

Site Selection Evaluation Technical Memorandum

Prepared for

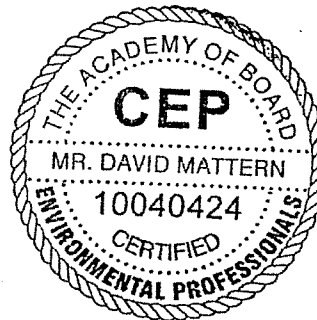
Cades Schutte, LLP
1000 Bishop St, Suite 1200
Honolulu, HI 96813

Prepared by

Parametrix
411 108th Avenue NE, Suite 1800
Bellevue, WA 98004-5571
T. 425.458.6200 F. 425.458.6363
www.parametrix.com

CERTIFICATION

The technical material and data contained in this document were prepared under the supervision and direction of the undersigned, whose seal, as a professional engineer licensed to practice as such, is affixed below.

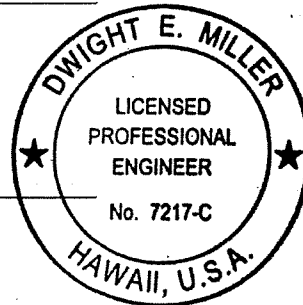


David Mattern

Prepared by David Mattern, Certified Environmental Planner 10040424

Dwight E. Miller

Checked by Dwight Miller, PE



Approved by Dwight Miller, PE

This work was prepared by
me or under my supervision

Dwight E. Miller 12/13/11

SITE SELECTION HISTORY

The history of landfill site selection on Oahu is described in detail in Section 11.2 of the 2008 SWMP. A siting effort begun in 2003 considered 45 sites, ultimately recommending the Waimanalo Gulch site. This site was selected by the City and County of Honolulu in 2005, with provisions to limit materials received at the landfill to: 1) processed solid waste; 2) any other material of a non-hazardous nature that cannot be converted into processed solid waste solely because such a conversion method does not exist; and 3) any non-hazardous material that must be disposed of to protect the health and safety of the public due to an emergency or disaster declared by the City and County of Honolulu. They also directed the facility to be closed in 2008. This bill was vetoed by the Mayor. The current site selection process commenced in 2011, pursuant to a Land Use Commission order and the 2008 SWMP. The Mayor formed a Landfill Site Advisory Committee to advise the City and County of Honolulu. The committee began meeting in January 2011 and has not yet selected a site.

The following discussion evaluates the current site selection process to date, which is compared to sound, established site selection methodologies and to the principles and processes described in the 2008 SWMP. The current site selection process has numerous weaknesses and, as presently configured, is unlikely to produce credible, useful results.

DECILES

Simply defined, a decile is a statistical measurement method of splitting up a set of ranked data into 10 equally large subsections. In the 2011 siting study, multiple siting criteria are measured using deciles (specifically criteria 1, 7, 9, 10, 11, 12, 13, 14, 15, 16, 17, and 19). The measurement appears to be an attempt to create a scale by which the potential sites can be compared to each other. The measurement technique works by establishing a range of values for all sites and dividing that range into 10 scoring categories. Using site capacity as an example, if the lowest capacity is 15 years and the highest is 30 years, there is a range of 15 years and the “deciles” are 1.5-year increments. A site with 19 years capacity would be in the third decile and receive a score of 3, and a site with 26 years would be in the seventh decile and receive a score of 7.

According to the Merriam-Webster dictionary definition, the term “decile” is incorrect for the methodology described and would be inappropriate if used. Decile is defined as “any one of nine numbers that divide a frequency distribution into 10 classes such that each contains the same number of individuals.” The methodology does not create classes with the same number of individuals (i.e., sites) but instead divides the measured values. Hence, the term is incorrectly applied. Further, a frequency distribution of the sites based on a particular characteristic would lose the information contained in the measured values.

This type of measurement is not found in site selection literature and in my experience is unprecedented. There are two fundamental flaws with this technique. First, this measurement makes no attempt to consider a potential effect or condition and simply assumes an equal, linear relationship across whatever range of values is measured. Many of the criteria measured with deciles involve distances of a site to a type of feature (e.g., residential areas). This measurement technique ignores that effects such as noise vary with distance in a non-linear manner and is influenced by the potential presence of intervening topography or other factors. Other criteria, such as prevailing wind, are more appropriately measured categorically rather than a forced, linear scale.

Second, the scores returned by deciles can vary greatly depending on the outlying values or clustering. Consider the case where there is one site with a large value (an outlier) and other sites have more similar values. By dividing the entire range into 10 categories, many of the

sites would have similar scores and potentially meaningful differences among them would be lost. Alternatively, in the situation where sites have similar values this method would return different scores where, in fact, there would be little or no meaningful difference among them.

It is much more straightforward and quite feasible to simply consider the potential for a specific effect or condition and score that directly. These types of criteria and measurements were described in the 2008 SWMP (see pages 11-7 to 11-9), but there is no explanation in the 2011 siting study why this approach was not followed during the current siting process. For example, noise is included under nuisance criteria: "Noise - Sites should have a minimum adverse impact on noise levels in surrounding residential or other noise-sensitive areas. Noise levels may result from traffic to and from the facility, construction and operation of the facility. Attempts should be made to maintain reasonable ambient levels." This description lends itself to a useful set of scoring categories, such as: a) no noticeable change in noise to the sensitive receptors, b) noticeable but not intrusive, c) intrusive, and finally d) possible exceedance of allowable noise levels. This type of descriptive scoring is much more useful and more easily understood than a number based on an arbitrary range.

WEIGHTING

Weighting is an unavoidable part of a decision-making process, such as landfill site selection or screening. Weighting is an explicit recognition that factors in the decision process vary in their importance. Indeed, *not* weighting factors implies they are all equally important, which is a common weakness in many selection processes. Developing weights can be a useful exercise that separates what is being considered and how it is measured from the relative importance it has to the decision at hand. Separating measurement and importance provides clarity and makes the final results easier to interpret.

In this case, the advisory committee is given complete authority over weighting the criteria. While the committee develops weights behind closed doors, the consultant scores the various sites. Only when the committee is satisfied with the consultant's work (the consultant cannot question the committee's weighting) without knowing the results by site are the criteria scores and weights combined (see Meeting No. 5 Group Memory, page 4). This elaborate procedure, the same as used in 2003, may lend a sense of drama to the process but is hardly needed to produce credible, useful results. On the contrary, openly discussing which effects or conditions are most important and which are desirable but not as critical can be a very important educational opportunity for an advisory committee and also give direction to the technical experts on local community values. The literature on site selection, and my experience, shows the benefits of openly discussing and explaining criteria weights (O'Hare, 1983).

Further, the weighting exercise can be expanded and used to build consensus by developing multiple sets of weights, each based on different perspectives. For example, three sets of weights for all criteria could be developed, emphasizing in turn environmental protection, community protection, and operating efficiency and cost. These sets of weights should be developed collaboratively and openly. Participants in this type of weighting exercise tend to be more willing to accept some weights they would otherwise reject because they know one of the sets of weights will be based on their values. The results will show different rankings of the sites; most likely, there will be a group of sites that rates well and a group that rates poorly under any of the weighting scenarios. In any case, the results will help promote further discussion on the merits of the sites and siting criteria.

ORGANIZATION OF CRITERIA AND IMPLICIT WEIGHTING

In the current study, the selection criteria are not specifically organized, although they appear roughly grouped in a topical manner. This points to a basic weakness in the overall process and a common error in these types of studies—implicit weighting. Implicit weighting occurs when the features being evaluated are correlated so that some conditions are counted multiple times, effectively receiving greater weight, while other conditions remain counted only once and their weight is effectively reduced. This method skews the results and obscures what is actually being measured. For example, consider criterion 16 (location relative to wetlands and Natural Area Reserve System [NARS] land) and criterion 17 (location relative to listed threatened and endangered species). Both are certainly important considerations, and they are also likely to be related, i.e., it is more likely to find listed species in wetlands and NARS lands. In the mathematical logic of the siting study, however, they are separate. The net effect is to double count what is essentially one factor—potential effects on important habitat and species.

The 2011 siting criteria have several similar cases of correlated criteria creating implicit weights, notably with regard to visitor services or facilities. Implicit weights can be avoided by organizing the criteria into clusters or in a hierarchical structure (Hobbs, 1985). This approach is described in the 2008 SWMP but was not followed in 2011. The 2008 SWMP describes four categories—sustainability, suitability, socio-political, and nuisance—with specific criteria within each category but no other detail on measurement or weighting. A useful practice for siting studies is to combine the criteria, scores, and weights within a category, similar to a subtotal, which can be more usefully compared among the sites than just a single overall result. If desired, sub-categories can be developed. Using the example above, “potential effects on important habitat and species” could have three components: wetlands, NARS lands, and threatened and endangered species. The score for this category would be determined by the scores for each component and the weights assigned through a collaborative process. These techniques are well developed, and while they can be made elaborate by creating four or five hierarchical levels, they are scalable and flexible.

Criteria and the resulting scores are most useful where they indicate the actual features of a site and represent a form of measurement; deciles create what is essentially an arbitrary scale. When the arbitrary scores are then multiplied by weights established without a technical rationale and finally added together, the results are largely meaningless, even for just creating a rank ordering of the sites. Unfortunately, human nature will lead to reading much more into the results and concluding, for example, that a site with a final score of 60 is 50 percent better than a site with a score of 40. Considering the 2011 scoring and weighting process, this is of course grossly inaccurate and wholly misleading.

MITIGATION AND MINIMIZATION

The facility siting strategy described in the 2008 SWMP includes a step to try and avoid or reduce potential impacts (see Figure 11-1 and pages 11-9 to 11-10). The approach described in the SWMP provides clarity by explicitly separating the initial, or gross, effect and what the net effect would be following reasonable mitigation. There is no explanation why this approach was not applied in the current siting study.

RANGE OF SITES

The 2011 siting study largely adopts the same sites evaluated in 2003. Little effort was made to reconsider the potential universe of sites. In January 2011, the state of Hawaii and the Marine Corps were asked if sites on their land could be considered (the state declined; the Corps response was not included in the committee minutes) and committee members were

asked to suggest appropriate sites. The letters to the state and Marine Corps stated “an island-wide site inventory” was undertaken but no explanation is provided as to how this search was conducted. Establishing the set of sites being considered is a crucial step. Too narrow a search precludes potential sites from ever being evaluated, and too broad a search can make the effort ponderous and inefficient. Further explanation is needed to support a robust and credible siting study.

SITE EVALUATION PROCESS

To date, the current siting study does not appear to follow generally accepted processes for public facility siting. As noted above, it also does not appear to fully follow the process described in the 2008 SWMP. As the current process progresses, it appears to be straying from the process described when the Landfill Site Advisory Committee’s work began in 2011. The November 8, 2011 group memory includes additional GIS analysis looking for sites mauka of the UIC and No Pass line; instead, the selection process should have identified potential sites much earlier. Other discussions during this meeting indicate they were revisiting criteria on groundwater protection and site size (see page 3). The GIS analysis presented at this meeting has other flaws. For land ownership the analysis requires a minimum of 100 acres under single ownership. This is an unnecessarily difficult condition to meet. Adequate size is important and looking for sites with a manageable number of owners is reasonable as a practical matter, but the conditions treated here as minimum requirements are not warranted. Other subjects in the November GIS analysis, such as critical habitat and agricultural lands are similarly treated as pass/fail without asking if there would be an effect, and if so, if it could be avoided or mitigated. Overall is it puzzling why a coarse-scale exclusionary screening exercise would be introduced at this point in the siting study. These are important subjects that should be thoughtfully addressed throughout the siting process and not brought back as the study is supposed to be reaching its conclusion.

The process usually followed for siting public facilities can be visualized as a funnel, beginning with broad consideration of a large number of sites with generally available information, then narrowing the number of sites and increasing the level of detail being studied. This process efficiently excludes less suited sites early in the process and then focuses greater and greater effort on the best prospects (Saaty, 2008; Kiker et al., 2005; Chang et al., 2007). In most cases, the last and most detailed level of study is the environmental impact statement (EIS).

The 2008 SWMP loosely describes this type of process (see Figure 11-1), with design and mitigation applied to a narrowed range of sites, followed by neighborhood notification and meetings, and then further review of scoring before the sites are recommended for evaluation in an EIS. However, the work to date is logically flawed and incomplete; hence, it does not provide a sufficient basis to narrow the range of sites, let alone justify selection of a single site.

SPECIFIC CRITERIA

The following section briefly comments on the siting criteria developed in 2011 and their relationship to siting criteria included in the 2008 SWMP:

1. Landfill capacity: See overall comment on using deciles for scoring.
This criterion corresponds to the “Site, size, and shape” criterion in the 2008 SWMP. The SWMP criterion description is more complete.
2. Location relative to educational institutions, health care facilities, or park and recreation facilities: This criterion is poorly described with no explanation of

the types of effects that are of concern, only that more distance is better. This is an over simplification that obscures valid considerations. Examining the potential for these types of facilities to be affected would be simpler and more transparent.

There is no directly comparable criterion in the 2008 SWMP, other than the general "Impact on surrounding areas." The 2011 criterion could be considered a subset, provided implicit weighting is avoided.

3. Location relative to residential concentrations: See overall comment on using deciles for scoring. This criterion is poorly described with no explanation of the types of effects that are of concern, only that more distance is better. Simple straight-line distance measurements ignore how topography can either shield or expose an area. Consider two sites, both with residential areas ½ mile away. If at one site the residences are on the far side of a ridge they would be substantially shielded from the landfill. If the other site was across a valley, the noise of landfill operations could be amplified by the topography. As defined, this criterion would assign both cases equal scores.

This criterion could be considered to correspond to the 2008 SWMP criterion "Noise," but no explanation is provided. This criterion could also be a subset of the 2008 "Impact on surrounding areas" criterion.

4. Location relative to visitor accommodations: The problems described above for criterion #3 also apply to this criterion.

There is no directly comparable criterion in the 2008 SWMP, other than the general "Impact on surrounding areas." The 2011 criterion could be considered a subset, provided implicit weighting is avoided.

5. Location relative to local or visitor commercial facilities: The problems described above for criterion #3 also apply to this criterion.

There is no directly comparable criterion in the 2008 SWMP, other than the general "Impact on surrounding areas." The 2011 criterion could be considered a subset, provided implicit weighting is avoided.

6. Effect on established public view planes: Overall, this criterion is well defined; however, the measurement and scoring should be more clearly described.

There is no directly comparable criterion in the 2008 SWMP, other than "Screening" and the rather general "Impact on surrounding areas." The 2011 criterion could be considered a subset of the latter, provided implicit weighting is avoided.

7. Wind direction relative to the landfill site: See overall comment on using deciles for scoring. Further, what constitutes an "appropriate prevailing wind pattern" should be explained.

This criterion appears to correspond to the 2008 SWMP criteria "Odor" and "Dust." The SWMP criteria are better defined in that they explain what effects are being addressed.

8. Effect on local roads and traffic in residential neighborhoods: This criterion is poorly explained; the statement "That distance will be weighted by the number of residential parcels along those roads" is vague. Is the length

multiplied by the number of parcels? What about multi-family developments? What constitutes a residential area?

This criterion corresponds to the 2008 SWMP criterion “Traffic.” The SWMP criterion provides a clearer explanation of the potential effects being addressed.

9. Wear and tear on highways and roadways caused by landfill traffic: See overall comment on using deciles for scoring. Including this factor with site development costs would provide a clearer understanding.

The closest 2008 SWMP criterion is “Traffic.” The 2011 criterion is more focused and specific.

10. Location relative to identified community disamenities: See overall comment on using deciles for scoring.

This criterion appears to roughly match the intention of the 2008 SWMP criterion “Community Burden.” The 2011 criterion is broader and more encompassing.

11. Location relative to H-Power: See overall comment on using deciles for scoring. Further, although the rationale explains the H-Power contract has cost adjustments for distances greater than 12-miles, the measurement ignores this provision. Further, there is no consideration that the WGS� might continue to accept H-Power ash while municipal solid waste is received at another site.

This criterion is a subset of the 2008 criterion “Site Location.”

12. Effect of precipitation on landfill operations: See overall comment on using deciles for scoring. This criterion addresses design factors mixed with siting criteria. For the purposes of site selection, the focus should be on the total annual precipitation. Further, measurement of the criterion could score against areas with particularly high precipitation levels.

There is no corresponding 2008 SWMP criterion. This is a useful addition to the set of criteria.

13. Landfill development, operation, and closure cost: See overall comment on using deciles for scoring. This criterion should be converted to evaluate sites over a common period, such as 25 years, to provide valid comparisons.

There is no corresponding 2008 SWMP criterion. If considered as life-cycle costs, this would be a useful addition to the criteria.

14. Displacement cost: See overall comment on using deciles for scoring.

There is no directly comparable criterion in the 2008 SWMP, other than the general “Impact on surrounding areas.” The 2011 criterion could be considered a subset, provided implicit weighting is avoided.

15. Potential for solid waste-related land uses: See overall comment on using deciles for scoring.

There is no directly corresponding 2008 SWMP criterion. This is a useful addition to the set of criteria.

16. Location relative to wetlands and NARS land: See overall comment on using deciles for scoring. This criterion is poorly described with no explanation of

the types of effects that are of concern, only that more distance is better. This is an over simplification that obscures valid considerations. Examining the potential for wetland or NARS sites to be affected would be simpler and more transparent.

There is no directly corresponding 2008 SWMP criterion, other than the general "Impact on surrounding area." This is a useful addition to the set of criteria.

17. Location relative to listed threatened and endangered species: See overall comment on using deciles for scoring. This criterion could likely double-count areas also considered by criterion #16, because it is more likely threatened and endangered species would be found in NARS sites. There is nothing inherently wrong with considering these areas to be very important, but its important values should be described clearly, measured effectively, and weighted appropriately.

This corresponds well with the 2008 SWMP criterion "Endangered species." The SWMP criterion is better explained as avoiding effects.

18. Surface water resources: This criterion is poorly defined. How is "potential for discharge" determined? It is hard to conceive of a site with no potential for discharge, which under this definition would give every site the same scoring of "1." The potential for surface water discharges is a normal consideration in landfill development that can, to some degree, be addressed by design and best management practices (BMPs). Factors that should be measured include upstream flows entering the site and flows generated on site.

There is no corresponding 2008 SWMP criterion, other than the general "Impact on surrounding area." With better definition this is a useful addition to the criteria.

19. Archaeological and culturally significant resources: See overall comment on using deciles for scoring. Similar to other criteria, this one uses simple straight-line distance without consideration of intervening features and without addressing the actual effects that are of concern or relative value of the resources.

There is no corresponding 2008 SWMP criterion, other than the general "Impact on surrounding area." With better definition this is a useful addition to the criteria.

20. Quality of agricultural lands: This criterion is well described.

There is no corresponding 2008 SWMP criterion, other than the general "Impact on surrounding area." This is a useful addition to the criteria.

There are several criteria in the 2008 SWMP that are not adequately addressed by the 2011 criteria. These include:

- Aquifer location: From meeting minutes, it appears sites with potential aquifer impacts are excluded from the screening process. The Landfill Site Advisory Committee appears to be diverging from the siting process set forth in the SWMP. Stage 2 of that process consisted of applying exclusionary criteria to eliminate sites from further consideration, then developing City-specific siting criteria for areas that are not excluded based on EPA, Department of Health, and Board of Water Supply

siting requirements. Notwithstanding City Ordinance 03-09, the Board of Water Supply has the authority to allow a landfill to be permitted within the No Pass Zone. Past correspondence has indicated the Board of Water Supply might be open to this possibility and application of engineering controls could technically make these types of sites environmentally feasible. The Committee is currently considering potential sites that are mauka of the No Pass Zone. However, in addition to potable water sources, the Committee is using other criteria to exclude potential sites, such as the ones introduced in the November 8, 2011 meeting.

- Environmental justice: The characteristics of affected populations are not addressed by the 2011 criteria. The 2008 SWMP states: “No sites should place an excessive environmental burden on a particular race, color, national origin, or income group.” This is an important consideration that is recognized at the federal level by Executive Order 12898 and normally addressed during environmental review. Historically, landfills located in minority communities have been a major impetus for recognizing the disproportionate burden and risk these communities faced. In Hawaii, environmental justice is recognized and protected by Act 294 (Kahihikolo 2008). No explanation is provided for omitting this important consideration from the siting process.

The current site selection process has numerous weaknesses and, as presently configured, is unlikely to produce credible, useful results.

SUPPLEMENTAL EIS

The flooding events of December 2010 and January 2011 raised questions as to the adequacy of the previous environmental review and design on which the review was based. The most relevant statement in the Final EIS (page 5-38) states:

“5.6.5. Potential Impacts and Mitigation Measures

Flood Zone

Drainage controls to handle storm events have been implemented for the portions of the site used for landfilling. The drainage controls were designed to accept peak flows from a ~~100-year design storm~~ from a tributary area of 622 acres. Future control of storm and flood flows will be designed by the City and WMH to be consistent with the requirements for control of storm water runoff by the State and City & County of Honolulu. **With the mitigation measures proposed, the potential for adverse impacts associated with flooding are not anticipated.**” (emphasis added)

It is worth noting page 8-21 of the Final EIS has similar logic in relying on design to dismiss potential impacts.

The events of December 2010 and January 2011 show the design assumptions supporting the Final EIS were incorrect and hence the environmental analysis was flawed. Hawaii environmental regulations (§11-200-27) state: “A supplemental statement shall be warranted when the scope of an action has been substantially increased, when the intensity of environmental impacts will be increased, when the mitigating measures originally planned are not to be implemented, or where new circumstances or evidence have brought to light different or likely increased environmental impacts not previously dealt with.” In this case, clearly the mitigating measures originally planned were not adequate and environmental impacts have increased. Therefore, a supplemental EIS appears warranted.

REFERENCES

- Chang, N.B. G. Parvathinathanb, and J.B. Breeden. 2007. Combining GIS with Fuzzy Multicriteria Decision-making for Landfill Siting in a Fast-growing Urban Region. *Journal of Environmental Management* (2007), doi:10.1016/j.jenvman.2007.01.011.
- Hobbs, B.F. 1985. Choosing How to Choose: Comparing Amalgamation Methods for Environmental Impact Assessment. *Environmental Impact Assessment Review*. 1985:5:301-319
- Kahihikolo, Leslie R. 2008. Hawaii Environmental Justice Report. Prepared for the State of Hawaii Environmental Council.
- Kiker, G.A., T.S. Bridges, A. Varghese, T.P. Seager, and I. Linkovjj. 2005. Application of Multicriteria Decision Analysis in Environmental Decision Making. *Integrated Environmental Assessment and Management: Volume 1, Number 2*, pp. 95–108.
- O’Hare, Michael. 1983. *Facility Siting and Public Opposition*. Van Nostrand Reinhold, New York.
- Saaty, Thomas L. 2008. *Decision Making for Leaders: The Analytic Hierarchy Process for Decisions in a Complex World*. Revised Edition. RWS Publications.

