

Wai‘anae Coast Environmental Health Assessment for Kingdom Pathways



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KINGDOM
PATHWAYS
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Executive Summary

This health assessment provides foundational information about the environmental health perceptions, concerns, and experiences of those who reside and work along the Waiʻanae Coast of Oʻahu, Hawaiʻi. Environmental health refers to the relationship between people and their environment and how that relationship influences people's health and wellbeing. Pollution in all its forms—from the air, water, and land—presents significant human health risks. Along the Waiʻanae Coast there are numerous developments and activities that contribute to pollution in that area, such as a strong military presence and a disproportionate share of Oʻahu's waste processing and disposal facilities.

The Waiʻanae Coast is home to one of the state's largest populations of Native Hawaiians. It is an area of strong cultural importance, with evidence of human settlement going back 600 years. There are important archeological sites and it is the birthplace of the demi-god Maui. Yet, it is an area of high poverty, poorer health outcomes than the rest of the state, and an inequitable share of polluting industries and activities. Thus, this environmental health assessment is also a first step in addressing a significant environmental justice concern for the state of Hawaiʻi generally and for Native Hawaiians specifically.

To complete this health assessment, two methods were used: a survey and conversation mapping. The survey collected data from 111 residents of the Waiʻanae Coast. Data collected from the survey provide information on environmental health concerns and perceptions, as well as some health indicators. No similar data yet exist for the Waiʻanae Coast. Conversation mapping is a method that can collect a large amount of written data—mimicking a conversation—in a short period of time from a group of people who attend a meeting on a topic of interest. Two maps were created, one on environmental changes and another on health challenges. The data from the conversation maps were used to provide context to survey results, as well as ideas for action and advocacy.

Those who completed the survey skewed female and older. Nearly a third were Native Hawaiian, with 12% residing on Hawaiian Homestead lands. The average number of years residing along the Waiʻanae Coast was 35. Approximately half of the sample lived within a half-mile of Pōkaʻī Bay and about a third within a half-mile of Māʻiliʻilii stream/drainage canal. Both of these areas were identified by Kingdom Pathways as areas of concern. Other areas of concern identified were Ulehawa Stream and PVT Construction and Debris Disposal, also known as PVT Land Company.

Nearly a quarter of survey respondents (24%) reported that they believed they had or had had a health condition due to air pollution in their neighborhood, while 16% reported that they had or had had a health condition due to water pollution in their neighborhood. There were no statistically significant associations between believing one had had a health condition due to air or water pollution and respondent demographic and household characteristics, except for residing on Hawaiian Homestead Lands. Those who resided on Hawaiian Homestead Lands were much more likely to report that their

health had been harmed by water pollution than those who did not live on Homestead Lands. Moreover, respondents who lived on Hawaiian Homestead Lands were also much more likely to rate the air quality of their neighborhood as poor or fair (75%), compared to those who did not live on Homestead Lands (30%).

While respondent demographic and household characteristics were largely unassociated with reporting having had a health condition due to air or water pollution, where respondents lived was. Nearly half of those living within a half-mile of Ulehawa Stream believed they had or had had a health condition due to air pollution and a similar percentage (44%) of those living within a half-mile of PVT Land company also believed this. Further, a third of those living near PVT Land Company reported that they had or had had a health condition due to water pollution.

Generally, respondents who experienced serious health concerns or conditions were more likely to report that air or water pollution had harmed their health than those without similar health concerns or conditions. Unsurprisingly, those who had ever been told by a doctor that they had asthma or lung disease were significantly more likely to report having had health problems due to air pollution. There were also associations with heart disease and gastrointestinal disease and reporting that air or water pollution had contributed to current or past health conditions. Finally, respondents who reported that they had respiratory allergies or had swimmers' ear in the past were much more likely to believe that air or water pollution had harmed their health than those who did not report these conditions.

Survey respondents were asked to rate their neighborhoods. **Nearly two-thirds (62%) rated their neighborhood as a good or excellent place to live. A similar percentage (63%) rated the air quality in their neighborhood as good or excellent.** Less than half (45%) rated their neighborhood as looking excellent or good. A bit less (42%) rated the cleanliness of their neighborhood as good or excellent. Those who believed that they had had a health condition due to air or water pollution were more likely to rate their neighborhood as poor or fair looking than those who did not believe they had had a health condition due to pollution. Survey respondents who reported that they had had a health condition due to air pollution were more likely to rate their neighborhood as having poor or fair cleanliness and poor or fair air quality, compared to those who did not believe they had had a health condition due to air pollution.

Survey respondents were bothered by noises from the road in their homes; 53% reported that road noises bothered them moderately to extremely and 51% reporting that noises from large vehicles bothered them moderately to extremely. Those that were moderately to extremely bothered by noises from large vehicles were also more likely to believe that they had had a health condition from air or water pollution, compared to those less bothered by large vehicle noise. Perceived neighborhood air quality was associated with being bothered at home by noises from large vehicles. Among those rating the air quality in their neighborhood as poor or fair, 64% were moderately to extremely bothered at home by noise from large vehicles, compared to 36% who were less bothered by noise from large vehicles.

The survey also asked respondents about the water quality of beach parks along the Waiʻanae Coast. **Most respondents felt the water quality of their beaches was sub-standard.** Almost no respondents rated the water quality as excellent at any of the beaches. Pōkaʻī Bay stood out, as it was the beach park that most survey respondents rated, and only 16% rated the water quality as good or excellent. In fact, 41% rated the water quality as poor. The conversation mapping results similarly described poor water quality at Pōkaʻī Bay and that negative changes to the water had occurred within two generations.

The conversation mapping process explored specific types of pollution in more depth than was possible with the survey. The most common type of pollution discussed on the environmental changes map was from waste. Dialog about waste was strongly framed as an injustice, with the Waiʻanae Coast described as being treated as “a dumping ground.” There was deep concern about and resentment toward polluting industries, specifically ones that handle waste, being disproportionately present in Waiʻanae. The injustice of “generations of military dumping” and the handling of waste from homeless sweeps, were also highlighted. Frustration was expressed over the lack of governmental action and accountability.

Conversation mapping participants also examined health challenges facing the community. Content on the health challenges map primarily focused on what could be done to address challenges, rather than what the challenges were, how they were experienced, or their causes. Many of the discussions were on what could be done to improve diet and increase exercise. Interestingly, there were few conversations that explicitly linked environmental pollution to health. On the other hand, conversations on the map frequently invoked Native Hawaiian-specific content, most of which related to actions that could be taken to address health challenges by caring for the ʻāina.

The conversation mapping resulted in numerous suggestions to address environmental changes and to improve health along the Waiʻanae Coast. There was a strong emphasis on educating children, both in schools and the community, to reduce pollution and to malama ʻāina, as well as to set the foundation for healthy lifestyles. Strategies and activities supporting pilina (relationships) and advocacy were emphasized on the environmental changes conversation map. Local and Native Hawaiian inspired food, exercise, and commerce programs were suggested on the health challenges map. Cross-cutting both maps was the importance of learning and living Native Hawaiian culture.

To conclude, this report provides the first comprehensive environmental health assessment of the Waiʻanae Coast. The results underscore the need for a stronger focus on both the environment and people’s health in the area, while also providing suggestions for action and advocacy.

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Background

The objective of this health assessment is to provide foundational information about the environmental health perceptions, concerns, and experiences of those who reside and work along the Waiʻanae Coast of Oʻahu, Hawaiʻi. Environmental health refers to the relationship between people and their environment and how that relationship influences people’s health and wellbeing. Pollution in all its forms—from the air, water, and land—presents significant human health risks. Along the Waiʻanae Coast there are numerous developments and activities that contribute to pollution in that area. How pollution affects the health of people living in Hawaiʻi is deeply understudied (Weldon and Pirkle 2025); work on this topic is all but absent for the residents and workers along the Waiʻanae Coast. The absence of work on this topic along the Waiʻanae coast is a part of a larger issue of environmental injustice facing this community. As briefly overviewed in this background section, this community is disproportionately burdened by environmental hazards combined with economic inequities, structural racism and historical trauma, which are all classic features of environmental injustices (American Public Health Association, n.d.). This project seeks to provide a starting point from which to address this critical environmental health gap.

Geographic location of the health assessment and potential contributors to environmental health concerns

This health assessment will focus on the communities of Nānākuli, Waiʻanae, and Mākaha of the Waiʻanae Coast (leeward coast) of Oʻahu, Hawaiʻi. This area sits at the foot of the Waiʻanae Mountains and is known for its sunshine, beaches and more arid climate than other parts of Oʻahu (“Leeward Coast | Go Hawaii,” n.d.). It includes the Lualualei Valley, which is the largest coastal valley on the southwestern side of Oʻahu and has had documented Native Hawaiian settlements (both temporary and permanent) dating to as early as the mid-1400s (Naval Facilities Engineering Systems Command, Hawaii 2024). Between Lualualei Valley and Nanakuli Valley is Puʻu Heleakala, at the foot of which was the birthplace of the demi-god Māui (Fujikane 2021). The Waiʻanae coast is also believed to have the densest collection of archeological sites on the island (Lovell 2017). These handful of examples highlight the tremendous cultural importance of the project area.

Military footprint

There is a significant military footprint along the Waiʻanae Coast. The Navy’s Lualualei Annex is one example that is contextually important to this assessment, given its size and the watersheds and streams that run through it. Additionally, the area contains the Lualualei Superfund Site due to soil contamination with polychlorinated biphenyls, volatile organic compounds and metals (US EPA, n.d.; Higuchi 2009)

The Lualualei Annex is composed of two separate, but contiguous facilities: Naval Magazine Pearl Harbor (NAVMAG PH) Lualualei and Naval Radio Transmitter Facility (NRTF) Lualualei. Access to the Annex is restricted due to the presence of ordinance and munitions (Naval Facilities Engineering Systems

Command, Hawaii 2024). The Annex contains 9220 acres of land and is situated on the eastern side of the Lualualei Valley and within the Lualualei Valley floor (Naval Facilities Engineering Systems Command, Hawaii 2024). Most of the Annex falls within the State of Hawai'i State Agricultural District, with the upland areas of the NAVMAG PH Lualualei extending into the State Conservation District and the northwest corner of NRFT Lualualei touching the urban district containing the town of Mā'ili. Within the Annex are the Mā'ili'ili and Ulehawa Watersheds (Naval Facilities Engineering Systems Command, Hawaii 2024). There is also one perennial stream located in Lualualei called the Pūhāwai Stream. NAVMAG PH Lualualei lands drain toward a fork of the Mā'ili'ili Stream, which emanates from the Wai'anae Mountain Range. Adjacent and south of NRTF Lualualei is Ulehawa Stream which runs through NAVMAG PH Lualualei (Naval Facilities Engineering Systems Command, Hawaii 2024). All streams empty into the Pacific Ocean and pass by residential areas. Thus, any pollution of these streams will also travel by residential areas and into the ocean.

The Kaena Point Satellite Tracking Station and Makua Military Reservations are other important Department of Defense facilities along the Wai'anae Coast that have their own environmental footprints and concerns.

Waste Disposal

There are several waste processing and disposal sites in the Wai'anae Coast area. Two notable ones are PVT Land Company and Waimanalo Gulch. PVT Land Company, in the heart of Nānākuli, is adjacent to Lualualei Naval Road (figure 1), which leads to the



Figure 1: Google Map of PVT Land Company LTD. Location along Lualualei Naval Road

Lualualei Annex described above (Fernandez-Akamine 2024). It is also adjacent to Ulehawa Stream, which also runs through NAVMAG PH Lualualei, along the landfill's west side, through the Princess Kahanu Estates Hawaiian Homes community and out to sea (Fernandez-Akamine 2024). Figure 2 shows the sand-blocked exit of the Ulehawa stream as it flows out to the ocean. Within a 1-mile radius of the PVT Land Company are hundreds of homes, six schools, and many churches, parks and stores (Fernandez-Akamine 2024).

The PVT Land Company receives over 40% of the waste generated on O‘ahu including wood, plastic, furniture, mattresses and contaminated soil. It is also the only construction and demolition debris facility on the island (Fernandez-Akamine 2024).

Waimanalo Gulch, which is just south of the Hawaiian Electric Kahe Power Plant, accepts municipal solid waste and sandblast media, and some types of soil waste (Waste Management Solutions, n.d.). This site



Figure 2: Ulehawa stream. Flows through NAVMAG PH Lualualei, adjacent to the PVT Land Company and exits near Ulehawa Beach Park. Its exit to the ocean is frequently blocked by sand, as seen in this photo taken by Pirkle Epidemiology and Evaluation.

has a long history of violations which has on occasion led to litigation (Sapolu 2009). For example, Waste Management of Hawai‘i accepted two misdemeanor charges under the Clean Water Act for medical waste entering the ocean from the site (khon2, n.d.). Waimanalo Gulch is located near residential areas as well as areas of work and recreation (Sapolu 2009). Currently, it is scheduled to cease operations in March 2028 (Fernandez-Akamine 2024).

PVT Land Company and Waimanalo Gulch are just two examples of the disproportionate share of sewage treatment plants, landfills and powerplants in the area. Eleven of the 18

such facilities on O‘ahu are located in and along the Wai‘anae Coast (Fernandez-Akamine 2024; Sapolu 2009).

Agriculture

There are a number of important agricultural producers along the Wai‘anae Coast with MA‘O Organic Farms being the best known (Morita 2011). Nearly all of these farms are in and around the town of Wai‘anae. Some of these farms raise pigs and other livestock. It is unclear if agriculture in the region contributes to pollution of the local environment. Agricultural operations can have significant effects on water quality. Agricultural runoff—nutrients in fertilizer and livestock manure, pesticides and other substances—is the leading cause of negative water quality impacts to rivers and streams (US EPA 2015b). Typically, organic producers have less of an environmental impact compared to those raising animals. There are multiple forms of agricultural production (organic and non-organic horticulture, livestock production, etc.) in the area.

Ocean Pollution

Ocean pollution creates risks to physical health, such as gastrointestinal illness from consuming fish and seafood containing contaminants from manmade pollution (Centers for Disease Control and Prevention 2025). There are also mental, emotional, and spiritual risks associated with the environmental damage from marine-pollution. Studies have identified that blue spaces, especially oceans, are associated with mental and physical health benefits (Britton et al. 2020; Gascon et al. 2017)

In Hawai'i, many ocean-based activities are deeply tied to culture. For example, spearfishing is associated with physical, psychological, and emotional wellbeing benefits; the practice is often linked to nature connectedness, as well as food acquisition, especially of high-quality fish (Sbragaglia et al. 2023; Young et al. 2016). Native Hawaiian expertise and cultural traditions related to spearfishing, or o'i'a, are well documented by historians, and many rites, traditions and practices recorded nearly 200 years ago continue to this day (Kahā'ulelio 2006; Kamakau 1976). Similarly, surfing, which originated with Native Hawaiians (Clark 2011), has been linked to mental and physical health benefits, greater community cohesion, and stronger intra-family relationships (Manero et al. 2024; Sentell et al. 2024). Hawaiian oral history dated around the 15th Century richly describes chiefs and deities surfing and competing in the same manner as surfers do today (Kahā'ulelio 2006; Kamakau 1976).

One area of particular concern for those along the Wai'anae coast is Poka'i Bay. It is a large, protected bay in Wai'anae. Poka'i Bay is a popular destination, known for its white beaches and reliable surf break. It is also of deep cultural importance to Native Hawaiians. For example, there are large petroglyphs—ki'i pōhaku—that are typically covered by sand, but occasionally visible when there are large shifts in the sand, as occurred mid-July 2025 (Richardson 2025). There is a heiau—Kū'iliioa Heiau—at Poka'i Bay that is still used for cultural practices and ceremonies today (Lovell 2017).

Unfortunately, there are a number of pollution concerns affecting Poka'i Bay such as illegal dumping, runoff containing chemicals from nearby streets, and fecal bacteria from diverse sources (Laguardia 2023; "HCR94 SD1," n.d.). There are particular concerns about contamination of the waters from fecal bacteria from Kaupuni Stream, which drains into Poka'i Bay. Water monitoring from the Blue Water Task Force reports that 31% of samples collected from this stream exceed Hawai'i State Department of Health (HDOH) water quality standards for the fecal bacteria *Enterococcus* (Blue Water Task Force, n.d.).

Cesspools

Cesspools are holes in the ground to which untreated sewage is discharged. They can serve a variety of buildings such as single-family residences, commercial and public service buildings, and multi-unit residential buildings such as apartment complexes (US EPA 2015a). They are used throughout Hawai'i for the disposal of untreated sanitary waste and they raise significant risks of polluting oceans, streams and groundwater (US EPA 2015a). The main concerns from cesspools are pathogens, particularly from fecal waste, impacting human and animal health when they pollute water systems used for drinking (i.e.,

groundwater) or for recreation (i.e., the ocean). The large amount of nitrates in this type of waste can damage land or aquatic ecosystems including corals (US EPA 2015a). There are an estimated 88,000 cesspools in Hawai'i, most of which are small-capacity (US EPA 2015a). Because of the environmental and human health concerns posed by cesspools in Hawai'i, HDOH regulations require that cesspools of any size be upgraded, converted or closed by January 1, 2050 (US EPA 2015a).

Conversation mapping conducted in Nānākuli in May 2025 highlighted significant concerns about the costs of meeting the HDOH regulations by 2050, while also recognizing the environmental health risks, especially to water and specifically the need for more water quality monitoring (Capacity Collaborative and Kingdom Pathways 2025). Those held in Wai'anae in January 2024 also highlighted costs concerns, but additionally, sentiments of government bullying and a lack of inclusiveness in addressing the challenge. Interestingly, at least one Wai'anae participant cited research identifying high nitrates measured by researchers from the University of Hawai'i during shoreline analyses (Capacity Collaborative and Kingdom Pathways 2025). Cesspools present an important environmental health risk across the state of Hawai'i. Along the Wai'anae coast, they are also an environmental justice issue given the highly visible vestiges of colonialism in the community, along with the high levels of economic hardship (see next section).

Population characteristics and health equity concerns

The Wai'anae Coast of O'ahu experiences economic and health inequities when compared to other parts of the O'ahu. A significant portion of the population living along the Wai'anae Coast is Native Hawaiian. Statewide, seven of the top 10 areas with the largest population of Native Hawaiians, in absolute numbers, are on O'ahu, with all but one of these being along the Wai'anae Coast (State of Hawaii 2012). Many households along the Wai'anae Coast struggle with the basic cost of living, but do not fall under the federal poverty line; these are categorized as Asset Limited, Income Constrained, Employed, or ALICE. An estimated 52% of households in the 96792 zip-code (most of the Wai'anae Coast) are below the ALICE threshold. This threshold includes both those at or below poverty level and ALICE (United for ALICE 2025).

There is limited public health surveillance data specific to the Wai'anae Coast. However, available data do indicate high rates of chronic disease among residents of the Wai'anae Coast. For example, the estimated prevalence of hypertension among the State of Hawai'i's priority populations (Native Hawaiians, Pacific Islanders, Filipino and/or low-income adults) on the Leeward Coast is 31-35%. In contrast, it is 27-29% for most other parts of O'ahu (CDC 2024b). At 234-1830 deaths per 100,000, for the residents of Wai'anae, cardiovascular disease deaths are significantly higher than most of downtown Honolulu (largely around 170-207 deaths per 100,000) (CDC 2024a).

Environmental health data for the area is mostly absent. However, testimony from neighborhood board meetings provide insights into the concerns of the local community. For example, one description of a board meeting in Nānākuli recounted the testimony of an older man describing how living near to the

PVT Land Company contributed to constant white-like dust in his home (Sapolu 2009). There have also been reports of respiratory concerns due to the PVT Land Company (Sapolu 2009)

Conclusion

There are numerous environmental health concerns along the Wai‘anae Coast, but almost no efforts to document or understand their impacts on the communities living there. Further, these are underserved communities, with significant Native Hawaiian representation, that are disproportionately burdened by polluting industries such as landfills. Accordingly, this health assessment seeks to provide much needed information on the environmental health concerns of residents of the Wai‘anae Coast. Underpinning this work is a clear goal of improving environmental justice for the communities living there, by providing much needed environmental data and incorporating resident experiences and perspectives.

Methods

Pirkle Epidemiology and Evaluation Consulting, LLC. employed two broad categories of methods to achieve the goals of the Health Assessment as outlined by Kingdom Pathways: quantitative and qualitative. The quantitative approach involved the collection and analysis of data from a survey of residents living along the Wai‘anae Coast. The qualitative approach used conversation mapping to collect textual data.

Quantitative Survey

Background on quantitative surveys

Quantitative surveys collect data that can be counted and summarized statistically. For example, data from quantitative surveys may be presented as percentages or as means (i.e., average values). Often, these data are shown in tables or in figures, such as bar charts.

Quantitative surveys typically collect data using closed-ended questions. This means that the person completing the survey, described as the respondent, is given response options created by the survey developer. The respondent might be asked to check a box with four response options such as excellent, good, fair, and poor. For example, a common question in health research is “In general, would you say that your health is excellent, good, fair, or poor.” After this question, the respondent is then asked to select one of those options, usually by checking a box. Sometimes, the respondent is asked to write or type in a specific number, such as their age. Additionally, the survey developer may decide to have an option called “other” and then allow the respondent to enter an answer. This is often done when asking a respondent to report their ethnicity, as not all ethnicities are typically listed in a survey.

Survey Development

Kingdom Pathways engaged Pirkle Epidemiology and Evaluation Consulting, LLC to assist with designing a survey to assess the environmental health concerns, as well as health status, of residents of the 96792 zip-code (O‘ahu’s Wai‘anae Coast).

Proper survey development entails much more than coming up with questions and response categories. Questions can be confusing to respondents or unintentionally ask more than one question in a single sentence (referred to as double-barreled). Proper training and experience are needed to construct questions administered through surveys. Often, other experts have extensively piloted and administered questions with excellent measurement properties, which means that the questions measure what they are intended to measure. Knowledge of those surveys and specific commonly-administered questions in environmental health can contribute to more successful surveys and speed up the process of developing them. Dr. Pirkle of Pirkle Epidemiology and Evaluation Consulting, LLC. has extensive global experience in survey development, facilitating the successful execution of the survey used in this assessment.

While extensive knowledge of and experience with survey development is important to developing a strong survey instrument to collect data on questions of interest, so is collaboration. The survey for this health assessment needed to meet the expectations of the client—Kingdom Pathways—and be appropriate to the context in which it was administered, as well as to the population who completed the survey. Kingdom Pathways knows the community they serve. Thus, multiple meetings and rounds of feedback were conducted with the client to assure that the survey was designed to collect the most important information for their purposes.

The collaborative process to develop the survey started with an in-person site visit by Dr. Pirkle. In addition, three Zoom meetings were held to discuss the draft survey created by Pirkle Epidemiology and Evaluation Consulting, LLC. The survey questionnaire also was reviewed eight times by Kingdom Pathways, with feedback provided by email. A copy of the final questionnaire is provided in Appendix 1. It contains 23 questions and took respondents less than 10 minutes to complete.

The final survey collected information about respondent demographics, their concerns about air and water pollution affecting their health, proximity to potentially environmentally contaminated locations, health conditions that may be related to environmental pollution exposures, neighborhood ratings for livability and noise, among others.

Survey Administration

Once the survey was completed, it was provided to Ward Research Inc. on September 18, 2025. Ward Research Inc. is a local research company with the infrastructure to distribute surveys across the state of Hawai'i and to record the data in a manner that supports statistical analysis. Dr. Pirkle has previously worked successfully with Ward Research Inc.

From October 6 to November 4, 2025 a mixed-mode survey was distributed to adult residents of the 96792 zip-code, which represents the Wai'anae Coast. The estimated population of adults living in this zip-code is 34,000. Ward Research, Inc. first coded the survey electronically for distribution to their proprietary panel of verified Hawai'i residents, to whom they can quickly send online surveys. They also disseminated the survey through mail to random addresses in the 96792 zip-code. For the mail surveys, they first sent out a postcard, with Kingdom Pathways' logo, to let residents know that a survey would be coming. This technique can improve response rates; that is, the number of people completing a survey out of those contacted. Those completing the survey by mail could return the completed paper survey to Ward Research or complete it electronically using a QR link on the mailed survey. Finally, random phone numbers in the 96792 zip-code were called and residents could also complete the survey over the telephone.

Survey Sample

A total of 111 respondents completed the survey. There were 16 respondents from the online panel, 33 who were reached by telephone, and 62 that completed the mailed survey. Because 95 (86%) of the

respondents were reached by telephone or mail, the sample is predominantly a random one. This is an advantage; random samples are considered less prone to bias than other types of samples, even those from proprietary panels.

Data analysis

After the data were collected by Ward Research Inc., they were sent to Pirkle Epidemiology and Evaluation Consulting, LLC in the form of a spreadsheet. Data were uploaded to the statistical software STATA version 18 for analysis. Responses were examined descriptively by calculating frequency and percent values. Appropriate cross-tabulations of two variables at a time were also conducted and the Chi-square statistical test used to assess for statistically significant differences at $p \leq 0.05$, when appropriate.

Conversation Mapping

Approach

Conversation mapping is an efficient technique for collecting a lot of information in a short period of time by allowing all participants at a conversation mapping session to contribute simultaneously. Conversation mapping is considered an effective way of capturing different and sometimes contradictory stakeholder perspectives in a manner that can reduce tension and encourage forthrightness (Capacity Collaborative and Kingdom Pathways 2025). The information provided through conversation mapping is qualitative, in that the responses are open-ended and not typically coded for statistical analysis. The data are presented in the form of a visual map.

Data collection strategy

A total of 10 people from the Waiʻanae Coast attended a single conversation mapping session held on November 22, 2025 at the Kalanihoʻokaha Community Learning Center in Waiʻanae. Participants represented a wide age range from their late teens to older adults. Many were members of the KOA Hui and several lived on Hawaiian Homestead lands.

The conversation mapping session lasted two and a half hours. It started with a 10-minute presentation explaining what is environmental health and what is a health assessment, and then briefly overviewed a handful of examples of pollution such as air, water, and soil contamination. The purpose of this presentation was to introduce the participants to the overall project. It was given by Dr. Catherine Pirkle, the owner of Pirkle Epidemiology and Evaluation Consulting. This presentation was followed by another given by Carmen Guzman-Simpliciano, co-founder of Kingdom Pathways. Ms. Guzman-Simpliciano's presentation described the conversation mapping process and provided instructions to all of the participants on how they would participate in the process.

Conversation mapping participants were selected by Kingdom Pathways and the Capacity Collaborative. Two large sheets of paper were placed on tables in the meeting room, along with markers. In the middle of each sheet of paper was a trigger phrase meant to generate dialog about the environment and health along the Waiʻanae Coast. Two trigger phrases were provided.

The stakeholders at the meeting were divided up and assigned a station with one trigger phrase. Participants were given time to respond to the trigger in writing and to respond to the contributions of others, thus generating a dialog. Each response is called a conversation bubble and the combination of these bubbles constitutes the conversation map. Once everyone finished writing their responses at one station, they then switched stations and began a new one.

Establishing the triggers

An iterative process was used to determine the trigger phrases. At an initial Zoom meeting held on October 15th, 2025, Dr. Pirkle met with Kingdom Pathways and the Capacity Collaborative to brainstorm ideas and clarify objectives. Based on this conversation, three priority topics were identified:

- 1) Individual and community knowledge of environmental risks along the Wai‘anae Coast
- 2) Changes in the environment over time along the Wai‘anae Coast
- 3) Health conditions people believe to be associated with the environment

Subsequent meetings and discussions on Zoom and by email led to the final two trigger phrases: **Health Challenges and Environmental Changes**. These were viewed as broad enough to capture information relevant to the three priority topics listed above.

Data Analysis

The responses to each trigger were transcribed verbatim into a Word document and then uploaded into the qualitative analysis software MAXQDA (VERBI Software 2025).

To analyze the data, an adaptation of rapid qualitative analysis (Prevention Research Center at UMass Chan 2024) was used to examine and synthesize the conversation mapping data. To do this, an initial list of domains was created using the pollution examples that were presented during the 10-minute presentation by Dr. Pirkle at the conversation mapping session. These domains were supplemented by topics of focus assessed by the quantitative survey. Finally, three additional domains were added to align with the objectives set forth by Kingdom Pathways for this project: Native Hawaiian-specific content to align with the mission and vision of Kingdom Pathways; justice/fairness/equity content given the underlying motivation for this project; and action and advocacy content given explicit goals to make changes in the community.

This approach to creating domains to analyze the data was useful for linking the quantitative findings with the qualitative ones. Additionally, when applicable, inductive coding was used when sub-domains were identified during the review of the conversation bubbles of the map. For example, the actions proposed by the conversation mapping participants were divided into a number of sub-categories, such as food, education, and physical activity.

Quantitative Survey Results

Who participated in the survey?

Individual respondent characteristics

Table 1 shows the demographic and social characteristics of those people who took the environmental health assessment survey. The sample was generally older, with nearly half (46.0%) 65 years and older. It was mostly female (69%) and close to one third Native Hawaiian (29%). Just over a third of the sample had a high school degree or less, while about 40% had some college or university and/or an associate’s or technical degree. A quarter of the sample were college graduates.

Table 1: Number and percentage of respondents according to demographic and social characteristics. The missing column reflects the sum of "do not know" and "prefer not to respond" answers. The total sample was 111 people.

Characteristic	Number	Percent	Missing
Age			0
25-34	6	5.4%	
35-44	13	11.7%	
45-54	13	11.7%	
55-64	28	25.2%	
65-74	28	25.2%	
75+	23	20.7%	
Sex/Gender			0
Male	34	30.6%	
Female	77	69.4%	
Native Hawaiian			0
Yes	32	28.8%	
No	79	71.2%	
Education			0
High school graduate or less	38	34.2%	
Some college/university or a technical/associate’s degree	44	39.6%	
College/University graduate	29	26.1%	
Years living along the Wai‘anae Coast			4
15 years or less	28	25.2%	
16-50 years	53	47.8%	
51 years or more	26	23.4%	

There were 107 respondents who reported the number of years they had lived along the Wai‘anae Coast. On average, respondents had lived 35 years in the area. Unsurprisingly, years of residence along the Wai‘anae Coast was correlated with respondent age; that is, older respondents lived more years in the area. For example, the average number of years in the area was 49 for those 65 years and older; 39 for those 45 to 64 years, and 19 for those 25 to 44 years. Ten percent of the sample had lived along the Wai‘anae coast for 5 years or less. Thus, most people in the sample had lived a good portion, if not all, of their lives in the area.

Household characteristics

On average, survey respondents lived with one other person; that is, they lived in a two-person household. Just under a fifth (18.9%) of the sample lived alone, while just over a third (34.2%) lived in a 4-person household. Four households had eight people and one had nine. Most of the sample did not have children 17 or less residing with them. Nearly a third (30.6%) of the sample reported living with one or more children; four respondents lived with four children and two lived with five.

Most of the respondents in the sample (80.9%) lived in a single-family home, detached from any others. Thirteen respondents, or 11.9%, lived on Hawaiian Homestead lands.

Where do the survey respondents live?

The survey asked the respondents five questions about where they lived in proximity to sites identified by Kingdom Pathways as having water or air pollution, or both. These sites were Pōkaʻī Bay, Māʻiliʻilii Stream/Drainage Canal, Ulehawa Stream, PVT construction debris disposal, and Waimanalo Gulch. Respondents were described as living near these sites if they were within a half-mile radius. In the survey, respondents were given reference points to help them determine if they were within a half-mile. For example, the survey indicated that Pōkaʻī Bay Beach Park was about a 10-minute walk from Waiʻanae Elementary and that a half-mile from Waimanalo Gulch was between the Hawaiian Electric Kahe Power Plant and the Landfill. Some of these areas were not mutually exclusive.

Half (50.9%) of the survey respondents reported living within a half mile of Pōkaʻī Bay. Just under a third (30.3%) of the respondents reported living within a half-mile of Māʻiliʻilii Stream/Drainage Canal, 16.0% within a half-mile of PVT construction and debris disposal, and 15.3% within a half-mile of Ulehawa Stream. Only 2 respondents reported living within a half-mile of the Waimanalo Gulch. Because so few respondents lived in close proximity to this site, no further analyses were conducted using this variable (i.e., Waimanalo Gulch).

Proximity to sites of concern and respondent characteristics

Living within a half-mile of Pōkaʻī Bay was associated with being 45 years or older. The percentage of those identifying as Native Hawaiian or living on Hawaiian Homestead Lands was less than those who did not identify as Native Hawaiian or live on Homestead Lands. These differences were statistically significant. Living within a half-mile of Māʻiliʻilii Stream/Drainage Canal was also associated with not identifying as Native Hawaiian ($p < 0.01$) and more years living along the Waiʻanae Coast ($p 0.06$). Pōkaʻī Bay and Māʻiliʻilii Stream/Drainage Canal are fairly close to each other. Thus, it is not surprising that there are similar associations observed between respondent demographic characteristics and their proximity to areas of concern. In contrast, there was an association between identifying as Native Hawaiian and living within a half-mile of Ulehawa Stream ($p < 0.01$) and within a half-mile of PVT construction and debris disposal. No other demographic or household characteristics were associated with living in proximity to Ulehawa Stream. There was an association between lower educational attainment and living within a half-mile of PVT construction and debris ($p 0.01$).

Perceived Health Problems and Air and Water Pollution

Two questions on the survey asked respondents if they believed they had or had had health problems due to air or water pollution in their neighborhoods.

More respondents believed that air pollution had or was harming their health than water pollution. According to the survey results, approximately a quarter (23.6%) of respondents believed they had or had had a health problem due to **air pollution**. At 16.4%, less respondents believed they had or had had a health problem due to **water pollution** (figure 3).

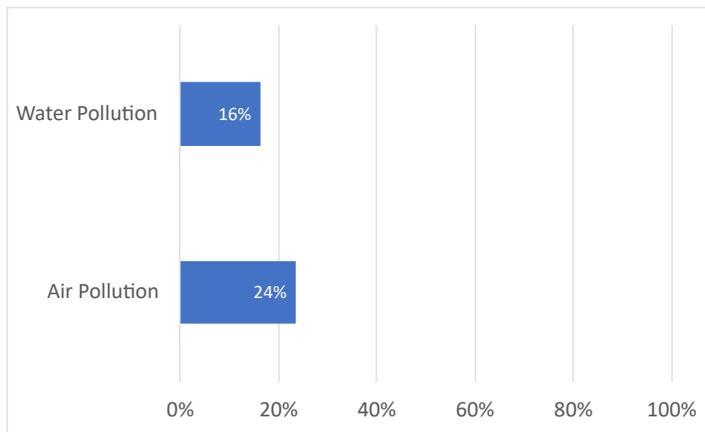


Figure 3: Percent of respondents reporting that they believe they have or have had health problems due to air or water pollution in their neighborhood

Many respondents expressed uncertainty about whether or not they had or had had health problems due to air or water pollution in their neighborhoods: for air pollution, 16.4% responded that they did not know and for water pollution, 19.1% said that they did not know. “Do not know” responses, rather than a definitive “no”, indicate a respondent has not ruled out air or water pollution contributing to their health problems, but also lack certainty about it.

Table 2 shows respondent reports of health concerns due to air and water pollution by their demographic characteristics: age, sex/gender, Native Hawaiian identity, and educational attainment.

Table 2: Number and percentage of respondents reporting they believe they had or had had a health condition due to air or water pollution in their neighborhood, according to demographic characteristics (n=110 due to one “prefer not to answer” response). Column percentages are presented.

	Air Pollution			Water Pollution		
	Yes	No	DNK	Yes	No	DNK
Age						
25-44	6, 23.1%	8, 12.1%	5, 27.8%	3, 15.8%	10, 14.3%	6, 28.6%
45-64	9, 34.6%	29, 43.9%	3, 16.7%	7, 36.8%	30, 42.9%	4, 19.1%
65+	11, 42.3%	29, 43.9%	10, 55.6%	9, 47.4%	30, 42.9%	11, 52.4%
Sex/Gender						
Male	8, 30.8%	21, 31.8%	5, 27.8%	7, 36.8%	21, 30.0%	6, 28.6%
Female	18, 69.2%	45, 68.2%	13, 72.2%	12, 63.2%	49, 70.0%	15, 71.4%
Native Hawaiian						
Yes	9, 34.6%	19, 28.8%	4, 22.2%	7, 36.8%	21, 30.0%	4, 19.1%
No	17, 65.4%	47, 71.2%	14, 77.8%	12, 63.2%	49, 70.0%	17, 81.0%

Education						
HS graduate or less	8, 30.8%	26, 39.4%	3, 16.7%	7, 36.8%	25, 35.7%	5, 23.8%
Some College or University	12, 46.2%	25, 37.9%	7, 38.9%	8, 42.1%	27, 38.6%	9, 42.9%
College or University graduate	6, 23.1%	15, 22.7%	8, 44.4%	4, 21.1%	18, 25.7%	7, 33.3%
Years on Wai‘anae Coast						
15 years or less	7, 26.9%	18, 28.6%	3, 17.7%	4, 22.2%	21, 30.9%	3, 15.0%
16 to 50 years	15, 57.7%	27, 42.9%	10, 58.8%	11, 61.1%	28, 41.2%	13, 65.0%
51 years or more	4, 15.4%	18, 28.6%	4, 23.5%	3, 16.7%	19, 27.9%	4, 20.0%

Perceived health problems from pollution and respondent demographic characteristics

Age

There were no statistically significant differences, at $p \leq 0.05$, between the respondent age group and reporting that they believed they have or have had a health condition due to air or water pollution. However, the numbers of respondents in some of the cells were small. Small numbers make it harder to detect statistically significant differences, even if the differences are meaningful. Thus, it is also important to look at the descriptive patterns in the data, especially with small samples, even when differences are not statistically significant (Figure 4).

Younger adults (32%) were more likely to believe that air pollution had harmed their health compared to middle-aged (22%) or older adults (22%), but they were also the least certain when responding to this question. Middle-aged adults had the most confidence answering this question and nearly three quarters responded that air pollution had not harmed their health (Figure 4).

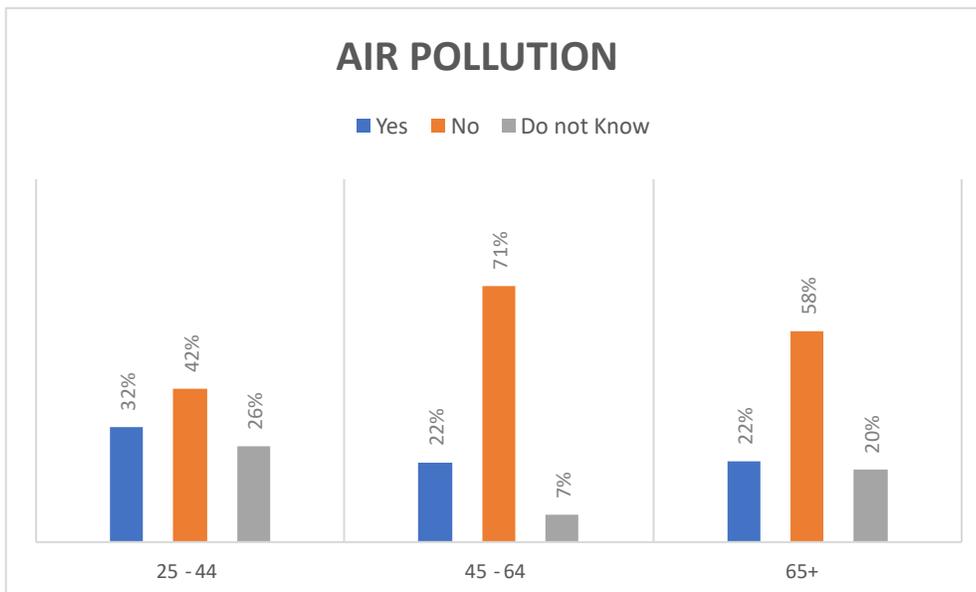


Figure 4: Percent of respondents reporting that they believed they had or had had a health condition due to air pollution in their neighborhood, by age group (n=110)

Because respondents who answered “do not know” to this question most likely believe it is possible that they have or have had a health

condition due to air or water pollution, a variable was created that grouped “yes” and “do not know” responses into one category. This variable was also used when comparing respondent demographic

characteristics to their responses to the two questions about air and water pollution having negatively affected their health.

When “yes” and “do not know” responses were grouped into a single category and analyzed by age group, the results continued to show that younger people were more concerned that air pollution may have harmed their health than middle-aged adults and older adults. Fifty-eight percent of younger adults

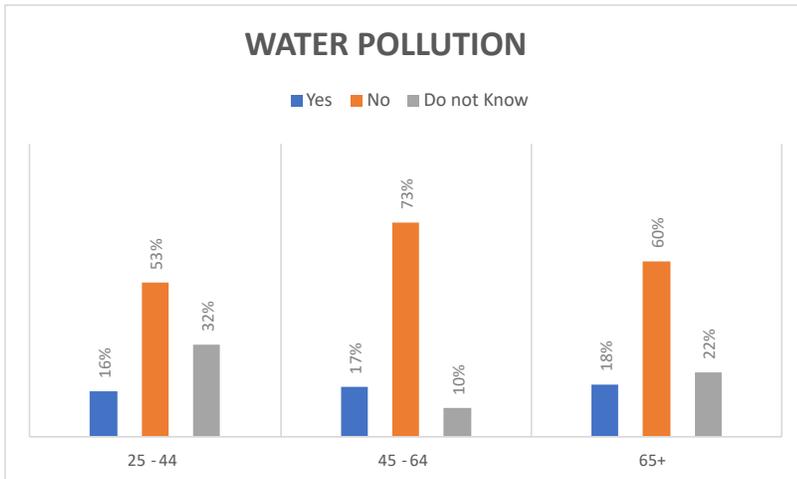


Figure 5: Percent of respondents reporting that they believed they had or had had a health condition due to water pollution in their neighborhood, by age group (n=110)

responded with yes or do not know to the question about whether or not air pollution had harmed their health as compared to 29% for middle-aged adults and 42% of older adults (appendix figure 1).

The percentage of respondents reporting that they had or had had health conditions due to water pollution in their neighborhood was similar across age groups varying from 16% (young adults) to 18% (older adults, figure 5). Because the numbers were so similar, an additional analysis

with the combined “yes” and “do not know” variable was not conducted.

Sex/Gender

There were no discernable differences in the reporting of health conditions due to air or water pollution by male or female sex.

Native Hawaiian Ethnicity

Those identifying as Native Hawaiian were slightly more likely to report that they had been sickened at some point by air or water pollution in their neighborhood, compared to those who did not identify as Native Hawaiian. The difference was not statistically significant (figure 6). Based on the “do not know” responses, Native Hawaiian respondents were more confident in their answers to this question than non-Native Hawaiian survey respondents. When the responses “yes” and “do not know” were grouped together, the differences in responses between Native Hawaiian and Non-Native Hawaiian respondents was smaller (results not shown). Considering both analyses together, the results indicate little difference between Native Hawaiian and non-Native Hawaiian respondents believing they had or had had a health condition due to air or water pollution.

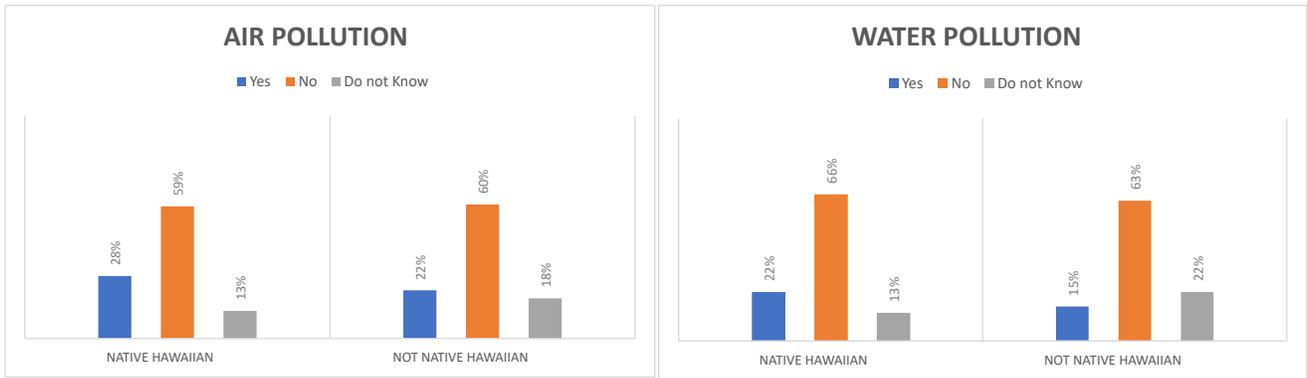


Figure 6: Percent of respondents reporting that they believed they had or had had a health condition due to air or water pollution, by self-identification as Native Hawaiian (n=111)

Education

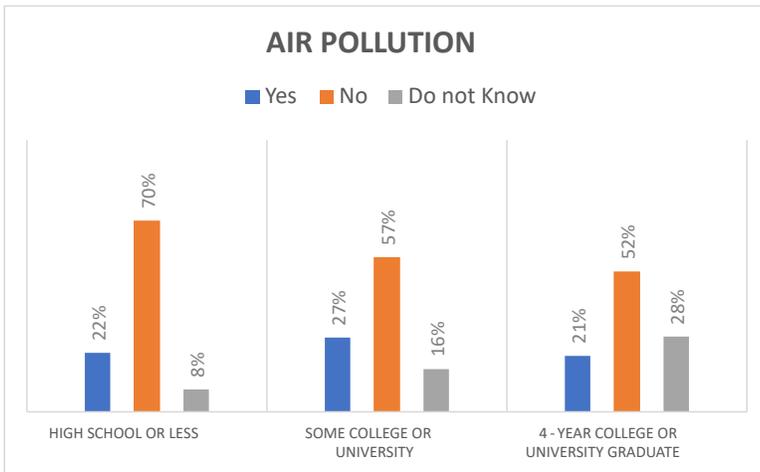


Figure 7: Percent of respondents reporting that they believed they had or had had health conditions due to air pollution by educational attainment group (n=110)

There were no statistically significant differences in respondents reporting that they believed they had or had had a health condition due to air or water pollution in their neighborhood, by educational level. However, while not statistically significant, the descriptive patterns for air pollution were interesting. Those who had completed less years of schooling were more confident in their responses and more likely to report that they had not been sicked by air pollution in their neighborhood. There was a gradient in the responses from least to most education

(figure 7). Those with a college degree were the least confident in responding, with 28% answering “do not know”. When “yes” and “do not know” responses were combined, the percent responding “yes/do not know” to the air pollution question was 48%, 43%, 30% for those with a 4-year degree, those with some college, and those with a high school degree or less, respectively (appendix figure 2). Those with

higher levels of education may be more aware of environmental health concerns and thus less likely to dismiss these concerns as causes of health conditions that they may have or have had.

Years living along the Wai‘anae Coast

Figure 8 shows the percentage of respondents reporting that they believed they had or had had health conditions due to air and water pollution in their neighborhoods. For both air and water pollution, the group least likely to respond that they had or had had a health condition due to one of these types of pollution in their neighborhood was those who had lived along the Wai‘anae Coast 51 years or longer. A

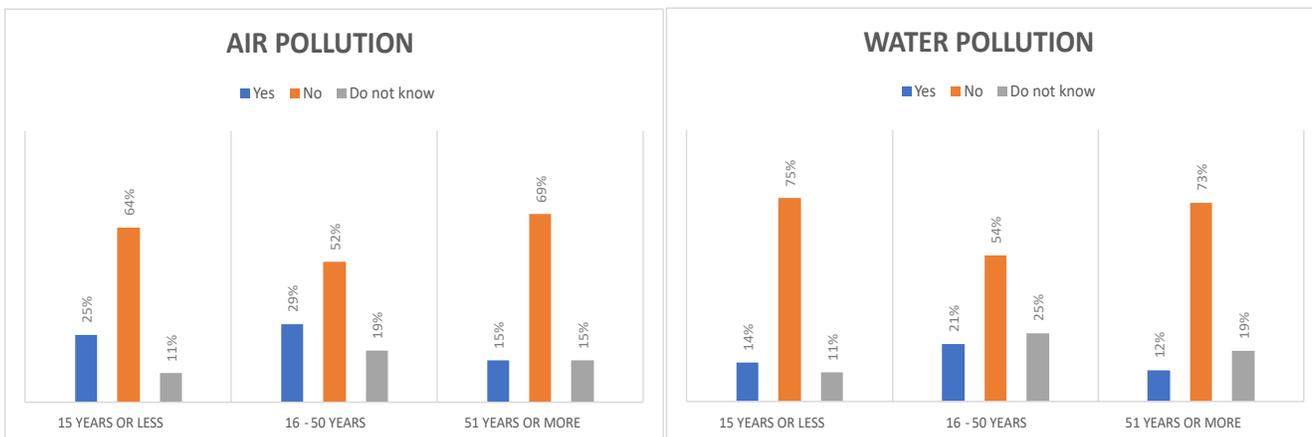


Figure 8: Percent of respondents reporting that they believed they had or had had health conditions due to air and water pollution by the years they have lived along the Wai‘anae coast (n=106)

similar percentage of respondents reported that air pollution had harmed their health when comparing those who had lived along the Wai‘anae coast 15 years of less (25%) to those who had lived along the Wai‘anae Coast 16-50 years (29%). In contrast, for water pollution, a similar percentage of respondents answered that water pollution had harmed their health in the 15 years or less group (14%) and the 51 years or more group (12%). None of the differences were statistically significant. The patterns described here were largely the same when the “yes” and “do not know” responses were grouped together (results not shown).

Perceived health problems from pollution and respondent household characteristics

Lives alone or lives with children

Analyses were conducted to assess if there were differences between those reporting that they had or had had a health condition due to air or water pollution, according to whether they lived alone or if they lived with children. For air pollution, there were no notable differences between groups for either measure. For water pollution, of the 21 people who lived alone, only 2 people believed they had or had had health conditions due to water pollution. In other words, very few people who lived alone believed that water pollution in their environment had made them sick at some point during their lives.

Slightly more respondents who lived with children reported that they believe they had or had had a health condition due to air pollution, compared to those who did not live with children. Those who lived with children were more likely to respond that they had not had a health condition due to water pollution than those who did not live with children (figure 9).¹ The differences between groups were not statistically significant for either air or water pollution.

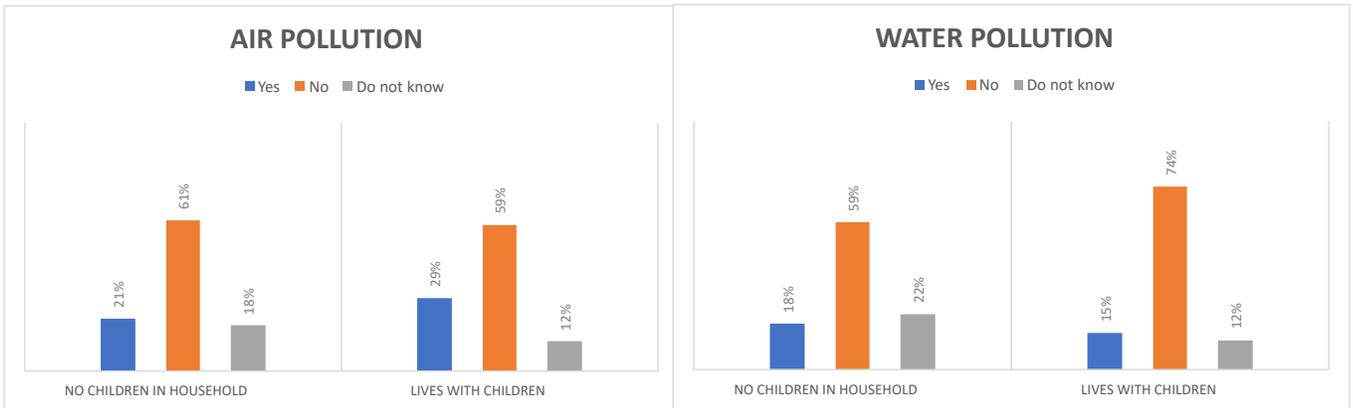


Figure 9: Percent of respondents reporting that they believed they had or had had a health condition, due to air or water pollution in their neighborhood, according to whether or not children lived in their household (n=110)

Number of people living in the house

Compared to those who lived alone or who lived in households of two to four people, those in larger households (five or more) were more likely to report that they had or had had health a health condition due to air or water pollution in their neighborhood (figure 10). None of the differences between groups were statistically significant.

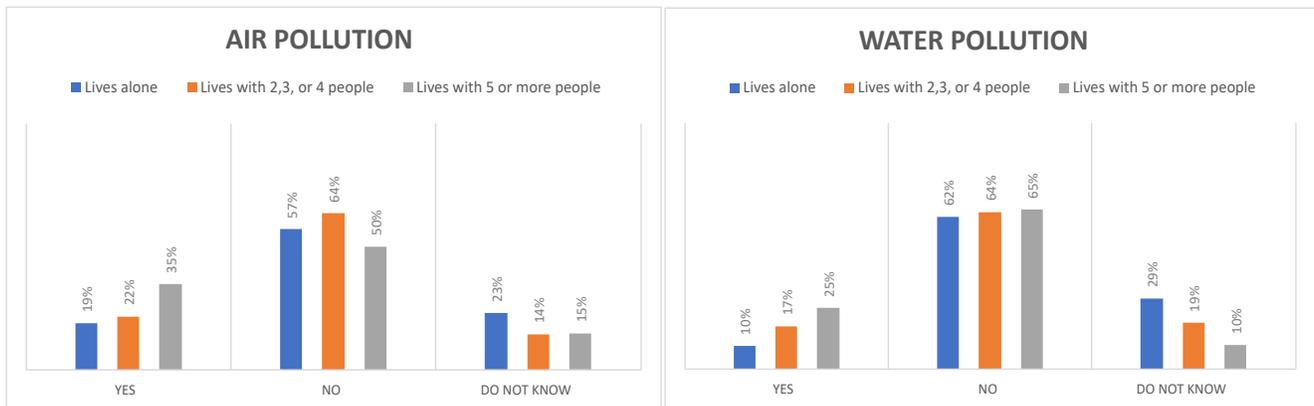


Figure 10: Percent of respondents reporting that they believed they had or had had health conditions, due to air and water pollution in their neighborhood according to the size of the household (n=110)

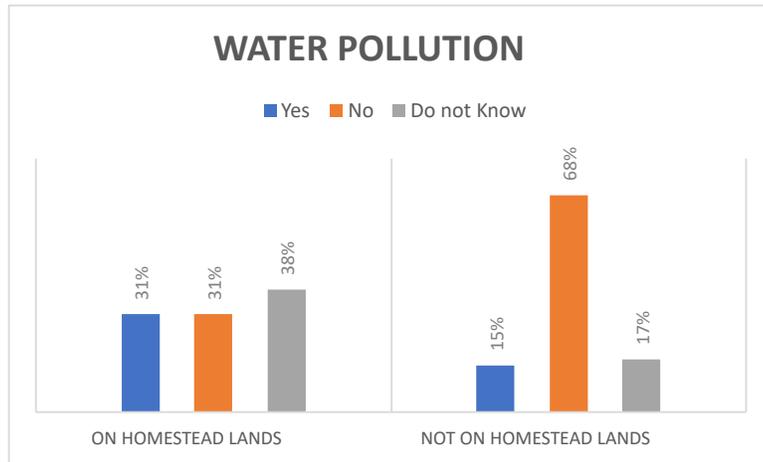
¹ We did not ask if the children in the household had or had had a health condition due to air or water pollution. All questions were directed at the respondent, who had to be an adult. We also do not know if the respondent was a parent or guardian, we only know whether or not there were children in the household.

House Type

The type of house the respondent lived in was not related to perceptions of whether or not they had been made sick by air or water pollution.

Hawaiian Homestead Lands

For water pollution, there was a statistically significant difference ($p=0.03$) between those who lived on Hawaiian Homestead Lands and those who did not. This was not observed for air pollution. Only four of



the 13 respondents who lived on Hawaiian Homestead Lands reported that they did not think they had or had had a health condition due to water pollution, while 5 reported “do not know”. Among those respondents living on Hawaiian Homestead Lands, 31% answered that they had or had had a health condition due to water pollution, compared to 15% among those not living on Hawaiian Homestead Lands (figure 12). These results were corroborated by using the alternative water pollution variable that combined “yes” with “do not know”. In this

Figure 11: Percent of respondents reporting that they believed they had or had had a health condition due to water pollution in their neighborhood, according to whether or not they lived on Hawaiian Homestead Lands (n=108)

comparison, the p-value was <0.01 (appendix figure 3).

Perceived health problems from pollution and proximity to areas of concern

There were no associations between living near Pōkaʻī Bay or Māʻiliʻilii Stream/drainage canal and reporting that air or water pollution had harmed respondent health. There was a statistically significant association between living within a half-mile of Ulehawa Stream and reporting that air pollution had harmed respondent health ($p 0.05$). Nearly half of respondents who lived within a half-mile of Ulehawa Stream reported that they believed they had or had had a health condition due to air pollution. A similar association was observed for those living in proximity to PVT and air pollution ($p 0.04$) with again, nearly half of respondents within a half-mile of this location reporting that they believe they had or had had a health condition due to air pollution. Further, those residing in close proximity to Ulehawa Stream and the PVT construction and debris disposal site were much more confident in their responses, than those who lived more than a half-mile from these sites (figure 13). A greater percentage of those living within a half-mile of PVT reported that they had or had had health conditions due to water pollution than those reporting the opposite (Figure 14). But with a p-value of 0.08, the result was not statistically significant.

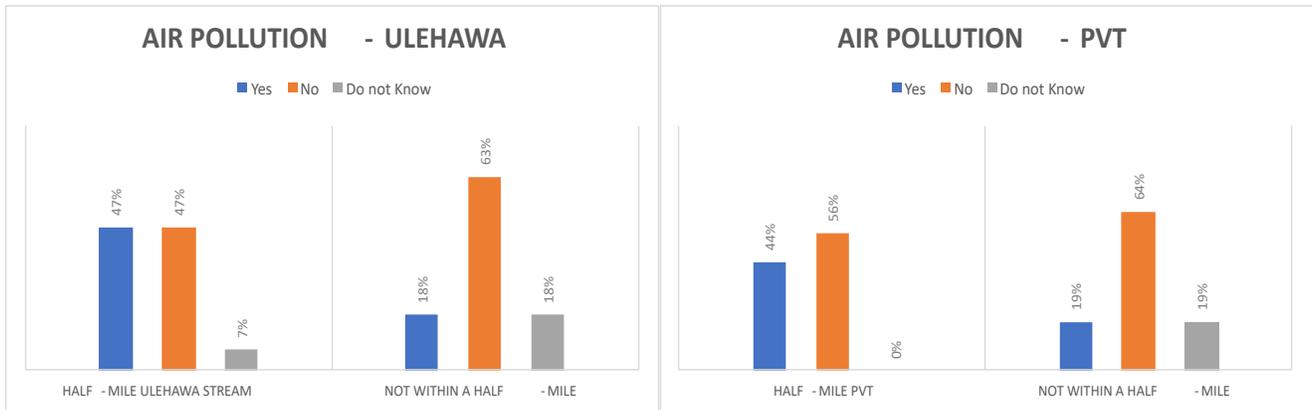


Figure 12: Percent of respondents reporting that they believed they had or had had a health condition due to air pollution in their neighborhood, according to proximity to Ulehawa Stream (n=97) and PVT construction and debris disposal (n=99)

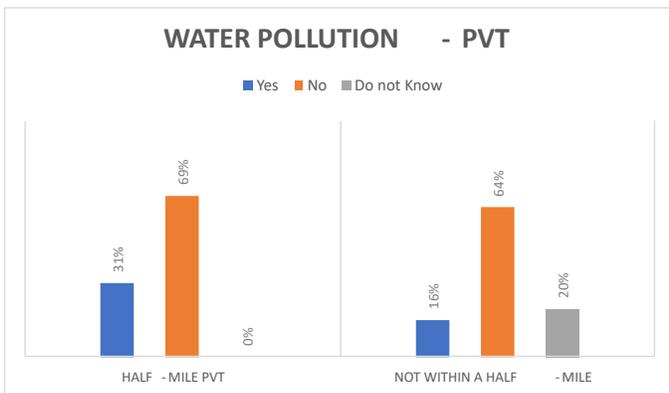


Figure 13: Percent of respondents reporting that they believed they had or had had a health condition due to water pollution in their neighborhood, according to proximity to PVT construction and debris disposal (n=99)

Summary

One in four respondents believed that air pollution had harmed their health at some point during their lives and one in five respondents believed the same for water pollution. Generally, the respondent's personal and household characteristics were not associated with their perceptions that air or water pollution had harmed their health. Younger adults in the sample, that is, those 25-44 years, were more concerned about air pollution having harmed

their health than older respondents in the sample. While not statistically significant, the difference between the two groups was large (10%). Similarly, compared to those who lived alone or who lived in households of two to four people, those in households of five or more were more likely to report that they had or had had a health condition due to air or water pollution in their neighborhood. Again, this difference was not statistically significant, but it was large (35% of those in larger households believed air pollution had harmed their health versus 19% among those who lived alone). **Finally, there was a strong association and statistically significant association between living on Hawaiian Homestead Lands and believing that water pollution contributed to health conditions experienced by the respondent at some point during their life.**

Health Conditions Reported and Suspected

Respondents to the survey were asked if a doctor had ever told them that they had one or more of the following health concerns or conditions: asthma, chronic lung disease, hypertension, heart disease, type-2 diabetes, gastrointestinal disease, and osteoporosis. All of these conditions have been demonstrated in the scientific literature to have associations with certain types of environmental pollutants. For example, there is strong evidence from around the globe that air pollution is associated with cardiovascular and respiratory diseases (Liu et al. 2023). Similarly, a large number of studies have linked air pollution to osteoporosis (Allen et al. 2024).

Chronic conditions

Table 3 shows the number and percent of respondents with each of the chronic conditions assessed. The most common condition in the sample was hypertension, with half of the survey respondents reporting they had been told by a doctor that they had hypertension at some point in their lives. Asthma was the second most common condition at 23%, followed by type-II diabetes at 22%.

Table 3: Number and percent of survey respondents who believed they had or had had a health condition due to air or water pollution by presence or absence of select chronic conditions. Bolded cells indicate statistically significant associations.

	Total with condition (n, %)	Air pollution harmed health (n=26)	p-value	Water pollution harmed health (n=19)	p-value
Asthma	25, 22.5%		<0.01		0.22
Yes		11, 45.8%		7, 29.2%	
No		15, 17.4%		12, 14.0%	
Lung disease	12, 10.8%		0.04		0.06
Yes		6, 50.0%		5, 41.7%	
No		20, 20.4%		14, 14.3%	
Hypertension	55, 49.6%		0.44		0.86
Yes		10, 18.5%		10, 18.5%	
No		16, 28.6%		9, 16.1%	
Heart disease	17, 15.3%		0.05		0.06
Yes		7, 41.2%		6, 35.3%	
No		19, 20.4%		13, 14.0%	
Diabetes	24, 21.6%		0.24		0.28
Yes		7, 29.2%		6, 25.0%	
No		19, 22.1%		13, 15.1%	
Osteoporosis	15, 13.5%		0.21		0.11
Yes		6, 40.0%		4, 26.7%	
No		20, 21.1%		15, 15.8%	
Gastrointestinal disease	9, 8.1%		<0.01		<0.01
Yes		6, 66.7%		6, 66.7%	
No		20, 19.8%		13, 12.9%	

Those whose doctor had ever told them they had asthma or lung disease were much more likely to believe that air pollution harmed their health than those without these conditions. Those with lung disease were also more likely to believe that water pollution had harmed their health than those without lung disease. Those respondents whose doctor had told them they had heart disease, such as a heart

attack, coronary heart disease, or angina, were more likely to report that air or water pollution had harmed their health than those without these conditions. This was also the case for gastrointestinal disease (table 3).

Proximity to areas of concern and chronic conditions

There were some associations between certain chronic conditions and proximity to locations of concern. Among those with lung disease, 56% lived within a half mile of Mā'ili'ilii stream/drainage canal compared to 45% who lived more than half a mile from this location (figure 15). The p-value for this comparison

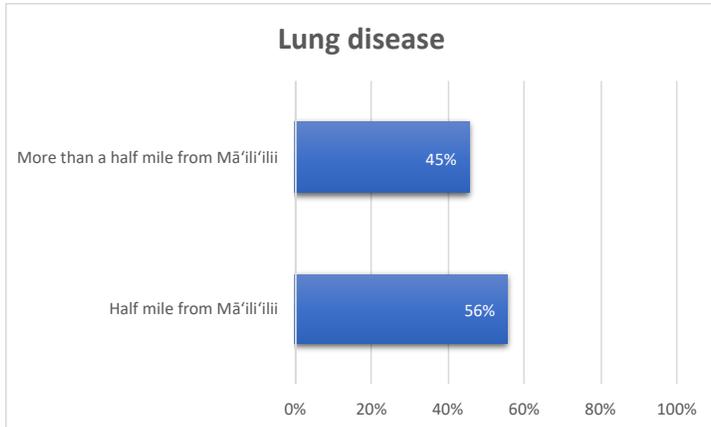


Figure 14: Percent of respondents with lung disease according to proximity to Mā'ili'ilii stream/drainage canal (n=99)

was 0.06.

Among those with heart disease, less (33%) lived within a half-mile of Ulehawa Stream and PVT than those who lived in proximity to these locations (66%). The results were statistically significant.

Water related health conditions

Fish consumption illnesses

In this survey, we asked respondents if they had ever been told by a doctor that they had ciguatera or scombroid fish poisoning.

Ciguatera fish poisoning may result from the consumption of large sub-tropical carnivorous fish such as barracuda and grouper. This type of fish poisoning can cause gastroenteritis followed by neurological symptoms. Cardiovascular symptoms such as bradycardia and hypotension are also associated with this type of poisoning. Symptoms can last for months or years (Centers for Disease Control and Prevention 2025).

Scombroid fish poisoning can occur with the consumption of inadequately chilled histidine-rich fish such as tuna and mahi-mahi. The histidine converts to histamine and other scombrotoxins as a result of bacterial action and results in what resembles an acute allergic reaction with features such as flushing, headache, wheezing, and gastroenteritis (Centers for Disease Control and Prevention 2025).

Three people reported that a doctor had told them they had had one of these types of fish poisoning: two with ciguatera fish poisoning and another one with scombroid fish poisoning. An additional person reported that they suspected they had had scombroid fishing poisoning. **In total, four respondents had been told by a doctor or suspected that they had one of these two types of fish poisonings.** Three of the four individuals who were told by a doctor or suspected they had had fish poisoning also reported that they believed they had or had had health conditions due to both water and air pollution.

Methicillin-resistant *Staphylococcus aureus* (MRSA)

We asked respondents if they had been told by a doctor or suspected that they had had MRSA. MRSA is caused by a type of bacteria known as *Staphylococcus aureus* that is resistant to common antibiotics such as penicillin. It causes skin infections, but is typically harmless. However, it can cause more serious infections if it gets into deeper tissues, the blood stream or the lungs (Disease Outbreak Control Division, Hawai'i Department of Health, n.d.). People can become infected with MRSA through a variety of ways, including swimming and surfing in the ocean, because it lives in saltwater (Disease Outbreak Control Division, Hawai'i Department of Health, n.d.).

Four survey respondents reported that they had been told by a doctor that they had MRSA and an additional two suspected that they had had MRSA. **In total, six people believed they had had or suspected they had had MRSA.** All six people who had been told by a doctor or suspected they had had MRSA reported that they had had or had a health condition due to air pollution. Five of the six reported the same thing for water pollution, with the sixth person reporting “do not know”.

Proximity to areas of concern and water-related health conditions

Of the four individuals who reported experiencing fish poisoning, three of them lived within a half-mile of Pōka'i Bay and/or Mā'ili'ilii stream/drainage canal. Four of the six respondents reporting having had MRSA also lived within a half-mile of Pōka'i Bay and/or Mā'ili'ilii stream/drainage canal. These results align with most respondents in the survey living within a half-mile of these two locations.

Respiratory allergies, such as allergic rhinitis and sinusitis

Twenty-nine respondents (26.4%) reported that they had respiratory allergies, such as allergic rhinitis and sinusitis. There was a statistically significant association between respondents reporting having respiratory allergies and believing air pollution had harmed their health ($p < 0.01$). While only 26% of respondents reported respiratory allergies, 58% of those reporting air pollution had harmed their health had respiratory allergies (figure 16). While not statistically significant ($p = 0.10$), the pattern was

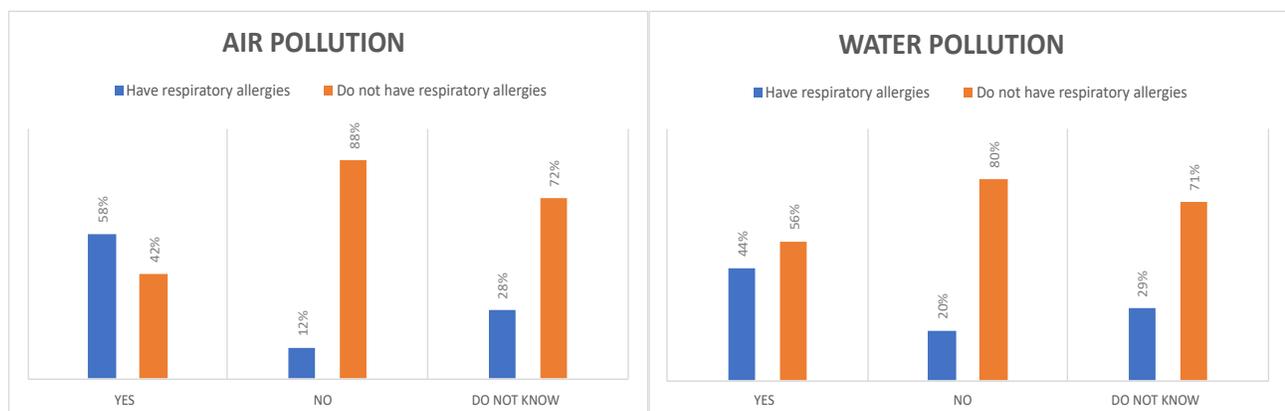


Figure 15: Percent of respondents reporting that they believed they had or had had health conditions due to air or water pollution, according to whether or not they had respiratory allergies (n=109)

similar for water pollution, with 44% of those reporting that water pollution had harmed their health having respiratory allergies.

Swimmers' ear

A quarter of the sample (24.3%) reported having had swimmers' ear before, with 14.4% reporting they had had it one to three times and 9.9% reporting they had had it four or more times. There were statistically significant associations between having had swimmers' ear and respondents believing that they had or had health conditions due to air ($p < 0.01$) and water ($p < 0.01$) pollution. Nearly everyone who reported having had swimmers' ear four or more times believed that air pollution had harmed their health; most respondents in this group also believed that water pollution had harmed their health (figure 17). Among those reporting that water pollution had harmed their health, 58% had had swimmers' ear before (results not shown). This is twice the proportion in the sample that reported having had swimmers' ear before.

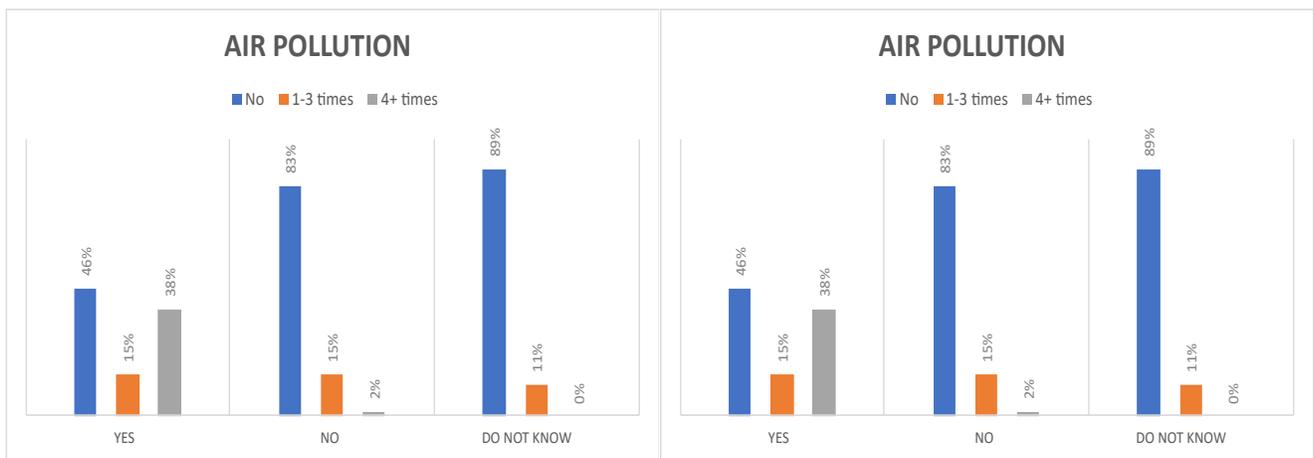


Figure 16: Percent of respondents reporting that they believed they had or had had health conditions due to air or water pollution, according to the number of times they had swimmers' ear in the past (n=111)

Proximity to areas of concern, respiratory allergies, and swimmers' ear

There were no associations between reporting respiratory allergies and any of the areas of concerns (Pōka'i Bay, Mā'ili'ilii Stream/drainage canal, Ulehawa Stream, and PVT construction and debris disposal). Likewise, there were no associations with swimmers' ear.

Summary

There were a number of chronic health conditions that were associated with survey respondents reporting that they had experienced health problems due to air or water pollution. Unsurprisingly, those who had ever been told by a doctor that they had asthma or lung disease were significantly more likely to report having had health problems due to air pollution. Interestingly, nearly three times as many respondents who had been told they had lung disease reported having had a health condition due to

water pollution, compared to those who had not been told they had lung disease. There were also associations with heart disease and gastrointestinal disease.

A small number of respondents reported water-related illnesses. Four people had been told by a doctor or suspected they had had fish poisoning and three of these individuals reported they had been sickened from air or water pollution. Six respondents reported having been told by a doctor or they suspected they had had MRSA. All of them reported having had health problems due to air pollution and five of the six reported having had health problems from water pollution.

Respondents who reported that they had respiratory allergies or who reported having had swimmers' ear in the past were much more likely to believe that air or water pollution had harmed their health than those who did not report these conditions.

Generally, respondents who experienced serious health concerns or conditions were more likely to report that air or water pollution had harmed their health than those without similar health concerns or conditions.

How do you rate your neighborhood?

The survey asked respondents to rate their neighborhoods from excellent to poor, as well as how their neighborhoods look and their cleanliness. Table 4 shows how survey respondents rated their neighborhoods. Nearly two-thirds (62.4%) rated their neighborhood as a good or excellent place to live. A similar percentage (63.2%) rated the air quality in their neighborhood as good or excellent. Less than half (44.6%) rated their neighborhood as looking excellent or good. A bit less (41.8%) rated the cleanliness of their neighborhood as good or excellent. Concerningly, a quarter of respondents rated the way their neighborhood looks as poor and a fifth rated the cleanliness of their neighborhood as poor.

Table 4: Numbers and percentages of respondents reporting excellent, good, fair, or poor for attributes of their neighborhoods (n=110)

	Excellent N,%	Good N,%	Fair N,%	Poor N,%
As a place to live	25, 22.9%	43, 39.5%	28, 25.7%	13, 11.9%
The way it looks	10, 9.1%	39, 35.5%	33, 30.0%	28, 25.5%
Cleanliness	10, 9.1%	36, 32.7%	41, 37.3%	23, 20.9%
Air quality	20, 18.9%	47, 44.3%	29, 27.4%	10, 9.4%

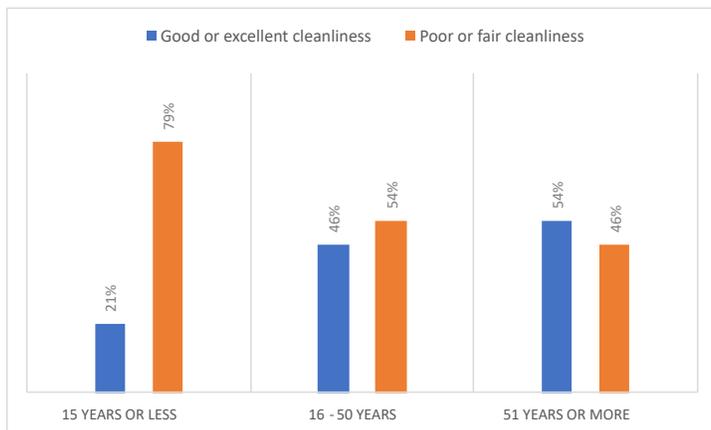


Figure 17: Percent of respondents reporting good or excellent cleanliness of their neighborhood, compared to poor or fair cleanliness, according to how long they lived along the Wai'anae Coast (n=106)

For the most part, respondent demographic and household characteristics were not associated with how they rated their neighborhoods generally, their looks and their cleanliness. A greater percentage of those living alone (80.0%) reported that they lived in a good or excellent neighborhood compared to those who lived with others (58.4%); the p-value for the comparison was 0.07. Also, a higher percentage of those living with children 17 years or younger reported that the cleanliness of their neighborhood was fair or poor (71.6%), compared to those with no children in the household (53.6%); the p-value was 0.08. There was a statistically significant difference (p-value 0.03) between the length of time people had lived along the Wai'anae Coast and how they rated the cleanliness of their neighborhood. Those who had lived along the Wai'anae Coast for less time (15 years or less) were more likely to rate the cleanliness of their neighborhood as poor or fair compared to those who had lived along the Wai'anae Coast for longer (figure 18).

A number of demographic and household characteristics were associated with respondents' ratings of air quality in their neighborhoods: age group (p 0.01), educational attainment (p 0.08), years on the Wai'anae Coast (p 0.08), and living on Hawaiian Homestead Lands (p<0.01). Older age groups were more likely to rate the air quality as good or excellent than younger ones; those 25-44 years mostly rated the

air quality as poor to fair. Those with a high school education or less and who had completed a 4-year degree at a college or university were more likely to rate the air quality as good or excellent than those who had some college or university. Those who had lived along the Wai‘anae Coast for 51 years or more overwhelmingly rated the air quality as good or excellent, while those who had lived along the Wai‘anae Coast for less time were more equivocal in their ratings. Finally, those who lived on Hawaiian Homestead

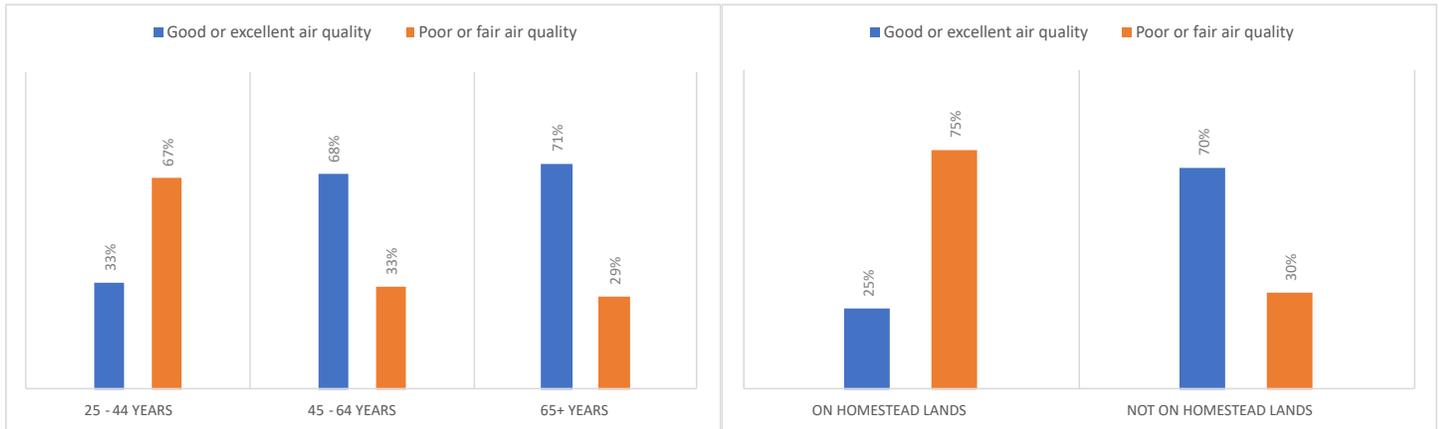


Figure 18: Percent of respondents reporting good or excellent air quality in their neighborhood, compared to poor or fair air quality, according to age group (n=106) and living on Hawaiian Homestead Lands (n=104).

Lands predominately rated their air quality as poor or fair; the opposite was observed for those who did not live on Hawaiian Homestead Lands. Figure 19 presents the results for age group and living on Hawaiian Homestead Lands.

Neighborhood Ratings and Health Conditions from Pollution

There were associations between how respondents rated their neighborhoods and if they believed they had or had had a health condition due to air or water pollution. Those who reported that they believed air or water pollution had harmed their health were more likely to rate their neighborhood as looking

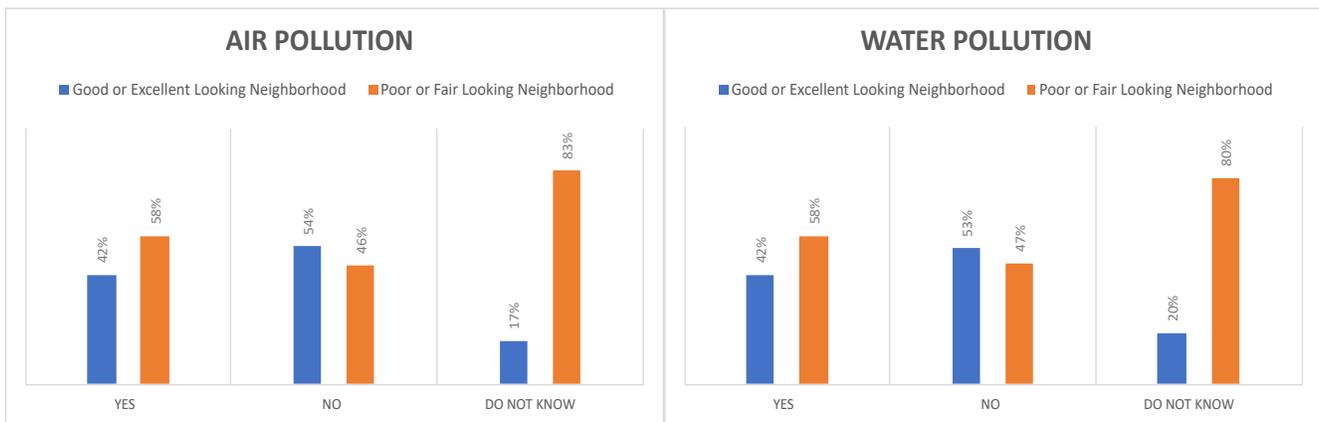


Figure 19: Percent of respondents reporting that they believed they had or had had health conditions due to air or water pollution, according to how they rated the way their neighborhood looked (n=109)

poor or fair than those who did not report having had a health condition due to air or water pollution.

This was also strongly observed for those who indicated they did not know if air or water pollution had harmed their health (figure 20). Those who reported that they had or had had a health condition due to air pollution were more likely to rate the cleanliness of their neighborhood as poor or fair. This was not observed as noticeably for water pollution. However, for both air and water pollution, those who indicated that they did not know if pollution had harmed their health were much more likely to report the cleanliness of their neighborhood as fair or poor (figure 21). The associations described in this paragraph were statistically significant.

Those who stated that they had or had had a health condition due to air pollution were much more likely



Figure 20: Percent of respondents reporting that they believed they had or had had health conditions due to air or water pollution, according to how they rated the cleanliness of their neighborhood (n=109)

to report poor or fair air quality in their neighborhoods than those who reported the opposite (figure 22). This was statistically significant ($p < 0.01$). While not statistically significant, a higher percent of those reporting that they did not believe water pollution had harmed their health rated the air quality as good or excellent (71%) compared to those that reported it as fair to poor (29%, $p = 0.06$).

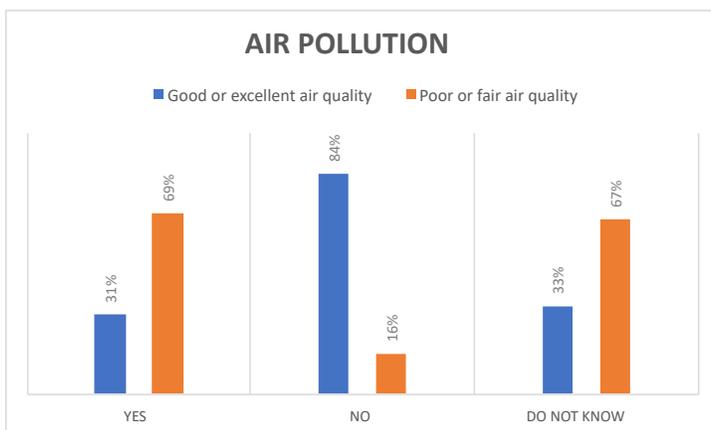


Figure 21: Percent of respondents reporting that they believed they had or had had health conditions due to air pollution, according to their rating of the neighborhood's air quality (n=105)

Neighborhood ratings and proximity to areas of concern

There were no associations between how respondents rated their neighborhood overall, by how it looks, or by its cleanliness with living within a half-mile of Pōkaī Bay, Mā'ili'iili Stream/drainage canal, or PVT

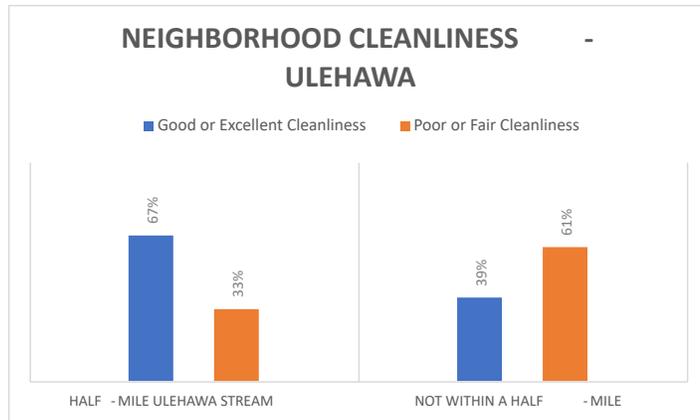


Figure 22: Percent of respondents reporting that their neighborhood had good or excellent cleanliness versus fair or poor, according to their proximity to Ulehawa Stream (n=98)

construction or debris disposal. However, those living in proximity to Ulehawa Stream were significantly more likely to rate the cleanliness of their neighborhood as good or excellent than those living more than a half-mile from the stream (figure 23). A similar association was observed for how the neighborhood looked, but it was not statistically significant (p 0.08). In contrast, a greater percent of those living within a half-mile of Mā'ili'iili Stream/drainage canal rated their neighborhood's air quality as poor or fair (55%) compared to those who rated it as good to excellent (45%) (figure 24). The difference was statistically significant (p 0.02).

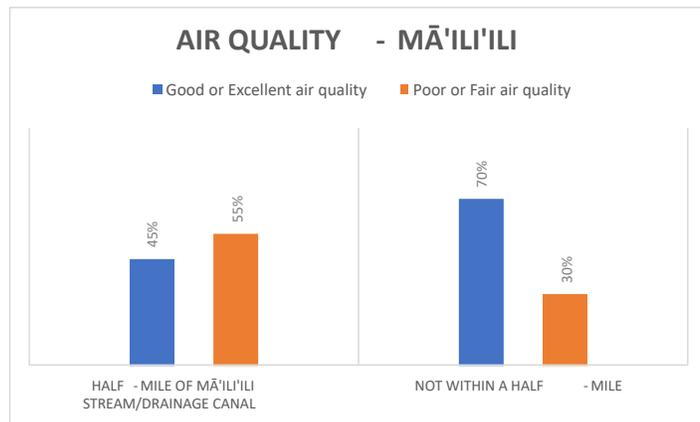


Figure 23: Percent of respondents reporting that their neighborhood had good or excellent air quality versus fair or poor, according to their proximity to Mā'ili'iili Stream/drainage canal (p=96)

Noise

Survey respondents were asked two questions about noise. The first question asked, “Thinking about the last 12 months or so, when you were at home, how much does noise from the road bother, disturb, or annoy you?”. About a quarter (26.4%) of respondents said not at all, while 47.3% said slightly or moderately, and 26.4% said very much or extremely. The second question asked, “Thinking about the last 12 months or so, when you were at home, how much does noise from loud vehicles, such as trucks and construction vehicles bother, disturb, or annoy you?”. About a quarter (24.3%) said not at all, while 51.4% said slightly or moderately, and 24.3% said very much or extremely. Figure 25 shows participant responses across the five response categories. Both of the questions about road noise were highly correlated, suggesting that most of the road noise bothering survey respondents is coming from large vehicles. Being bothered by road noises was not associated with any of the participant demographic or household characteristics (e.g., age, sex, education, people in household).

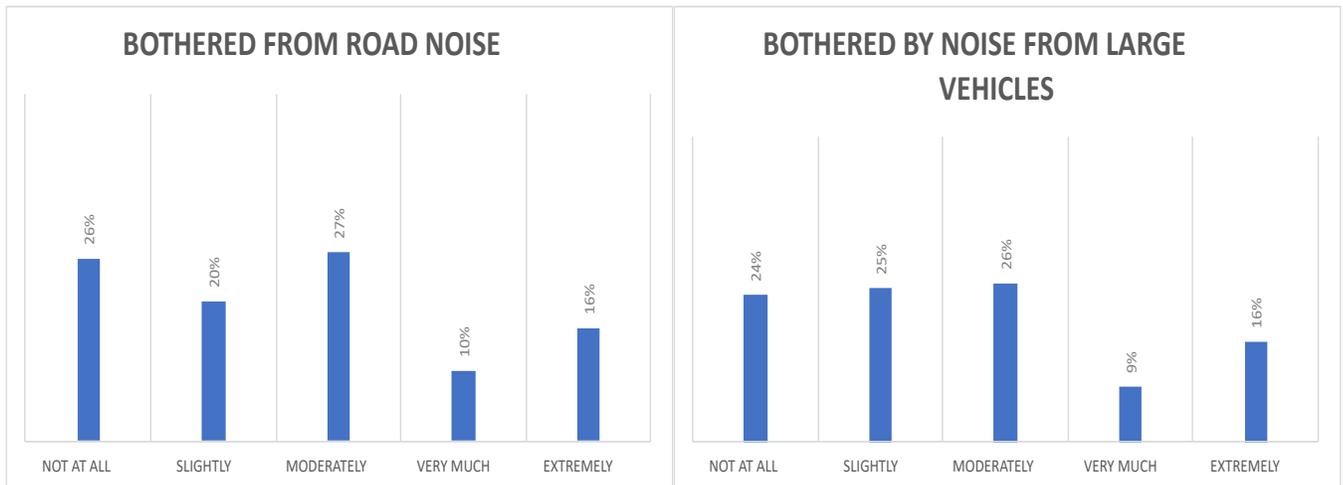


Figure 24: Percent of respondents reporting bother from noise on the road generally and from large vehicles specifically (n=111)

Noise and health concerns due to pollution

There were associations between being bothered by road noises and reporting that one had or had had a health condition due to air or water pollution. This was particularly evident among respondents reporting that noise from large vehicles bothered them moderately to extremely in the past 12 months, when they were in their homes (figure 26). Those reporting they were moderately to extremely bothered by noise from large vehicles were more likely to report that air pollution had harmed their health ($p=0.08$) and that water pollution had harmed their health ($p=0.06$).

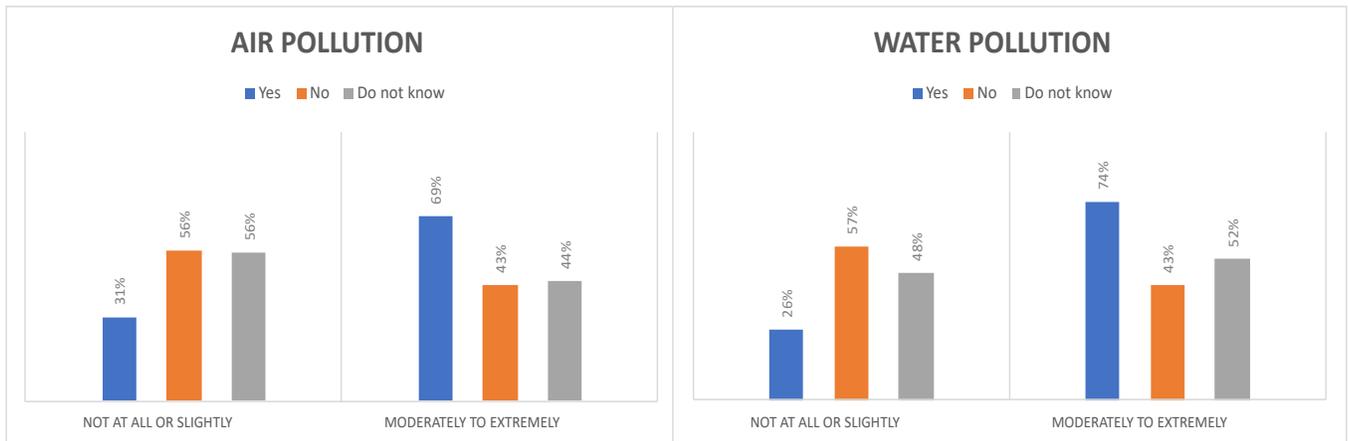


Figure 25: Percent of respondents reporting that they believed they had or had had health conditions due to air or water pollution, according to being bothered in their homes by noise from large vehicles (n=110)

Noise and proximity to area of concern

There were no associations between being bothered while at home by road noises and proximity to the four locations of concern. There were similarly no associations with being bothered at home by noise from large vehicles and these four areas of concern.

Noise and neighborhood rating

Being bothered by noise from large vehicles was statistically significantly associated with how people rated their neighborhoods overall ($p < 0.01$), but not with how they rated the way the neighborhood looked or its cleanliness. Nearly three quarters of those who rated their neighborhoods as poor or fair were bothered at home by the noise of large vehicles (figure 27). This suggests that large vehicle noise may contribute to negative general feelings about one's neighborhood that are distinct from how the neighborhood looks or its cleanliness.

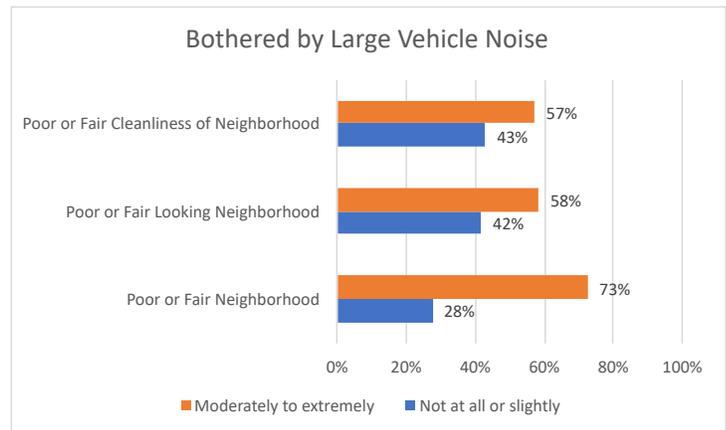


Figure 26: Percent of respondents bothered at home by large vehicle noise in the past year among those reporting poor or fair neighborhood characteristics (n=108)

Neighborhood air quality rating was not associated with being bothered at home by noise from the road. However, it was associated with being bothered at home by noise from large vehicles. Among those rating the air quality in their neighborhood as poor or fair, 64.1% were moderately to extremely bothered at home by noise from large vehicles, as compared to 35.9% who said they were not at all or slightly bothered by noise from large vehicles ($p = 0.04$).

Water quality ratings for various Wai‘anae Coast beaches

Survey respondents were asked to rate—from excellent to poor—the water quality of beaches along the Wai‘anae Coast. Table 5 presents the results.

Table 5: Respondent ratings of the water quality at various beach parks along the Wai‘anae Coast. DNK – Do not know and NA – Not applicable.

	Excellent N, %	Good N, %	Fair N, %	Poor N, %	DNK or NA N, %
Pōka‘ī Bay	1, 0.9%	17, 15.3%	30, 27.0%	46, 41.4%	17, 15.3%
Mā‘ili Beach Park	3, 2.7%	31, 27.9%	28, 25.2%	10, 9.0%	39, 35.1%
Ulehawa Beach Park	1, 0.9%	7, 6.3%	13, 11.7%	24, 21.6%	66, 59.5%
Depot Beach Park	3, 2.7%	9, 8.1%	17, 15.3%	8, 7.2%	74, 66.7%
Kalaniana‘ole Beach Park	3, 2.7%	14, 12.6%	13, 11.7%	5, 4.5%	76, 68.5%
Hawaiian Electric Beach Park	1, 0.9%	18, 16.2%	17, 15.3%	9, 8.1%	66, 59.5%
Kahe Beach Park	3, 2.7%	14, 12.6%	19, 17.1%	8, 7.2%	67, 60.4%
Tracks Beach Park	3, 2.7%	19, 17.1%	13, 11.7%	10, 9.0%	66, 59.5%

Almost no respondents rated the water quality as excellent at any of the beaches. Pōk‘aī Beach was the one in which most respondents provided a rating, with 85% of the sample doing so. The other 15% mostly responded that they did not know. Those who reported “do not know” and “non-applicable” to the questions likely do not visit that beach park. Mā‘ili Beach Park was the second best known, with 65% percent of the sample providing a rating. For all other beach parks, the majority of respondents did not provide a rating, largely because they did not know.

While Pōka‘ī Bay was the beach park about which most respondents were aware, the water quality was rated poor by 41% and fair by 27%. Only 16% of respondents rated the water quality at Pōka‘ī Bay as good or excellent. At 22%, only Ulehawa Beach Park came close to Pōka‘ī Bay in terms of the percent of respondents rating the water quality as poor. Ulehawa Beach Park slightly exceeded Pōka‘ī Bay (53% versus 49%) in terms of being rated as poor when excluding the “do not know” and “non-applicable” responses. However, only 45 people provided a rating for Ulehawa Beach Park in contrast to 94 for Pōka‘ī Bay. Irrespective, it appears that the public does not perceive the water quality at these beaches to be high and clearly, a lot of people perceive the water quality to be poor or at best, fair. Depot beach park also did not rate well.

Except for Mā‘ili Beach Park, the majority of respondents answered that they “did not know” when asked to rate beaches other than those at Pōka‘ī Bay. The best rated beach park was Mā‘ili, with 30.6% of respondents rating it as good or excellent (52.8% among those who provided a rating). Tracks and Hawaiian Electric Beach Park also did well. Among the 45 people who provided a rating for those beach parks, 49.9% rated Tracks Beach Park as good or excellent and 42.2% did so for Hawaiian Electric Beach Park. Only 35 respondents provided a rating for Kalaniana‘ole beach park. However, among these, 48.6% rated the water quality at this beach as good or excellent. Among the 44 people who rated Kahe beach park, 38.6% rated it as good or excellent.

It is noteworthy that only at two beach parks, Mā'ili and Tracks, did half or more of the respondents rate the water quality as good or excellent (after excluding the do not know and non-applicable responses). In other words, based on the responses from this sample, most people along the Wai'anae Coast feel the water quality of their beaches is sub-standard.

Conversation Mapping Results

Environmental Changes

Table 6 presents a synthesis of content from the conversation map related to each of the topical domains. The most common type of pollution discussed on this map was from waste, followed by ocean pollution. This waste domain was strongly framed as an injustice, with the Wai‘anae Coast described as being treated as “a dumping ground.” Dialog on ocean pollution was dominated by concerns for Pōka‘ī Bay. Harm to the marine environment from deep sea mining was the only topic in which federal policy was explicitly mentioned on either map. Military pollution was mentioned, but in contrast to the other types of pollution which emphasized concerns, or linked the pollution to certain causes like dumping, the discussion on military pollution centered on collaborative opportunities for the community to engage with the military to address concerns. Discussion of air pollution focused on toxic chemicals used in aerial sprays and those on soil pollution focused on the negative impacts to farming. Pollution from cesspools was not mentioned. Contamination of the drinking water from PFAS and lead was mentioned; in Hawai‘i, the drinking water comes from groundwater.

Health and wellbeing issues were touched on in this map, but were not the primary focus. Wellbeing was captured indirectly by highlighting the past abundance and environmental purity of places like Mākaha and Pōka‘ī Bay. No specific health conditions were mentioned, but toxicity from environmental contaminants including lead, PFAS, and microplastics were discussed. Soil pollution negatively affecting the cost of local foods was the topic of one conversation bubble. High-cost foods can be a risk factor for poor health outcomes when lower quality foods are selected instead.

Environmental and social injustices were discussed frequently on this map. There was deep concern and resentment about polluting industries, specifically ones that handle waste, being disproportionately present in Wai‘anae. The injustice of “generations of military dumping” and the handling of waste from homeless sweeps, were also highlighted. Frustration was expressed over the lack of governmental action and accountability. Interestingly, other than describing the inequitable impact of pollution along the Wai‘anae Coast, which has the largest Native Hawaiian population on O‘ahu, there was no explicit discussion on the link between these issues of environmental and social injustice and Native Hawaiian-specific topics, like the history of colonization.

Table 6: Synthesis according to domains of conversation mapping content for the Environmental Changes map. Notes: conversation bubble quotes are transcribed verbatim from the map; grammatical errors and misspellings are not changed. Words placed in brackets [] are explanatory notes from the author.

Domain	Synthesis	Illustrative conversation bubbles
Air pollution	<ul style="list-style-type: none"> Cited generally as a concern, and specifically related to dust blooms from PVT land company Concern about aerial sprays 	<p>"In 2021 and this year there has been aerial sprays done which makes the sky completely gray. Unfortunately, the chemicals that are being used are toxic and little is known about them."</p>
Waste/trash	<ul style="list-style-type: none"> Cleaning up trash and other forms of waste in the community a priority Framed as an injustice for the Wai'anae Coast Waste generated by the houseless a concern and viewed as an injustice due to high numbers in the community 	<p>"Wai'anae is known as the armpit of O'ahu for dumping."</p> <p>"Just like the homeless sweeps. They move 'opala [rubbish] all over but thinking of Hakimo Road. Need more solutions to stop polluting/peoples dumping! Stop them from coming/living in Wai'anae. Stop the dumping."</p>
Military pollution	<ul style="list-style-type: none"> Described as an important polluter Collaborative opportunities to work with military to address environmental concerns highlighted 	<p>"I have friend who planned out an entire cleanup in partnership w/ military, however the week before the cleanup they did the entire thing themselves. The road was cleared and spotless. Why can this not be something they do more often. It would be a better look to "counteract" their pollution and I am sure it would make the community much happier."</p>
Ocean pollution	<ul style="list-style-type: none"> The water quality of Pōka'i subject of two conversations; described as no longer clean Deep-sea mining a concern due to uncertainty of impacts; also related to culture, specifically negative impact to voyaging Only mention of federal policy 	<p>"Deep-sea mining... -This affects the ecosystems and the ocean channels that our people use for voyaging."</p>
Groundwater/cesspools	<ul style="list-style-type: none"> Pollution of groundwater indirectly referenced in discussion about contaminants in drinking water 	<p>"PFAS and lead in our drinking water"</p>
Soil pollution	<ul style="list-style-type: none"> Concerns about the impacts of poor or polluted soil on farming Soil contamination linked to specific industries and with frustration about lack of governmental action 	<p>"They closed the old kaiser cement? On [unnamed] road and now Ma'o farm is trying to replant soil contaminated? Close PVT too? Move to another area just like Waimanalo Gulch dump. Mayor promised to stop. Where would litter go they all say not in my community?"</p> <p>-We need to get this documented with gov't officials saying this so we can KEEP THEM accountable!"</p>
Wellbeing	<ul style="list-style-type: none"> Indirectly addressed when discussing past abundance of specific places on the Wai'anae Coast 	<p>"Mākaha once fed our community. The muliwai had mullet, pipi, limu."</p>
Health risk factors	<ul style="list-style-type: none"> Concerns about toxic effects of certain chemicals High cost of foods from poor soil quality cited as barrier to buying local foods Ocean viewed as critical to wellbeing 	<p>"Do people understand the health risks linked to this poisoning [referring to lead and PFAS]"</p> <p>"How can we get more local farms to have good quality soil so we can "buy" local w/o the cost of foods to go up?"</p> <p>"Most of our oxygen comes from the ocean."</p>

Illness & disease	<ul style="list-style-type: none"> • Toxic effects of contaminants in the environment • Need for healthcare system to be more local friendly 	<p>“Need to bring more awareness to what PFAS is in & how it negatively impacts us-most people have no idea how they are involved in our daily lives & how they really are forever.”</p>
Native Hawaiian-specific content	<ul style="list-style-type: none"> • Emphasis individual accountability and building trust, especially among k̄naka • Expressions of loss and sadness when describing the past; need to return to the ways of the past • Role of Native Hawaiians as stewards of the land 	<p>“How can we get kanaka to take accountability? -A lot of patience and handholding -Honestly? It’s being the bigger problem to your ohana and friends. Keep talking about it...”</p> <p>“It’s also accountability. It’s not only taking responsibility & accountability for one’s actions- it also looks like building pilina with each other and restoring that trust. Sharing mana’o & ‘ike in safe spaces. And doing something when you say you will do it.”</p>
Justice/fairness/equity	<ul style="list-style-type: none"> • Heavily focused on presence of industries that handle waste along the Wai’anae Coast • Military dumping over time a concern • Frustration over lack of action and accountability of government 	<p>“Campbell Industrial need alternatives. Stop bringing to Wai’anae.”</p> <p>“Our whole coast is treated as a dumping ground. From HECO power plants, air and ocean pollution to housing landfills and ‘āina that has been polluted from generations of military dumping, burning vehicles to dumping vehicles and ammo in the ocean (ammo reef) is on maps.”</p> <p>“We need to get this documented with gov’t officials saying this so we can KEEP THEM accountable!”</p>
Action and advocacy	<ul style="list-style-type: none"> • Education and awareness were frequently cited, especially with regard to children, family and friends. • Importance of building relationships to expand awareness and engage partners • Need to improving and expanding recycling facilities 	<p>“Agree, is there more that can be done to educate the school kids ... -I think finding 1 “group” first can really help! SCHOOL KIDS are more impressionable and then we can get their adults to help bridge the gap! -Agree. Kids can really be more influenced and they can bring home tha ‘ike to their ‘ohanas.”</p> <p>“The convenience center needs to be expanded, request more funds from our legislators. -Build a steel plant on O’ahu to recycle metals instead of shipping it out.”</p>

A number of actions and recommendations were made to address environmental concerns. The education of oneself, family and friends was recommended in several conversations, as was awareness building, especially regarding toxic chemicals. One conversation provided very specific recommendations about how to engage with the military to clean-up waste, with an emphasis on the importance of relationship-building and accountability. The convenience center was specifically highlighted in a broader conversation on improving and expanding recycling facilities. Advocacy for funding and governmental accountability was also discussed. Table 7 provides a list of actions and recommendations made by the conversation mapping participants.

Table 7: Specific recommendations and actions that could address environmental concerns. Notes: conversation bubble quotes are transcribed verbatim from the map; grammatical errors and misspellings are not changed. Content in brackets [] are explanatory notes from the author.

Sub-domain	Suggestions
Education and awareness	Educate children on environmental issues, especially in school Talk to your family and friends about the environment Go to community meetings and bring your family and friends Train community members on how to dissect fish to identify microplastics in their guts Build community awareness of toxic chemicals
Advocacy	Request more funds from legislators [related to recycling improvements] Obtain funds to support land and water-based activities that connect people to the environment Lobby for DOH ² to get more funds to test ocean and make timely advisories Get DOH and DAR ³ to dissect fish to see what is in them
Relationship building	Get people on the land [to build connections to it and “ground them”] Bring your friends and family to work the lo’i ⁴ Make the healthcare system more “local friendly” Develop a relationship with commanding officers at surrounding military bases to develop clean-up projects
Recycling and waste management	Expand the convenience center; use land above it Build a steel plant on O’ahu Trail cameras to catch people dumping Become more aligned and up-to-date with global waste management and recycling practices
Other actions	Sewing classes, agriculture, aquaculture Improve soil quality for farming Plant natives like pili grass to reduce wildfires Higher fines for environmental violations

Health Challenges

Table 8 presents a synthesis of content from the conversation map related to each of the topical domains. The health challenges map primarily focused on what could be done to address challenges, rather than what the challenges were, how they were experienced, or their causes. Many of the discussions were on what could be done to improve diet and increase exercise. There were few conversations that linked environmental pollution to health. Conversations on the map frequently invoked Native Hawaiian-specific content, most of which related to actions that could be taken to address health challenges, especially related to caring for the ‘āina.

Two major themes across the conversation map were individual responsibility and changing community mindsets. Issues of justice, policy and advocacy were far less commonly discussed. However, the generational trauma resulting from colonization was highlighted. But, instead of discussing the harms

² Hawai‘i Department of Health

³ Hawai‘i Department of Aquatic Resources

⁴ Taro fields

caused by this trauma, the conversation was generally hopeful, proposing how learning ‘ōlelo Hawai‘i and about one’s culture could help address this trauma and lead to positive change. While policy was not mentioned specifically, one conversation discussed leadership, which is critical to effective policy. The conversation underscored the need for Native Hawaiian leaders. None of the conversations proposed ways in which local, state, or federal governments could contribute to improving individual or community health.

The conversation mapping participants identified a number of health risk factors, particularly those that are behavioral such as diet, exercise, alcoholism and drug use. Proposed solutions to these issues were primarily about how individuals could change their behaviors (individual responsibility). However, some conversations touched on the role of the family and many on educating youth. Interestingly, there was a conversation specific to men (kāne) and the need to heal Native Hawaiian men who have been harmed by Western Culture.

There was limited discussion on the contributions of pollution to health challenges. Asthma from air pollution and concerns about PFAS and lead were raised. One solution proposed to increase exercise in the community was clearing the rubbish, which implied concern about waste along the Wai‘anae Coast.

Table 8: Synthesis according to domains of conversation mapping content for the Health Challenges map. Notes: conversation bubble quotes are transcribed verbatim from the map; grammatical errors and misspellings are not changed. Words placed in brackets [] are from the author to clarify content.

Domain	Synthesis	Illustrative conversation bubbles
Air pollution	<ul style="list-style-type: none"> Mentioned twice. Once related to illness and once as an example of an environmental change 	“Asthma from air pollution”
Waste/trash	<ul style="list-style-type: none"> Mentioned once as an action that can be done to improve the environment and to get exercise 	“Clear the rubbish”
Military pollution	Not mentioned	
Ocean pollution	Not mentioned	
Groundwater/cesspools	Not mentioned	
Soil pollution	Not mentioned	
Wellbeing	While health risk factors and illness were mentioned, wellbeing was only indirectly addressed through participants suggestions about what could be done to make the Wai‘anae Coast healthier	
Health risk factors	<ul style="list-style-type: none"> Most risk factors related either to a loss of Hawaiian culture and language or to specific behaviors, especially to diet, but also alcohol consumption, drug use, and vaping The risks to the community from homelessness, violence, drug use and alcoholism were related back to the home environment 	<p>“3 gen [generations] of disconnect to Hawaiian language & culture causes a lot of generational trauma”</p> <p>“Diet YES!! What you put into your body matters <u>so so</u> much +where it came from”</p> <p>“If kauhale is broken then what happens? Like homeless, alcoholics, violence”</p>

	<ul style="list-style-type: none"> • There was on brief conversation that brought up environmental health risk factors, such as PFAS and lead contaminants 	
Illness & disease	<ul style="list-style-type: none"> • Illness primarily discussed in the form of naming diseases, not the experiences of them • Some illness—asthma and cancer—were related back to the environment • Generally, mention of illness did not spark conversation (except a brief one on cancer) 	<p>“Cancer -Industrial buildings near homes -PFAS, lead”</p>
Native Hawaiian-specific content	<ul style="list-style-type: none"> • Specific proposed actions to improve health and the environment were often related to Native Hawaiian culture • Colonization, oppression, and generational trauma recognized as contributing to the health challenges of the community • Participants noted a desire for more accountability on the part of kānaka as stewards of the land. This fit into a broader narrative about individual responsibility and changing mindsets 	<p>“Teaching our younger gen. [generation] -1. After effects of colonization; 2. Systemic oppression; 3. Generational trauma -That being said this is the 2nd Hawaiian renaissance where people are able to learn ‘ōlelo Hawai‘i and their culture. We’ll have generational mana”</p>
Justice/fairness/equity	<ul style="list-style-type: none"> • Participants did not call out inequities or discuss unfair treatment. Rather, they talked about the need for community empowerment and leadership that represented Native Hawaiians • Policy solutions and engagement with policy-makers and governmental officials largely absent. There was a question about where to secure funds for projects and what to do in the absence of governmental leadership and action 	<p>“If the state/gov’t cannot provide better solutions to environmental issues, then who should be responsible for HEALTH CARE?”</p> <p>“Leaders are needed as we search for changes as we learn from each other. -Kāko‘a! We will still need leaders-but we need alaka‘i that represents Native Hawaiian interests more so than anything”</p>
Action and advocacy	<ul style="list-style-type: none"> • Most common discussion in the conversation mapping • Substantial dialog on individual responsibility to change oneself, along with individual and collective responsibility to change mindsets • Addressing pollution was not a major topic of discussion on actions that could be taken • Diet and exercise were a strong focus • Farming and growing food was frequently discussed across conversation bubbles • A number of the actions were centered around children, specifically school-based programs. There was also discussion about actions that crossed generations, especially related to teaching youth about culture 	<p>“All of it begins within oneself in order for change to happen & acceptance to be different.”</p> <p>“Need to reset our ways of thinking”</p> <p>“Yes! What types of exercises/programs will fit in Wai‘anae? -Work the lo‘i. Clear the rubbish. Grow some food.”</p> <p>-Ourself, grow your own food as much as possible I know its hard but get your neighbors involved and trade”</p> <p>“Schools can incorporate more farm-to-fork programs”.</p> <p>“Yes!! Showing our future generation how the environment connects to health, it’s importance of teaching young the Pacific ways in which we can care for it.”</p>

The conversation mapping participants identified a number of actions that could either be implemented or expanded to address health challenges. Table 9 provides a list of these, dividing by sub-domain. The are not exclusive; there is overlap across sub-domains. For example, more kalo, ulu, and fish are grouped under the sub-domain of food, but they are also related to culture. Most of the suggestions relate to the environment. For example, more kalo, ulu, and fish relate to farming and fishing practices. More Lā’au lapa’au⁵ training requires understanding of traditional plants, which is dependent on ecological preservation. Thus, while the conversations on the health challenges map mostly did not discuss pollution or other environmental concerns, they did propose solutions related to the environment. Solutions were primarily land-based. Other than mentioning more fish related to food recipes, water (wai)-based actions were not proposed as potential solutions to health challenges.

Table 9: Specific actions or programs that could address health challenges. Notes: conversation bubble quotes are transcribed verbatim from the map; grammatical errors and misspellings are not changed.

Sub-domain	Suggestions
Food	Backyard farming More kalo, ulu, fish Grow food Farm days for community
Cooking education	Cooking workshops ‘Elepiao ⁶ services for cooking classes and workshops Food recipes
Exercise	Exercises for kūpunas and youth programs in Kaiaulu Self-defense classes Work the lo’i’ Clear rubbish Build a gym on the West Side
Commerce & exchange	Ahupua’a trade centers More farmers markets More farmers Get your neighbors involved in trade Fewer fast-food restaurants Vegetarian drive-through restaurant
Education	Family-based learning Attend ‘āina events such as U-pick Hea ‘Āina o Mākaha ⁷ Education to obtain grants to grow one’s own food Know where one’s food comes from More farm-to-fork programs at schools
Culture	More cultural healing methods Focus on ancestral foods More Lā’au lapa’au ⁸ training Learn ōlelo Hawai’i about Native Hawaiian culture Address conflict with Kāne resulting from Western Culture

⁵ Traditional practice of physical and spiritual healing through the use of plants

⁶ ‘Elepiao Social Services is a subsidiary of the Waianae Coast Comprehensive Health Center. It works to address food insecurity through food distribution services, as well as cooking classes/workshops and other activities.

⁷ This is a farm to basket experience in Mākaha where guests harvest from designated fields, assist farmers with planting, wash and weight what they harvest, and learn health benefits/recipes for what is in the guests baskets.

⁸ Traditional practice of physical and spiritual healing through the use of plants

Discussion & Conclusions

Residents of the Wai‘anae Coast are concerned about air and water pollution. A quarter of the survey respondents reported that they believed they had or had had a health condition due to air pollution and a fifth reported the same thing for water pollution. Concerns about environmental pollution were most clearly demonstrated by the responses to the survey questions about the water quality of Wai‘anae Coast beaches. Almost no one reported the water quality of any of the beaches as excellent and many survey respondents rated them as fair or poor.

Pōka‘ī Bay is an area that warrants special attention in this report, given both its popularity and cultural significance. Illegal dumping, runoff containing chemicals from residential and commercial areas, and the presence of fecal bacteria in streams that drain into the Bay represent troubling sources of pollution to Pōka‘ī Bay (Laguardia 2023; “HCR94 SD1,” n.d.; Blue Water Task Force, n.d.). Most survey respondents (85%) provided a rating for the water quality of the Bay; 41% of survey respondents rated the water quality as poor and another 27% rated it as fair. These ratings reflect dialog on the Conversation Maps. For example, one conversation bubble included: *“I remember my grandmother used to take us to Pōka‘ī Bay and the beach was clean, green grass everyone, and the water was so clear that I could dive to the bottom without a snorkel. Ocean water is no longer clear or clean. My grandmother would be mad if she was around today.”* Results from this project highlight notable concerns about the water quality of Pōka‘ī Bay, which appear corroborated by the environmental monitoring of the Blue Water Task Force (Blue Water Task Force, n.d.).

Children and youth were brought up repeatedly in dialog on the conversation maps. For example, as part of a broader conversation on the Health Challenges map discussing the importance of teaching youth about environmental issues, one participant wrote *“Yes!! Showing our future generation how the environment connects to health, it’s importance of teaching young the Pacific ways in which we can care for it.”* Interestingly, the survey results suggest that younger and working-age adults are more concerned about environmental pollution harming their health than middle-aged and older adults. For example, 32% of adults 25-44 years reported that they believe they had or had had a health condition due to air pollution in their neighborhood, compared to 22% of older adults. This is a 10% difference. While this difference was not statistically significant a p-value of 0.05 or less, likely due to a small sample size and fewer younger adults in the survey than other ages, it is nonetheless striking that nearly a third of those 25-44 years believed that they had or had had a health condition due to air pollution. Moreover, this same age group was statistically significantly more likely to rate the air quality of their neighborhood as fair or poor, compared to older age groups. Given that people ages 25-44 often have children, they may be sharing their concerns about the environment and health with their children. Environmental education in the public school system, such as existing farm-to-fork programs, also has the potential to expand youth knowledge of environmental-health linkages and promote a generation of culturally-grounded environmental advocates.

On the conversation map with the trigger health challenges, pollution was not generally related to health risk factors and concerns. In fact, the only type of pollution mentioned directly in regard to health by the mapping participants was air pollution and this was done only twice. In the first instance, participants described health professionals not making the connection “between changes in our environment (i.e. air pollution) affecting our health so we must take care of env. [environment]”. In the second instance, air pollution was related to asthma. In the survey, 22.5% of survey respondents reported having been told by a doctor that they had asthma. These results very closely match estimates from the state of Hawai‘i. According to 2023 data from Nānākuli and Wai‘anae, the age-adjusted prevalence of asthma is 21.8% (Hawai‘i IBIS, n.d.). Because asthma is prevalent along the Wai‘anae coast, and exacerbated by poor air conditions (Asthma & Allergy Foundation of America, n.d.), it may be a condition the people can more clearly link to pollution than other health conditions.

The Conversation Mapping participants may not have linked pollution to specific (named) health conditions, because they were unaware of which conditions are associated with which types of pollution. Knowledge about some associations, such as between diabetes and persistent organic pollutants, like polychlorinated biphenyls (Lan et al. 2023; Barrios-Rodríguez et al. 2021), may require expert knowledge in toxicology or environmental health. Healthcare providers could help to educate their patients and the public about these associations, but they are often poorly trained in environmental health themselves and lack confidence in identifying and treating health issues of environmental origin (Trasande et al. 2006; Beitz and de Castro 2010; Gehle et al. 2011). This creates a vicious cycle, as illustrated by one of the conversations about PFAS chemicals on the Environmental Changes map:

“Do people understand the health risks linked to this poisoning and is their regular blood test at kids/adult physical medical appt.?”

Good thinking, local Drs/healthcare need to make our healthcare system more local friendly. We are not the same as the US Mainland!

Need to bring more awareness to what PFAS is in & how it negatively impacts us-most people have no idea how they are involved in our daily lives & how they really are forever. Education on how to identify what to look for and alternatives.”

The conversation mapping results added richness to the survey results. In particular, they frequently evoked dialog on intergenerational responsibility and learning. There was a strong focus on teaching younger generations. It was evident from the conversations that education of youth needed to extend beyond the classroom and into the land and the community. It also needed to extend past textbook teaching on the environment and health to include learning about the consequences of colonization, systemic oppression and generational trauma. Part of this education entails learning ‘ōlelo Hawai‘i and learning from kūpuna. The knowledge held by older generations is critical to understanding changes in the environment along the Wai‘anae Coast. For example, knowledge about past military dumping along

Quarry Road is helpful when assessing the quality of the soil for farming. Connections across generations and people are needed for mutual education, advocacy, and the development of place-based solutions.

To conclude, this report provides the first comprehensive environmental health assessment of the Waiʻanae Coast. The results underscore the need for a stronger focus on both the environment and people's health in the area, while also providing suggestions for action and advocacy. It also demonstrates that without localized, long-term research that reflects the histories and lived experiences of those living along the Waiʻanae Coast, the impacts of ecological damage, detrimental land use patterns, militarism and colonialism will remain invisible, thus making it harder for communities to understand what's affecting their health and to advocate for accountability and change.

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Appendix 1- Questionnaire

WAI'ANAЕ COAST COMMUNITY HEALTH SURVEY

Aloha,
Kingdom Pathways (www.kingdompathways.info), a Native Hawaiian nonprofit on the Wai'anae Coast that protects 'āina, preserves culture, and strengthens community health through the Huliau o Wai'anae initiative is conducting research on the impact of pollution in our community. Kingdom Pathways has partnered with Ward Research (www.wardresearch.com) and Pirkle Epidemiology and Evaluation to administer a survey to local residents to gather data, identify patterns, and learn more about residents' beliefs of the health of their neighborhoods. Your household has been randomly selected to receive this survey. All responses are confidential and will be combined with those of other residents.

If you would like to contribute to this study, please answer the questions below. The survey will close on **November 1st**, 2025, so please submit your survey in the enclosed business reply envelope as soon as possible. If you have any questions, please feel free to contact us at Kalei@kphui.info or wrsurvey@wardresearch.com.

If you prefer to provide your feedback online, please visit:

<https://www.xxxxxxx.com/xxxxx> (TBD)

Your password for the survey is «id». Mahalo nui in advance for your time and effort.

1. First, are you a current resident of O'ahu?
Yes
No (*Please do not complete*)
 2. How many years have you lived in the Wai'anae Coast area?
_____ years
 3. What is your age?
Under 18 (*Please do not complete*)
18-24
25-34
35-44
45-54
55-64
65-74
75+
 4. In your household, how many people live with you? These are people who regularly sleep in your home. Please include yourself in this number.
_____ person/people
 5. In your household, how many people are 17 years old or younger. These are teenagers and children that regularly sleep in your home.
_____ child(ren)
 6. Which best describes the building you live in?
A one-family house detached from any other house..
A one-family house attached to one or more houses.....
Building with 2 apartments.....
Building with 3 to 10 apartments.....
Building with 11 or more apartments
Boat, RV, or van.....
Other (Specify: _____) ...
Don't know
- Now, we'd like to ask you some questions about your household. For the purposes of this survey, your household is defined as all the total number of children and adults that reside in the same housing unit, and rely on the same sources of income and/or food. It may refer to either relatives or non-relatives who live in the unit.

7. Do you rent or own your home?
 I own my home
 I rent my home.....
 Don't know

8. Do you live on Hawaiian Homestead Lands?
 Yes.....
 No
 Don't know.....

9. Do you live or work within?

	Yes	No	Don't know	Not applicable
A 1/2 mile of Pōka'i Beach Park <i>(This is about a 10-minute walk. For example, it takes about 10 minutes to walk from Wai'anae elementary to the Beach Park.)</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A 1/2 mile of Mā'ili'ilii Stream/drainage canal <i>(For example, homes and businesses between Hila Street and the stream/canal are within 1/2 mile. So are those between the stream/canal and the Samoan Methodist Church Wai'anae Center.)</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A 1/2 mile of Ulehawa Stream <i>(This would include most homes and businesses between the stream and Lualualei Naval Road. It would also include most homes and businesses between the Ulehawa stream and Lualei Place.)</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A 1/2 mile of PVT construction debris disposal and processing site off of Lualualei Naval Road [also called PVT Land Company] <i>(This would include most homes and businesses between Mikana Street and the facility. It also includes those east of Hakimo Road between Kaukai and Hakimo Place.)</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A 1/2 mile of Waimanalo Gulch Sanitary Landfill <i>(This is about the distance between the Hawaiian Electric Kabe Power Plant and the Landfill.)</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Now we would like to ask you some questions about air and water quality. These questions refer to issues such as pollution. For example, when asking about the quality of water, we are asking you to think about issues such as trash or sewage in the water. These questions are not about recreation, such as the quality of the surf break.

10. Have you got, or have you had, health problems due, in your opinion, to air pollution in your neighborhood?
 Yes
 No
 Don't know
 Not applicable.....
11. Have you got, or have you had, health problems due, in your opinion, to water pollution?
 Yes
 No
 Don't know
 Not applicable.....

12. How would you rate...

	Excellent	Good	Fair	Poor	Don't know	Not applicable
The quality of the air in the neighborhood where you live	<input type="radio"/>					
The quality of the water at Pōka'i Bay	<input type="radio"/>					
The quality of the water at Mā'ili Beach Park	<input type="radio"/>					
The quality of the water at Ulehawa Beach Park	<input type="radio"/>					
The quality of the water at Depot Beach Park	<input type="radio"/>					
The quality of the water at Kalaniana'ole Beach Park	<input type="radio"/>					
The quality of the water at Hawaiian Electric Beach Park?	<input type="radio"/>					
The quality of the water at Kahe Beach Park	<input type="radio"/>					
The quality of the water at Tracks Beach	<input type="radio"/>					

Now we would like to learn a little about your health.

13. Has a doctor ever told you that you have one of more of the following health concerns or conditions? Please select all that apply

- Asthma.....
- Chronic lung disease, such as chronic bronchitis, emphysema, or asthma...
- Hypertension or high blood pressure.....
- Heart attack, coronary heart disease, angina, congestive heart failure, or other heart problems.
- Type II diabetes, that is to say, high blood sugar levels.....
- Gastrointestinal disease.....
- Ciguatera fish poisoning (ka'elo).....
- MRSA, a type of Staph infection.....
- Osteoporosis.....
- Scombroid fish poisoning.....

14. Have you ever suspected you've had any of the following health concerns or conditions?

- Please select all that apply
- Asthma.....
 - Chronic lung disease, such as chronic bronchitis, emphysema, or asthma...
 - Hypertension or high blood pressure.....
 - Heart attack, coronary heart disease, angina, congestive heart failure, or other heart problems.
 - Type II diabetes, that is to say, high blood sugar levels.....
 - Gastrointestinal disease.....
 - Ciguatera fish poisoning (ka'elo).....
 - MRSA, a type of Staph infection.....
 - Osteoporosis.....
 - Scombroid fish poisoning.....

15. Do you have respiratory allergies, such as allergic rhinitis or sinusitis?

- YesO
 No.....O
 Don't know.....O

16. Have you gotten swimmers ear before?

- No..... O
 Yes, one time only..... O
 Yes, two or three times O
 Yes, three or more times O
 Don't know O

17. You are almost done with the survey. Lastly, we would like to ask you some questions about your neighborhood. Overall, how would you rate....

	Excellent	Good	Fair	Poor	Don't know	Not applicable
Your neighborhood as a place to live	<input type="radio"/>					
The way your neighborhood looks?	<input type="radio"/>					
The cleanliness of your neighborhood	<input type="radio"/>					

18. Thinking about the last 12 months or so, when you were at home, how much does noise from the road bother, disturb, or annoy you?

- ExtremelyO
 Very Much.....O
 Moderately.....O
 Slightly.....O
 Not at all.....O
 Not applicableO

20. What gender do you identify as?

- Male O
 Female O
 Prefer to self-describe (.....) . O

21. Are you Hispanic, Latino/a, or Spanish origin?

- Yes..... O
 No O
 Don't know..... O

19. Thinking about the last 12 months or so, when you were at home, how much does noise from large vehicles, such as trucks and construction vehicles bother, disturb, or annoy you?

- ExtremelyO
 Very Much.....O
 Moderately.....O
 Slightly.....O
 Not at all.....O
 Not applicableO

22. Which one or more of the following would you say is your race or ethnicity? Select all that apply.

- White O
 Black or African-American O
 American Indian or Alaska Native O
 Chinese O
 Filipino O
 Japanese O
 Korean..... O
 Native Hawaiian..... O
 Chamorro/Guamanian O
 Samoan O
 Marshallese O
 Chuukese..... O
 Other
 (Specify:.....)..... O
 Don't know..... O

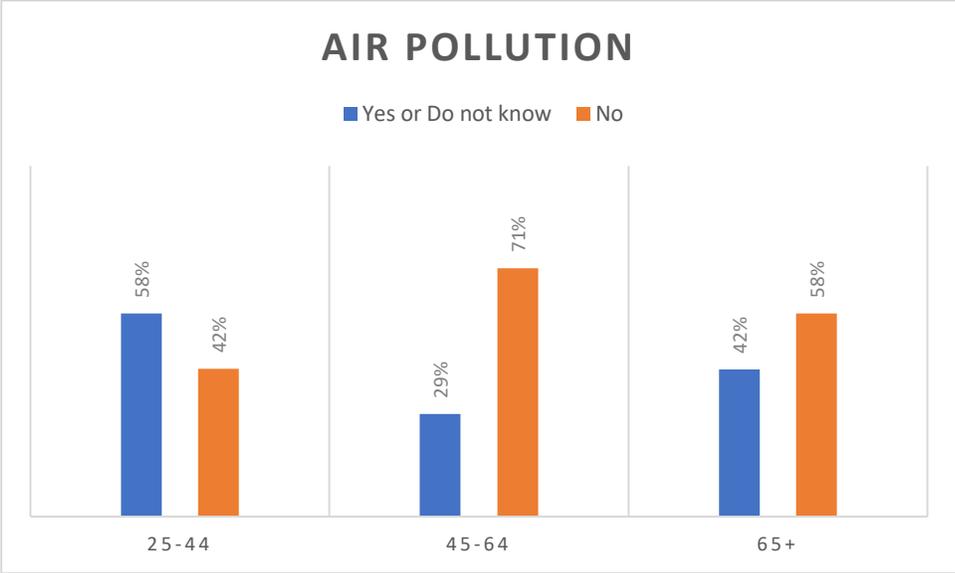
"We would like to learn a bit about you. The following questions help us to do so."

23. What is the highest grade or year of school you completed?

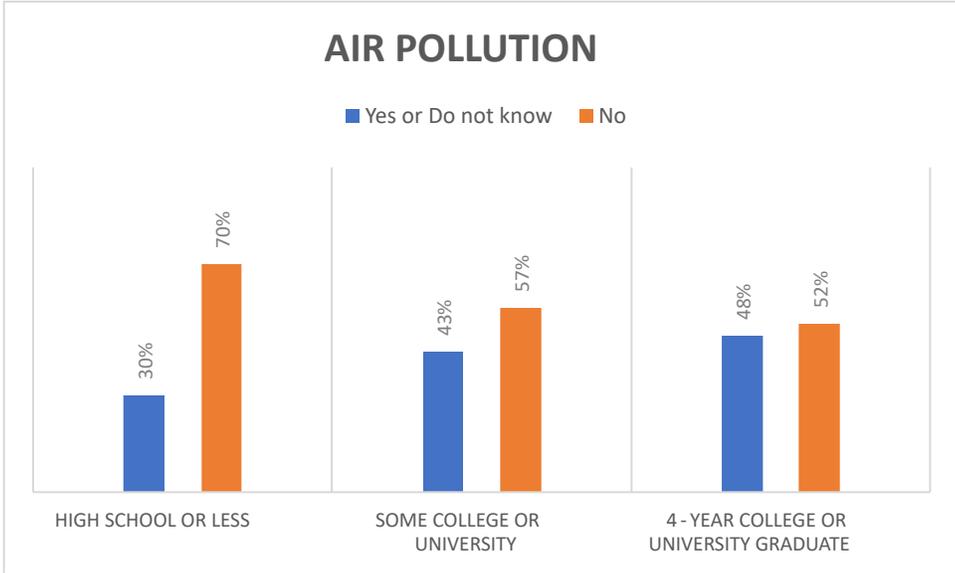
- Never attended school or only attended kindergarten or less.....
- Grades 1 through 8 (Elementary, also called primary or grammar school).....
- Grades 9 through 11 (Some high school, also called secondary school).....
- Grade 12 or GED (High school or secondary school graduate)
- College or university 1 year to 3 years (some college or university, or technical or trade school)
- College 4 years or more (College or university graduate)
- Don't know.....

Mahalo for taking the time to complete this survey. Your answers will help us the better understand how people feel about the physical environment and their health in Wai'anae and Nanakuli.

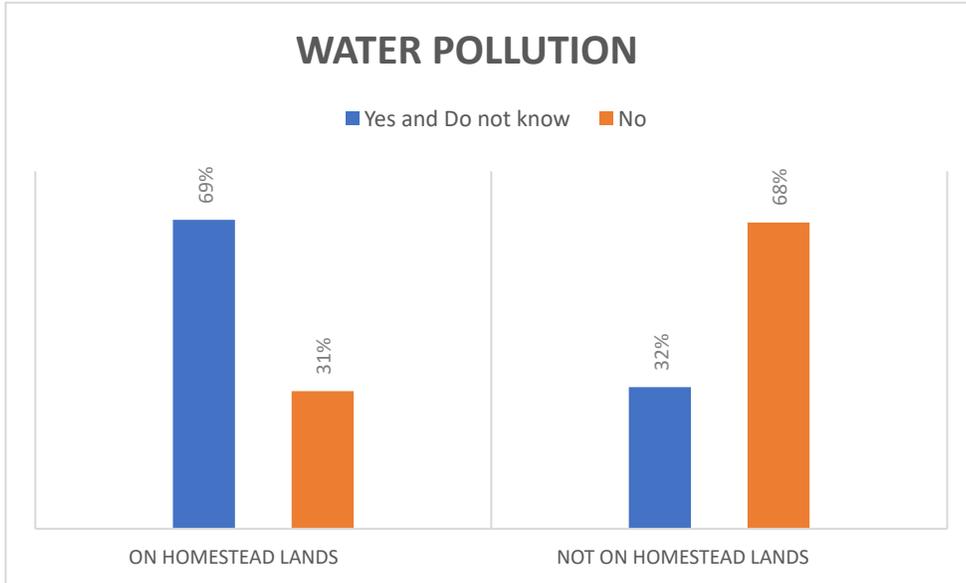
Appendix 2: Figures showing the results for combined yes/ “do not know” variable and respondent demographic characteristics



Appendix Figure 1: Percent of respondents reporting that they believed they had or had had a health condition, or that they were not sure, due to air pollution in their neighborhood, by age group (n=110)



Appendix Figure 2: Percent of respondents reporting that they believed they had or had had a health condition, or that they were not sure, due to air pollution in their neighborhood, by education group (n=110)



Appendix Figure 3: Percent of respondents reporting that they believed they had or had had a health condition, or that they were not sure, due to water pollution in their neighborhood, by living on Hawaiian Homestead Lands (n=108)

Appendix 3: Conversation map for Environmental Changes

1. One clean ocean water: I remember my grandmother used to take us to Pōkaī Bay and the beach was clean, green grass everyone, and the water was so clear that I could dive to the bottom without a snorkel. Ocean water is no longer clear or clean. My grandmother would be mad if she was around today.
 - 1.1. I agree, we need to do better.
 - 1.1.1. Agree, we need to relocate the houseless, overnight stays. Put a restriction and policy in place.
2. Mākaha once fed our community. The muliwai [estuary]⁹ had mullet, pipi [oyster], limu [edible seaweed]. Climate change and human changes (homes, hotels, apartment buildings) changes our shoreline completely. Our kūpuna [elders] would tell us these stories.
 - 2.1. Agree, a restoration project to come sounds like a good plan.
 - 2.1.1. Where restoration is incredibly important, we will go back to the old ways if the public is not educated on issues such as illegal water diversions. They will just continue and dry the environment.
 - 2.1.1.1. Initial program where community get something out of the restoration.
3. Pollution from people who chose to be lazy and dispose of trash, animal remains from hunting, and companies who flip homes and dump on the other side of the road, in streams or in our beaches and parks, instead of recycling or using the convenience center.
 - 3.1. The convenience center needs to be expanded, request more funds from our legislators.
 - 3.1.1. Build a steel plant on O'ahu to recycle metals instead of shipping it out.
 - 3.1.1.1. They closed one? Campbell Industrial need alternatives. Stop bringing to Wai'anae.
 - 3.1.2. Utilize the land above and around the convenience center to expand funds for recycling efforts.
4. What other industries and pollutants are affecting air, soil, water?
 - 4.1. Kanaka! It is not just industries.
 - 4.2. HECO, hotel, resort, fishers
 - 4.2.1. Water at golf courses?
 - 4.3. What is the plan to dispose of renewable energy sources e.g., solar panels
5. Not enough (grounded) Hawaiians to respect the land
 - 5.1. Harsh, true!
 - 5.2. Let our keiki teach us to be more grounded.

⁹ The author has provided translations of words on the map in ōlelo Hawai'i. These are indicated with text in brackets [].

- 5.3. People see money and relationships that support polluting our land and ocean instead of taking a stand and saying no!
 - 5.3.1. Agree, is there more that can be done to educate the school kids or influence the houseless in training to be 'āina [land] keepers.
 - 5.3.1.1. We just gotta put people on 'āina.
 - 5.3.1.2. Sewing classes, agriculture, aquaculture? Funds needed.
 - 5.3.1.3. I think finding 1 "group" first can really help! SCHOOL KIDS are more impressionable and then we can get their adults to help bridge the gap!
 - 5.3.1.3.1. Agree. Kids can really be more influenced and they can bring home the 'ike [knowledge] to their 'ohanas [family].

6. Our whole coast is treated as a dumping ground. From HECO power plants, air and ocean pollution to housing landfills and 'āina that has been polluted from generations of military dumping, burning vehicles to dumping vehicles and ammo in the ocean (ammo reef) is on maps.
 - 6.1. Wai'anae is known as the armpit of O'ahu for dumping.
 - 6.2. How can we stop this generational curse?
 - 6.2.1. Say it stops with us and then more accordingly.

7. What government agencies are responsible for these environmental issues?
 - 7.1. Federal, state agencies- DLNR, US military, EPA
 - 7.2. It's not only the government but the people to they dump their tires, fridge, couch, etc. Also adding to the problem.
 - 7.2.1. OLAAAA!
 - 7.2.1.1. How can we get kanaka to take accountability?
 - 7.2.1.1.1. A lot of patience and handholding
 - 7.2.1.1.2. Honestly? It's being the bigger problem to your ohana and friends. Keep talking about it. Tell them y'all hang out with them at the comm. meetings. Tell them meet me @ the lo'i [taro patch].

8. How is PVT landfill affecting the West Side community?
 - 8.1. Too close to residential areas
 - 8.2. Dust blooms, water runoff possible soil contamination
 - 8.2.1. What about the schools, businesses, homes in the area? How is their health being tracked?

9. Most of our oxygen comes from the ocean. Yet we continue to contribute to its pollution. What are things that we can do to lessen the pollutants?
 - 9.1. Its starts with our day to day lives...going zero waste, supporting brands that prioritize being eco-friendly and brands that have initiatives focused on taking care. For example brands hosting cleanups or sponsoring or donating to non-profits that do that kind of work.
 - 9.1.1. It starts with us to create this movement.
 - 9.1.1.1. More education needed.

10. Because of lack of education (for our community) leaders and industry workers can say whatever they want. PVT is also affecting community trust.
 - 10.1. They closed the old kaiser cement? On ??? road and now Ma’o farm is trying to replant soil contaminated? Close PVT too? Move to another area just like Waimanalo Gulch dump. Mayor promised to stop. Where would litter go they all say not in my community?
 - 10.1.1. We need to get this documented with gov’t officials saying this so we can KEEP THEM accountable!
 - 10.1.2. How can we get more local farms to have good quality soil so we can “buy” local w/o the cost of foods to go up?

11. Deep-sea mining
 - 11.1. We are messing up something we don’t know enough about
 - 11.1.1. We need protection Trump order left everything up!
 - 11.1.1.1. We need to pick their minds apart and know why logically
 - 11.1.1.1.1. Agreed! How did you get to the conclusion that it was Trump!
 - 11.2. This affects the ecosystems and the ocean channels that our people use for voyaging.

12. Why is there so much fuel for wildfires? Eg: invasive grasses
 - 12.1. Our ‘āina is not built for invasives. Our ‘āina needs its natives planted to mitigate wild fires. i.e., pili grass takes a long time to burn.
 - 12.2. Is this the new wildfire chief’s responsibility, I don’t see her reporting anything out regularly, why?
 - 12.2.1. Maybe she wasn’t taught?
 - 12.2.2. Most of the roads belong to DOT or C&C – private

13. Air pollution
 - 13.1. In 2021 and this year there has been aerial sprays done which makes the sky completely gray. Unfortunately, the chemicals that are being used are toxic and little is known about them.
 - 13.1.1. OMG, who/company is doing this, we need to investigate.
 - 13.1.1.1. Cloud seeding.

14. Water quality issues
 - 14.1. Ships that dump Pōka’ī Bay any consequences?
 - 14.2. Is there enough testing on a regular basis by the responsible agency?
 - 14.2.1. No, DOH needs more funding. They need to test when brown wtr advisory’s are issued & when its done
 - 14.3. How can microplastics be mitigated? How can people test for it in our waters?
 - 14.3.1. Have DOH and DAR dissect fish to see what is in their stomach
 - 14.3.1.1. Who would do this? Did this just become a new job opportunity?
 - 14.3.1.1.1. I have an old professor that would dissect seabirds so maybe someone in a similar position? Also gave students

opportunities to do the same research for marine debris in their stomachs

15. PFAS and lead in our drinking water

15.1. Do people understand the health risks linked to this poisoning and is their regular blood test at kids/adult physical medical appt.?

15.1.1. Good thinking, local Drs/healthcare need to make our healthcare system more local friendly. We are not the same as the US Mainland!

15.2. Need to bring more awareness to what PFAS is in & how it negatively impacts us-most people have no idea how they are involved in our daily lives & how they really are forever. Education on how to identify what to look for and alternatives.

16. Military pollution

16.1. Agree, who monitors clean-up or why do they not clean-up. What is the problem: we were always taught to clean-up our area when done!

16.1.1. Need to speak with commanding general on Schofield and build a community relationship

16.1.1.1. Agree, civil conversations and getting acquainted first.

16.1.2. I have friend who planned out an entire cleanup in partnership w/ military, however the week before the cleanup they did the entire thing themselves. The road was cleared and spotless. Why can this not be something they do more often. It would be a better look to “counteract” their pollution and I am sure it would make the community much happier.

16.1.2.1. It’s also accountability. It’s not only taking responsibility & accountability for one’s actions- it also looks like building pilina [connections] with each other and restoring that trust. Sharing mana’o [reflections] & ‘ike in safe spaces. And doing something when you say you will do it.

16.1.2.1.1. YES!! Making a commitment and following through means a lot more than most businesses/military realize.

16.1.2.2. Just like the homeless sweeps. They move ‘ōpala [rubbish] all over but thinking of Hakimo Road. Need more solutions to stop polluting/peoples dumping! Stop them from coming/living in Wai’anae. Stop the dumping.

16.1.2.2.1. Much of the “homeless” situation is the doing of our own making. Reliance on the gov’t. too much result in losing comm. self-sufficiency & reliance. Let us put self-sustaining systems in place & homelessness wouldn’t be an issue.

16.1.2.2.2. It starts with caring. The gov needs to do something for people to stop. They are not getting punished so what reason do they have to stop doing something that is free & convenient that “doesn’t affect them”. Effects the environment tho!! They just don’t realize the connection.

Appendix 4: Conversation Map for Health Challenges

1. Shallow minded people | professionals not making the connection between changes in our environment (i.e. air pollution) affecting our health so we must take care of env.
 - 1.1. Community also needs to understand WE have just as much power- if not MORE- to create the changes we want!
 - 1.1.1. Yes!! There needs to be more education to the public about how much power we as individuals (but also in groups) have
 - 1.1.1.1. Empowering community
 - 1.1.2. Would need to advocate for changes especially for future generation and need to make them care to be aloha and live pono.
 - 1.1.2.1. Yes!!!
 - 1.1.2.2. It all starts young!
 - 1.1.2.3. SPOT ON!
2. I've seen a shortage of medical students and people wanting to at least try.
3. A ia ihea i ke kaiaulu? Where is the community.
4. Cancer
 - 4.1. Industrial buildings near homes
 - 4.2. PFAS, lead
5. No fresh food options in Wai'anae "Healthy". Too much vape, stores that sell drug paraphenelia and liquor that caters to a big problem in the community.
 - 5.1. We have too much vape shops in Wai'anae.
6. Asthma from air pollution.
7. Diet
 - 7.1. YES!! What you put into your body matters so so much + where it came from.
 - 7.1.1. A lot of people don't "think" like that they rather eat whatever makes them happy ☹️
 - 7.1.1.1. It takes more of a mental challenge than physical
 - 7.1.1.1.1. It's shifting mindset @ perspectives!
 - 7.1.1.1.1.1. All of it begins within oneself in order for change to happen & acceptance to be different.
 - 7.1.1.1.1.1.1. This is not something you can force on to people- it has to be their own choice otherwise it will cause resentment from someone who does not want to change.
 - 7.1.1.1.1.1.1.1.1. Need to help to focus on chronic conditions, diabetes, heart, obesity.
 - 7.1.1.2. Guilty! ☺️
 - 7.2. Wae'anae has too much fast food options. Over 50 restaurants.
 - 7.2.1. I agree we need more FARMERS, backyard farming and education around obtaining grants to grow our food NO MORE FOOD DESERTS!
 - 7.2.2. It's all about convenience need to have more ways to show people how important their body is + more important than convenience

- 7.2.3. Social determinants of health
 - 7.3. Yes, BUT, it's also a focus on ancestral foods that nourish our bodies as kanaka-we need to malama aina.
 - 7.3.1. Where would you go 2 malama and who helps: state? schools? Community?
 - 7.3.1.1. Schools can incorporate more farm to fork programs
 - 7.3.1.1.1. 100%!! If schools can do this, so can community.
 - 7.3.1.2. All 3 could be the pillars.
 - 7.3.1.2.1. I think starting in the community 1st will help grow this Kanaka – healthy diet movement ☺
 - 7.3.1.2.1.1. Ahupua'a trade centers ☺
 - 7.3.1.2.1.1.1. Yes, open farm days for community, there are several farms on the West side.
 - 7.3.1.2.2. Everyone needs to work together!
 - 7.3.1.2.2.1. Exercise in some way should be explored within the communities....build a GYM on the West Side.
 - 7.3.1.3. We started at home, best place to start. Then we reached out to those that needed malama- mt. Ka'ala, Kāko'o 'Ōiwi, etc. There are many places; we just need to look for those asking for help, first.
 - 7.3.1.3.1. This is true however lots of people are scared to ask for help
 - 7.3.1.3.1.1. Need to change their ways of THINKING in order for change to occur mai wilahila no shame Hana Wale! Just do it
 - 7.3.1.3.1.1.1. YES!! It needs to be more normalized for people to be comfortable, if at least one does others will follow in the same path
 - 7.3.2. Know where our food comes from
 - 7.3.3. I think a program to be started will help, Bring Back our way! Our way
 - 7.3.3.1. Agreed, more farmers market + cooking workshops
 - 7.3.3.2. Yes, can be done in so many different ways, but a priority needs to be keiki so classes or something in school would an amazing initiative to add
 - 7.3.3.2.1. Yessssah
 - 7.3.3.3. Olaaaaaa
- 7.4. Need to reset our way of thinking
- 7.5. Exercises for kāpunas & youth programs in Kaiaulu?
 - 7.5.1. YES!! What types of exercises / programs will fit in Wai'anae?
 - 7.5.1.1. Work the lo'i. Clear the rubbish. Grow some food.
 - 7.5.1.2. Self-defense classes! Let's get rid of gun violence
 - 7.5.1.2.1. Kāko'o
 - 7.5.2. Hula?
- 7.6. Food recipes
 - 7.6.1. More Kalo, Ulu, fish
 - 7.6.1.1. More ways to making "our" staple foods healthier

7.6.1.1.1. Elepia'ō services offer classes & cooking workshops. Kalo, Ulu, Niu.

7.6.1.1.1.1. I help with this

7.6.1.2. Yasss girl

8. If the state/gov't cannot provide better solutions to environmental issues, then who should be responsible for HEALTH CARE?

8.1. Ourself, grow your own food as much as possible I know its hard but get your neighbors involved and trade

8.2. More La'aulapaau training, should have a practitioner in every household, especially in Wai'anae w/ the most Kānaka.

8.3. Kanka's,¹⁰we gotta show accountability

8.3.1. As stewards of the land, Native Hawaiians MUST fulfill their kuleana. WE GOT WE.

8.3.1.1. We have to set the example for others to follow

8.3.2. Teaching our younger gen.

8.3.2.1. Who will implement the changes/teachings? Where is the \$\$ to kōkua?

8.3.2.1.1. Starts at home, then at DOE!

8.3.2.1.2. Funding can be found. Our youth equals gov't funding.

8.3.2.1.2.1. Timeline to start programs how long is funding? Who monitors etc.?

8.3.2.2. Yes!! Showing our future how the environment connects to our health, it's importance of teaching young the Pacific ways in which we can care for it

8.3.3. Family-based learning.

8.3.3.1. BACK TO BASICS to live w/ Aloha & Be Pono

8.3.3.1.1. Ai

8.3.3.1.1.1. Gotta bring the resources straight to the community.

8.3.3.2. Go to 'āina/org events such as U-pick Hea Aina o Mākaha

8.3.3.3. The thinking & habits start within the kauhale.

8.3.3.3.1. If Kauhale is broken then what happens? Like homeless, alcoholics, violence, etc.

8.3.3.3.1.1. What's the root cause of this?

8.3.3.3.1.1.1. 1. After effects of colonization; 2. Systemic oppression; 3. Generational trauma

8.3.3.3.1.1.1.1. That being said this is the 2nd Hawaiian renaissance where people are able to learn ōlelo Hawai'i and their culture. We'll have generational mana.

8.3.4. We need to put aside our pride & ego to solve issues. Kāka'o-I agree.

¹⁰ This is likely a misspelling of kānaka

8.3.4.1. How can we get them to start this?

9. Mental emotional spiritual cultural

- 9.1. Bring back more cultural healing methods
- 9.2. 3 gen of disconnect to Hawaiian language & culture caused a lot of generational trauma.
- 9.3. Lots of Pre-disposed health issues
- 9.4. When I see this; it makes me think of our Poly men; the PRIDE can be a double-edged sword.
 - 9.4.1. Its our pride & ego that prevents us from growth. Soo much potential but our ownselves get in the way
 - 9.4.1.1. There's a conflict with our kāne. Western society dictates the OPPOSITE of what our kāpuna asked of kāne. If we can figure out the balance, we can start healing our kāne
- 9.5. Our health comes from our environments
 - 9.5.1. YES!! It's from ALL of it!
 - 9.5.1.1. Leaders are needed as we search for changes as we learn from each other.
 - 9.5.1.1.1. Kāko'a! We will still need leaders-but we need alaka'i that represents Native Hawaiian interests more so than anything
 - 9.5.1.1.1.1. Agree, got to introduce this to the keiki at school
 - 9.5.1.1.2. Anyone can start these initiatives. It just takes one voice