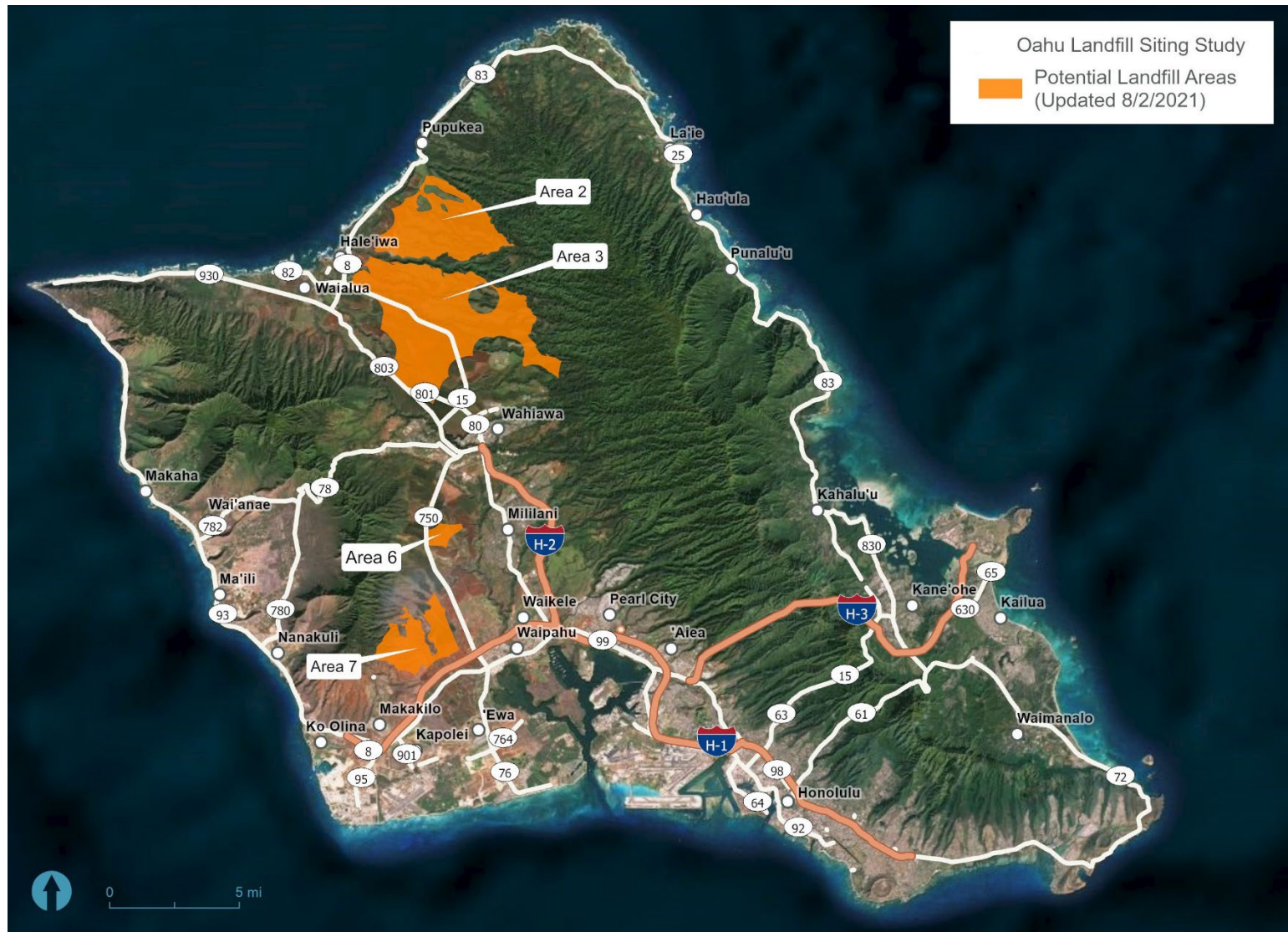
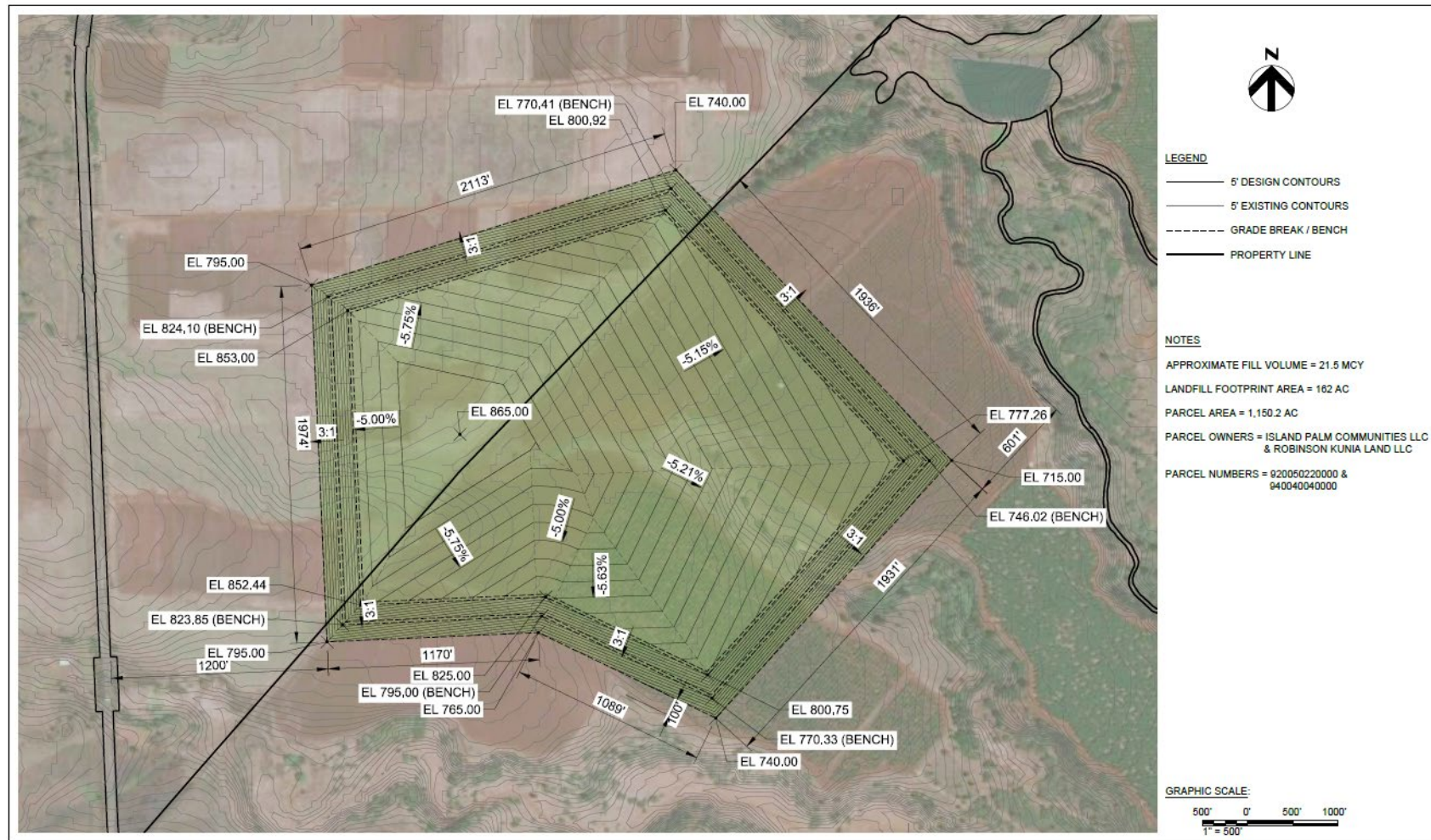


Figure 4.6 Conceptual Grading Plan Example



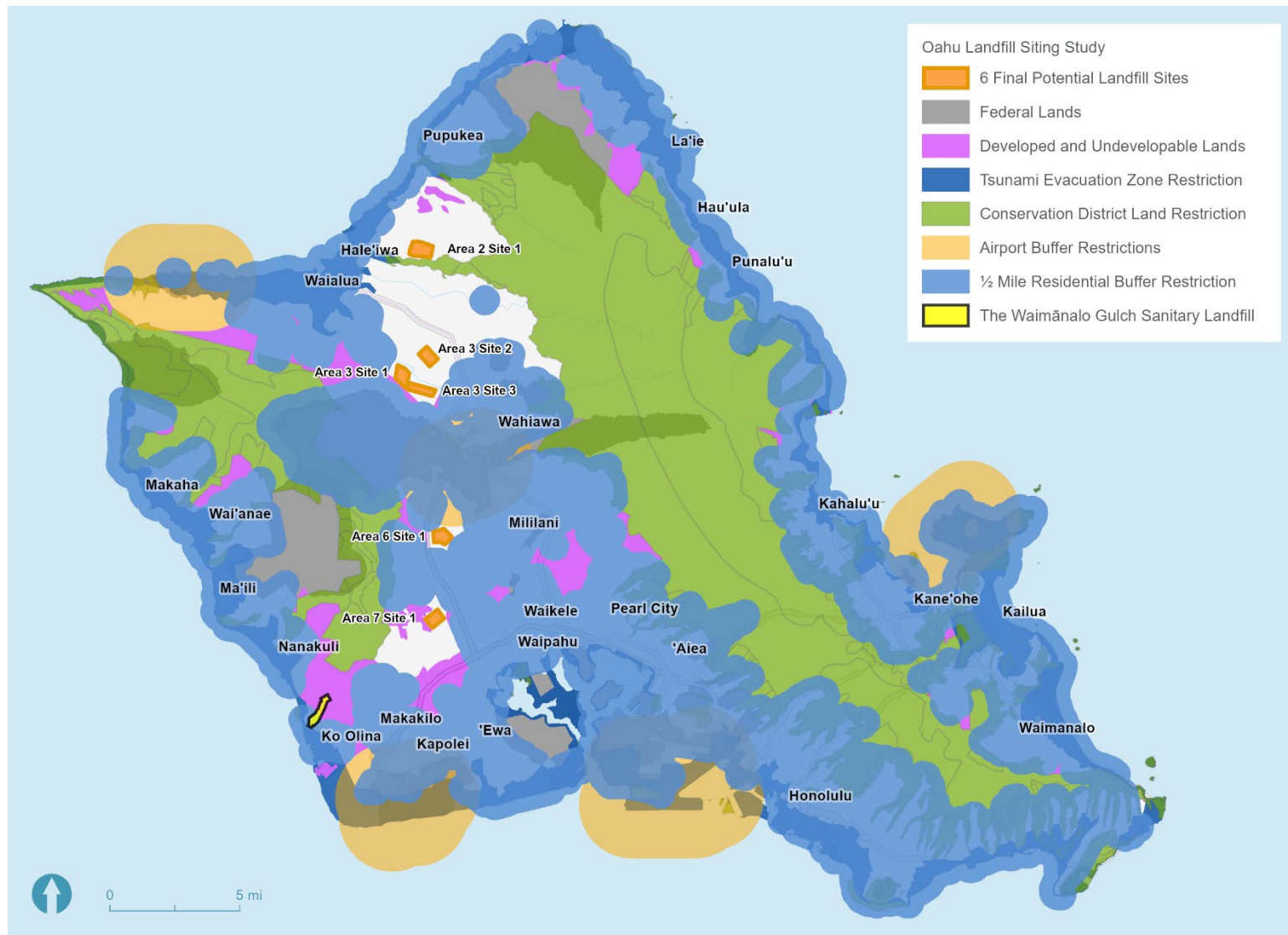
**OAHU LANDFILL SITING STUDY
AREA 6, SITE 1
CONCEPTUAL GRADING PLAN**

DATE
2/20/2022
FIGURE
1

Figure 4.7 Overview of Potential Landfill Sites



Figure 4.8 Overview of Potential Landfill Sites with Restrictions



Oahu Landfill Siting Study
Location of Area 2, Site 1

Legend

Potential Landfill Site

DETAIL MAP EXTENT

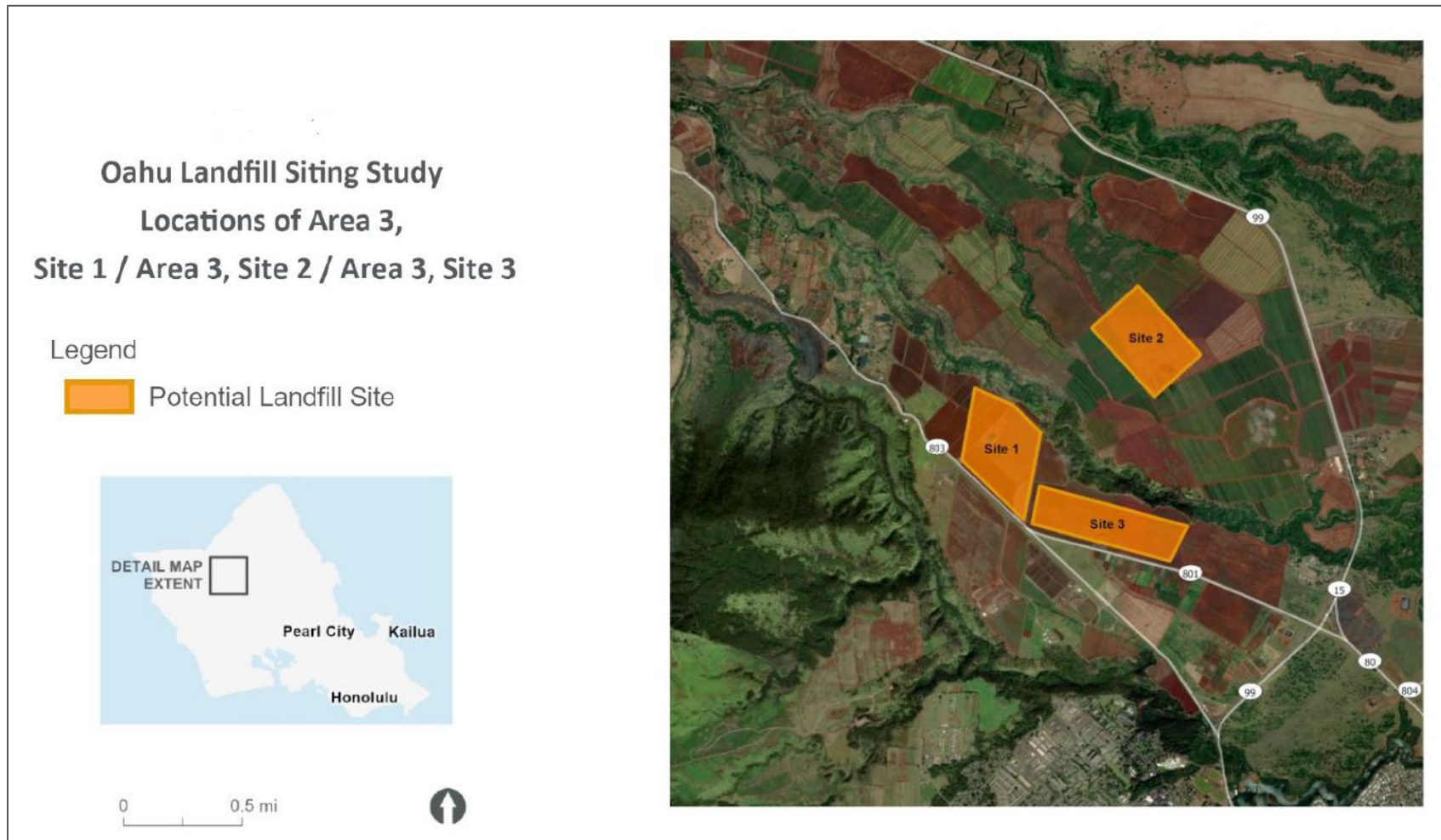
Pearl City Kailua

Honolulu

0 0.5 mi

↑

Figure 4.10 Locations of Area 3, Sites 1 through 3



Oahu Landfill Siting Study

Location of Area 6, Site 1

Legend

Potential Landfill Site

DETAIL MAP EXTENT Pearl City Kailua Honolulu

0 0.5 mi

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5 Site Scoring Methodology

5.1 Site Evaluation Method

The landfill site evaluation methodology was developed in four steps:

- Developing the objective and subjective evaluation criteria to be weighted, rated, scored, and used in the site ranking.
- Developing the weighting, rating, scoring, and ranking method.
- Researching and collecting data to develop potential landfill site technical support information for reference in rating and site scoring.
- Applying LAC's weights, ratings, scoring, and final site ranking.

Several of these steps were started simultaneously, and all steps coordinated to complete the evaluation and final site scoring process. The following sections provide more detailed information on the site evaluation methodology and scoring process presented to the LAC in Meetings 4, 5, and 6. Final scoring results and site rankings are provided in Section 6.

5.2 Site Evaluation Criteria

ENV used the 2012 MACLSS study as a basis to develop the site evaluation criteria for this study. ENV reviewed the 19 final evaluation criteria in the 2012 MACLSS study and eliminated all inapplicable criteria (e.g., location relative to residential concentrations) or revised the criteria to align with this study approach (e.g., combined location relative to wetlands, location relative to surface water resources). A draft list of evaluation criteria, divided into objective and subjective categories, was prepared containing 11 and 8 initial criteria in each category, respectively.

The draft list of objective and subjective evaluation criteria and definitions were presented to the LAC for discussion in Meeting 4. ENV incorporated the LAC's comments from Meeting 4 and presented a revised final list of evaluation criteria, with descriptions and explanations, to the LAC in Meeting 5 February 7, 2022. The final list consisted of 9 objective criteria and 8 subjective criteria, which are summarized in Tables 5.1 and 5.2. Definitions presented at Meeting 4 are listed below:

- Objective Criteria – Criteria based on unbiased, quantifiable facts and observations that are not influenced by personal feelings, perceptions, or desires.
- Subjective Criteria – Criteria based on personal opinions, experiences, knowledge, interpretations, assumptions, points of view, emotions, and judgement.

Table 5.1 Objective Site Evaluation Criteria Description and Explanation		
Criteria	Description	Explanation
1. Landfill Capacity	Total amount of waste that can be placed in the landfill	The City and County of Honolulu (CCH), Department of Environmental Services (ENV) intends to develop a new landfill with a minimum 20-year site life, which equates to an estimated 21.5 mcy of disposal capacity. This estimated disposal capacity is based on standard assumptions, including projected waste generation and recycling rates, waste compaction densities, and the estimated closure date of the PVT C&D Landfill. A larger landfill would typically require more land and capital costs; however, due to the lengthy permitting and development timeline for a new landfill (roughly 10 years), the anticipated high cost associated with siting and development, as well as an increasingly limited amount of land available for landfills, among several other factors, it is impractical to design a landfill with a lifespan of less than 20 years.
2. Land Acquisition, Landfill Development, and Roadway Improvement and Infrastructure Costs	Cost to acquire land, develop the landfill site, and complete all required roadway and infrastructure improvements to support the landfill	ENV anticipates that developing a new landfill will require a significant financial investment by CCH. Total development cost estimates will be completed for each landfill site, including acquisition, design, permitting, and construction costs, as well as required ancillary infrastructure improvements in the vicinity of the site to support heavy truck traffic. Differences in development cost estimates for each site reflects variations in site conditions and locations.
3. Time to Acquire Land and Develop Landfill	Time to complete the land acquisition process and develop the landfill site for waste acceptance	The land acquisition process will need to be completed either through condemnation, direct purchase, or a long-term lease. The time it will take to acquire and develop each site will be estimated by ENV and its consultants. Development planning and design is closely tied to the land acquisition method and timeline. When acquiring and developing the landfill site, ENV will strive to create scheduling efficiencies to reduce the project timeline to the greatest extent possible. The current landfill is mandated to stop accepting waste on March 2, 2028.
4. Location Relative to H-POWER	Driving distance to/from H-POWER	The location of the new landfill directly affects ENV's operational and contractual costs, including the costs to transport waste, ash, and residue from H-POWER. If the landfill is more than 12 miles from H-POWER, by contract, ENV incurs additional ash and residue hauling fees.

Table 5.1 Objective Site Evaluation Criteria Description and Explanation Cont.		
Criteria	Description	Explanation
		Additionally, the further away the landfill is from population centers, transportation of waste to the landfill when necessary will be more costly.
5. Effect on Traffic and Roadway System	The landfill's effect on traffic and the roadway system	ENV anticipates increased traffic and roadway system impacts in the vicinity of the new landfill site, as well as between the new landfill site and H-POWER. The extent of roadway system impacts is commensurate with the driving distances between H-POWER and the landfill. Additionally, increased waste hauler traffic could impact local traffic and roadway systems. Actual impacts would be addressed during the EIS process.
6. Effect of Precipitation on Landfill Operations	Effect of precipitation on operation of the landfill	The amount of precipitation a landfill site receives directly impacts landfilling operations and costs, and could increase environmental and human health risks. The more precipitation a landfill site receives, the greater the likelihood of challenging operational conditions and environmental effects related to stormwater runoff and leachate management.
7. Location with Regard to Important Agricultural Lands (IAL) of the Hawai'i LUC	Location of the landfill site within or outside of IAL designated by the Hawai'i LUC	A landfill site located in IAL areas will limit the use of that land for agricultural purposes. Additionally, due to restrictive land use requirements, permitting and developing a landfill site may become more challenging the closer that site is to IAL.
8. Location with Regard to the BWS Supply No Pass Zone	Location of the landfill site within or outside of the No Pass Zone established by BWS	The No Pass Zone is defined as "areas in which the installation of waste disposal facilities, which may contaminate groundwater resources used or expected to be used for domestic water supplies, shall be prohibited".
9. Municipal Water Wells within 1,000 feet	Municipal water wells within a 1,000-foot buffer zone	Standard solid waste industry practice is not to site a landfill in close proximity to a municipal or community water well. The U.S. EPA does not regulate set-back requirements; however, many states have established their own minimum requirements. The Hawai'i Wellhead Protection Program requires a minimum 1,000-foot setback from potential contaminating activities, such as a landfill site.

Table 5.2 Subjective Site Evaluation Criteria Description and Explanation		
Criteria ¹	Description	Explanation
10. Significance of Land Use Displacement	Significance of existing land use displacement	Land use information identified through review of various Hawai'i and CCH department records for the landfill site is provided for reference and consideration.
11. Significance of Proximity to Ecologically Important Areas	Significance of the direct and indirect effects to identified ecologically important areas within a one-half-mile buffer zone	A list of ecologically important areas, as identified through review of various federal agency and Hawai'i department records, within a one-half-mile buffer zone of the landfill site is provided for reference and consideration.
12. Significance of Proximity to Nearby Surface Water	Significance of the direct and indirect effects to identified surface water bodies within a one-half-mile buffer zone	A list of surface water bodies, as identified through review of various federal agency and Hawai'i department records, within a one-half-mile buffer of the landfill site is provided for reference and consideration.
13. Significance of Proximity to Nearby Archaeological and Cultural Resources	Significance of the direct and indirect effects to identified archaeological and cultural resources within a one-half-mile buffer zone	A list of archaeological and cultural resources, as identified through review of State of Hawai'i Department of Land and Natural Resources, State Historic Preservation Division records, within the landfill site boundary and within one-half-mile buffer of the site is provided for reference and consideration.
14. Significance of Proximity to Nearby Parks and Recreation Facilities	Significance of the direct and indirect effects to identified parks and recreation facilities within a one-half-mile buffer zone	A list of parks and recreation facilities, as identified through review of various federal agency and Hawai'i and CCH department records, within a one-half-mile buffer zone of the landfill site is provided for reference and consideration.
15. Significance of Proximity to Nearby Public Commercial Facilities	Significance of the direct and indirect effects to identified public use commercial facilities within a one-half-mile buffer zone	A list of public use commercial facilities, as identified through review of CCH Department of Planning and Permitting records, within a one-half-mile buffer zone of the landfill site is provided for reference and consideration.

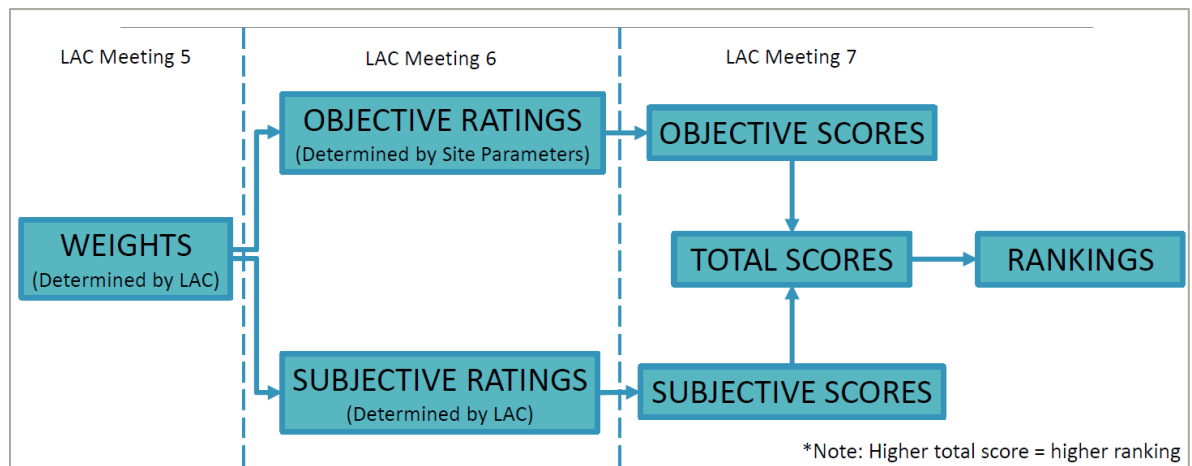
Table 5.2 Subjective Site Evaluation Criteria Description and Explanation Cont.		
Criteria ¹	Description	Explanation
16. Environmental Justice: Significance of Location Relative to Identified Community Disamenities	Significance of the landfill site location relative to identified community disamenities	A list of operational community disamenities, including landfills, power plants, wastewater treatment plants, and petroleum refineries, on O'ahu, as identified through review of various federal agency and Hawai'i and CCH department records, is provided for reference and consideration.
17. Significance of Effect on Established Public View Planes	Significance of effect on established public view planes for local communities	A list of communities where public view planes could potentially be affected from development of the landfill site is provided for reference and consideration.

1. Subjective criteria numbering sequential from Table 5.1.

5.3 Site Scoring Methodology

A multi-criteria decision-making analysis (MCDA) method was used to score and rank the final sites listed in Section 4.3.3. The MCDA method is amenable when decisions by a group involves ranking or choosing between alternatives. One variation of the MCDA method is to develop and apply weights and ratings to multiple criteria in scoring of alternatives. The weights and ratings reflect the relative importance of each member of the group in the decision-making process. Weighting and rating the evaluation criteria, described in Section 5.2, avoided the need for consensus among LAC members and allowed for an independent ranking of the final sites. The site scoring process using the MCDA method is described in the following sections and illustrated in Figure 5.1.

Figure 5.1 Site Scoring Process Flow Diagram



5.3.1 Evaluation Criteria Weighting

Evaluation criteria weighting involves assigning a numeric weight to each evaluation criteria. The composite average weights are then used with the criteria ratings to calculate a final score for each site. Each LAC member gives each evaluation criteria a weight value from 1 to 100, with weights being relative from one criterion to another to differentiate the importance of one criterion over another. As an example, if one LAC member determines that landfill capacity is the most important criteria, it would be assigned a weight of 100. If the same LAC member determines that the time to acquire land and develop the landfill is half as important as landfill capacity, that criteria would be assigned a value of 50. That LAC member could also determine the site's relative location to H-POWER is of no consequence and assign a value of 1. Weighting use in the scoring calculations is described in Section 5.4.3.

5.3.2 Evaluation Criteria Rating and Method

Criteria rating involves applying a numerical value in the scoring of each site to allow influence in the scoring process. The numerical value is based on the site's actual or judged performance in relationship to the criteria. Ratings developed in the site scoring are determined by actual site parameters for the objective criteria and by LAC member judgement for the subjective criteria, as shown on Figure 5.1.

The objective criteria ratings are determined by ENV because the site's performance on the criteria is measurable and not subject to LAC member judgement. Objective ratings are categorized by three different methods (or types) depending on the intended influence of the rating on the score: direct, inverse or binary. In this study, the resulting numerical rating value is zero to six for direct and inverse rating types, and zero or six if binary in nature. Figures 5.2 through 5.4 show examples of each objective criteria rating type.

Figure 5.2 Objective Rating – Direct Type Example

- Based on the favorability of a site relative to the most favorable site
- Higher number = more favorable
- Example 1: Landfill Capacity
 - Site 1: $50 \text{ M yd}^3 \times \frac{1}{50 \text{ M yd}^3} \times 6 = 6$
 - Site 2: $25 \text{ M yd}^3 \times \frac{1}{50 \text{ M yd}^3} \times 6 = 3$

Figure 5.3 Objective Rating – Inverse Type Example

- Based on the favorability of a site relative to the most favorable site
- Lower number is more favorable
- Example 2: Location Relative to H-POWER

- Site 1: 20 mi $\frac{10 \text{ mi}}{20 \text{ mi}} \times 6 = 3$

- Site 2: 10 mi $\frac{10 \text{ mi}}{10 \text{ mi}} \times 6 = 6$

Figure 5.4 Objective Rating – Binary Example

- Based on whether a site is “within or outside of”
- Higher number is more favorable
- Example 3: Location with regard to Important Agricultural Lands of the Hawai'i Land Use Commission

- Site 1: Within IAL = 0

- Site 2: Outside of IAL = 6

Subjective criteria ratings are determined by LAC because the site performance on the criteria is based on each LAC members judgment. Each LAC member applies a numerical value from zero to six to each criterion, which represents a members judgement of the significance of the effect each site has on the criteria being rated. All subjective ratings are categorized as reverse type, meaning the more significantly the criteria are rated by each LAC member the less favorable the site is in the final ranking. Figure 5.5 shows an example of reverse rating for subjective criteria.

Figure 5.5 Subjective Rating – Reverse Type Rating

- Lower number (less significant effect) is more favorable
- Applied rating is reverse of submitted rating
- Example:
 - Significance of Proximity to Nearby Ecologically Important Areas (direct and indirect effects of the location of the landfill relative to ecologically important areas within one-half-mile, with 0 being no effect and 6 being extremely significant effect)
 - Site 1 Submitted Rating = 4, based on a significant effect to a bird sanctuary 0.1 miles away
 - Applied Rating = $6 - 4 = 2$

5.4 Site Scoring Process

This section describes the scoring process completed by the LAC, which was based on the scoring methodology described in the previous sections. ENV provided examples and instructions on the overall scoring process during LAC Meetings 5 and 6. LAC members were provided prepared forms in Microsoft (MS) Forms during scoring, whereupon each LAC member could apply weights and ratings to the evaluation criteria anonymously. The weights and ratings provided by each LAC member were transferred into MS Excel scoring spreadsheets containing formulas to calculate the final scores described in the following sections.

5.4.1 Criteria Weights

ENV presented the methodology and instructions on how to weight each objective and subjective criteria to the LAC during Meeting 5. LAC members were provided a weight question form to record weights for each of the 17 evaluation criteria and a weight assistance form with descriptions of the criteria for reference. Weights were accepted from LAC members until February 22, 2022. Criteria weighting results are provided in Section 6. Example forms provided to the LAC are provided in Appendix D.

5.4.2 Subjective Criteria Ratings

ENV presented the methodology for rating the subjective criteria during Meeting 5 and provided instructions to the LAC on how to rate the criteria during Meeting 6. LAC members were provided a rating assistance form, rating question form, and the technical support documents described in Section 5.6 for use in the criteria rating exercise. Ratings were accepted from LAC members until March 24, 2022. Criteria rating results are provided in Section 6.

5.4.3 Final Scoring

ENV presented the evaluation criteria weighting and rating scoring method to the LAC during Meeting 6. Criteria weights and subjective criteria ratings received from LAC members were inserted into the MS excel scoring spreadsheet and an average weight and rating calculated for each site. Objective criteria ratings calculated by ENV are added directly into the same spreadsheet and averaged. Figure 5.6 shows an example of the output data when the subjective criteria ratings are transferred from the rating question form provided to the LAC. Figure 5.7 shows an example of the reverse calculation using the average subjective criteria rating and the resulting value used in the final score calculation. Figure 5.8 shows final scoring calculation using the average weights and average reverse ratings. The reverse calculation is not performed on the objective criteria ratings.

Figure 5.6 Example Output Table of Criteria Rating (Site Averages)

LAC Member	Site 2.1	Site 3.1	Site 3.2	Site 3.3	Site 6.1	Site 7.1
1	0	0	0	0	0	4
2	1	0	0	0	0	0
3	1	2	6	6	4	2
4	3	2	2	2	2	1
5	0	2	3	4	5	6
6	3	1	1	1	1	2
7	4	3	3	3	3	4
8	2	5	5	5	5	6
Average Rating	1.75	1.88	2.50	2.63	2.50	3.13

Figure 5.7 Example of Reverse Calculation of Subjective Rating

Proximity to Nearby Ecologically Important Areas (½-mile from landfill site)

0 = no potential effects (a good thing)

6 = potential significant effects (a bad thing)

The rating must then be reversed to be applicable with the rest of the scoring.

Example: Site 2.1 Average Rating = 1.75 (minimal impact, mostly good)

Average Reversed Rating = $6 - 1.75 = 4.25$

4.25 is entered into the scoring formula

Figure 5.8 Example Final Score Calculation for Sites by Criteria

Proximity to Nearby Ecologically Important Areas (½-mile from landfill site)

Average Weight x Average Reversed Rating (per Site) = Score

Average Weight		60.83				
X						
	Site 2.1	Site 3.1	Site 3.2	Site 3.3	Site 6.1	Site 7.1
Ave. Reversed Rating	4.25	4.13	3.50	3.38	3.50	2.88
=						
Score	258.53	250.92	212.91	205.30	212.91	174.89

5.5 Research and Data Collection

ENV performed technical research for all objective and subjective criteria for each site and provided technical support documents to the LAC for reference during subjective criteria rating. Technical support documents were also prepared and used by ENV to complete the objective criteria rating. ENV presented examples of subjective criteria support documents to the LAC in Meeting 6. Final technical support documents are provided Appendix E.

6 Results of Site Scoring and Ranking, and LAC Recommendations

Results of the final site scoring, rankings, and LAC recommendations are presented in this section. Scoring was performed according to the methodology described in Section 5, and results were presented to the LAC at Meeting 7.

6.1 Results of Site Scoring and Ranking

6.1.1 Criteria Weighting Results

Following Meeting 5, criteria weights were obtained from six out of eight LAC members. Average weights for the objective and subjective criteria are summarized in Tables 6.1 and 6.2.

Table 6.1 Average Criteria Weights – Objective Criteria	
Criteria	Average Weight (1 to 100)
1. Landfill Capacity	86.7
2. Landfill Acquisition, Landfill Development, and Roadway Improvement/Infrastructure Costs	59.2
3. Time to Acquire Land and Develop Landfill	47.5
4. Location Relative to H-POWER	60.8
5. Effect on Traffic and Roadway System	68.3
6. Effect of Precipitation on Landfill Operations	71.7
7. Location with regard to Important Agricultural Lands (IAL) of the Hawaii LUC	61.7
8. Location with regard to the BWS No Pass Zone	91.7
9. Municipal Water Well within 1,000 feet	91.7

Table 6.2 Average Criteria Weights – Subjective Criteria	
Criteria	Average Weight (1 to 100)
10. Significance of Land Use Displacement/Beneficial Reuse	52.5
11. Significance of Proximity to Ecologically Important Areas	60.8
12. Significance of Proximity to Nearby Surface Water	59.2
13. Significance of Proximity to Nearby Archaeological & Cultural Resources	48.3
14. Significance of Proximity to Nearby Parks & Recreation Facilities	47.5
15. Significance of Proximity to Nearby Public Commercial Facilities	36.0
16. Significance of Location Relative to Identified Community Disamenities	52.5
17. Significance of Effect on Established Public View Planes	33.3

6.1.2 Criteria Ratings and Scoring Results

Final average ratings and site scores for objective and subjective criteria are summarized in Tables 6.3 through 6.6. LAC members as a whole submitted subjective criteria ratings.

Table 6.3 Final Average Ratings – Objective Criteria									
Site	Criteria Number and Rating ¹								
	1	2	3	4	5	6	7	8	9
2.1	6	2.8	6	2.3	1.5	3.6	6	0	6
3.1	6	4.8	6	3.5	1.4	4.7	0	0	6
3.2	6	6	6	3.2	1.8	4.3	6	0	0
3.3	6	5.4	6	3.4	1.4	4.3	6	0	0
6.1	6	4.3	6	5.3	3.1	5.1	6	0	6
7.1	6	4.6	6	6	6	6	0	0	6

1. Refer to Tables 6.1 and 6.2 for criteria names.

Table 6.4 Final Site Scores – Objective Criteria

Site	Criteria Number and Scores									Objective Subtotal
	1	2	3	4	5	6	7	8	9	
2.1	520.0	162.6	285.0	141.6	103.7	259.5	370.0	0	550.0	2392.5
3.1	520.0	281.3	285.0	213.3	97.4	319.8	0	0	550.0	2281.4
3.2	520.0	355.0	285.0	193.7	119.4	308.1	370.0	0	0	2151.3
3.3	520.0	321.7	285.0	205.3	97.4	308.1	370.0	0	0	2107.5
6.1	520.0	256.6	285.0	322.0	210.0	365.6	370.0	0	550.0	2879.2
7.1	520.0	272.2	285.0	366.0	410.0	430.0	0	0	550.0	2832.3

Table 6.5 Final Average Ratings – Subjective Criteria

Site	Criteria Number and Rating							
	10	11	12	13	14	15	16	17
2.1	0.8	2.5	2.4	1.9	5.5	5.5	3.5	4.1
3.1	3.5	2.5	3.9	4.6	5.5	4.1	4.5	3.8
3.2	3.8	2.1	2.4	4.8	5.5	5.5	4.5	4.3
3.3	3.5	2.6	3.8	4.0	5.5	3.9	4.4	4.1
6.1	2.0	3.1	2.6	2.9	3.3	5.4	5.0	3.6
7.1	0.9	4.4	3.0	2.1	1.6	5.4	4.8	3.5

Table 6.6 Final Site Scores – Subjective Criteria

Site	Criteria Number and Scores								Subjective Subtotal
	10	11	12	13	14	15	16	17	
2.1	39.4	152.0	140.5	90.6	261.2	198.0	183.8	137.5	1203.0
3.1	183.8	152.0	229.3	223.5	261.2	148.5	236.3	125.0	1559.6
3.2	196.9	129.2	140.5	229.6	261.2	198.0	236.3	141.7	1533.4
3.3	183.8	159.7	221.9	193.3	261.2	139.5	229.7	137.5	1526.6
6.1	105.0	190.0	155.3	139.0	154.4	193.5	262.5	120.8	1320.6
7.1	45.9	266.1	177.5	102.7	77.2	193.5	249.4	116.7	1229.0

6.2 Site Ranking

Final site ranking and total scores are summarized in Table 6.7.

Table 6.7 Final Site Rankings and Total Scores			
Rank	Area, Site	Location	Score
1	Area 6, Site 1	Wahiawa near Kunia Road	4,200
2	Area 7, Site 1	Kapolei/Waipahu near Kunia Road	4,061
3	Area 3, Site 1	Wahiawa	3,841
4	Area 3, Site 2	Wahiawa	3,685
5	Area 3, Site 3	Wahiawa	3,634
6	Area 2, Site 1	Haleiwa near Kawaihoa Road	3,596

6.3 LAC Recommendations of Siting Results

Final site scoring and ranking was presented to the LAC in Meeting 7 as described in previous sections. During Meeting 7, LAC members were encouraged to openly discuss the site evaluation, scoring and ranking process, final site locations, and any other concerns or recommendations for inclusion in the final report. The following presents discussions and recommendations from the LAC as a whole. Appendix A includes written statements from LAC members who wished to provide further comment.

- The LAC observed that all final six landfill sites are located within the BWS No Pass Zone. During discussion, members were in majority agreement that the LAC does not recommend any of the final landfill sites due to their location within the BWS No Pass Zone. The LAC strongly felt that they could not support a landfill sited within the BWS No Pass Zone due to their convictions in ensuring preservation of groundwater resources on O'ahu.
- LAC discussed options that the City could consider in re-evaluating potential landfill sites outside of the BWS No Pass Zone. One recommended option included amending Act 73 to allow more geographic diversity in searching for additional sites. Potential amendment options discussed included reducing the one-half mile residential setback distance or removal of specific conservation subzones (e.g., General Subzone). The LAC expressed concerns that Act 73, along with time constraints placed upon the process by the LUC, may have limited the ability to perform a more extensive evaluation of sites outside the BWS No Pass Zone.
- LAC recommended additional evaluation of parcels below the BWS No

Pass Zone that may be more suitable for landfill siting through initiation of an eminent domain process (e.g., minimal residences on parcel). Acquiring a smaller number of residential properties to meet the requirements of Act 73 and remain outside the BWS No Pass Zone may be more conducive to preservation of groundwater and agricultural resources.

- LAC recommended further efforts by the City to encompass federal lands for siting a landfill, including state controlled lands with leases set to expire or underutilized by the federal government.

6.4 Community Benefits/Future Public Outreach

ENV included a landfill host community benefits (HCBs) presentation at the conclusion of Meeting 7. ENV explained the importance of HCBs as part of the overall process and requested LAC discussion and recommendation. Examples were presented of HCBs established for the WGSL, outer island landfills, U.S. EPA, and other governmental municipalities. The following recommendations were made by the LAC:

- LAC recommended that a HCBs package be established not only for the next community to host a landfill, but also include communities that have borne the burden of past O'ahu landfills.
- LAC recommended an advisory committee be established to assist in identification of host community concerns and the management of potential endowments. Community participation should play an important role in the process.