
PROJECT DOCUMENT

CommunityViz for GP Comprehensive Update

Technical Report:

Tasks G (Indicator Modeling)

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Tasks: G – Indicator Modeling

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INDICATORS: DESCRIPTION, MODELING APPROACH, AND DATA SOURCES

Scenario planning represents the next generation of analytical processes created to evaluate the Influence of different development types, locations, patterns and intensities on a wide range of topics of interest. Visualizations of the interaction between land use, urban form and infrastructure decisions, as well as the causal factors that explain the push-pull relationship between them, provides community leaders with the information needed to evaluate the consequences of potential actions.

This report provides more detailed information on metrics called indicators that have been identified by during the development of the County of Hawaii (CoH) growth scenarios. Indicators are impact or performance measures that apply to an entire scenario. They summarize conditions using a single summary statistic (e.g., a sum, average or ratio). Results are displayed in charts or tables for monitoring conditions inside CommunityViz, and often become the criteria for ranking growth alternatives in a scenario planning process. Indicators update automatically using formulas written in the software that respond to changes made in other areas of the analysis.

Indicator values may be exported from CommunityViz to other software platforms (e.g., Microsoft Excel) for reporting or other analyses. This technical report serves to accompany a set of over 220 indicators that were created to compare and contrast different land use scenarios. This set of indicators is assembled in a spreadsheet called the “Scenario Report Card”. In the Report Card, indicator results make comparisons of potential futures in the form of scenarios and to compare future scenarios with today. Some of the indicators that were initially proposed had to be shelved, usually due to lack of available data. Appendix 1 has a complete list of these indicators that were not addressed.

The indicator values are grouped into categories based on different themes. Some themes have more indicators than others. Over the course of the analysis many indicators were considered and some were not developed. In most situations it was the lack of available information that made some indicators impractical. In some cases, supplemental analyses were conducted to fulfill a particular need (e.g. the development of viewsheds, address visitor accommodations, examine affordability, etc.).

Tiered Analysis

Using feedback from the technical workshops, public sessions, and information generated by the planning process up to that point, discussions with CoH and consultant staff began to explore the concept of three different tiers of analyses that would inform the comprehensive planning process. Each tier would be oriented towards a different purpose, audience and level of expertise.

- Tier One. This tier consists of an expanded version of the analysis used in the Hawaii technical workshops. This analysis has a set of indicators, most of which are similar to or identical to indicators in the Tier Two analysis. Appendix 2 has a complete list of indicators in the Tier One analysis and where the indicators coincide with indicators in Tier Two. The Tier One indicators are described in the Evolution of Scenarios Technical Report. This analysis continues to be used for workshopping scenario alternatives with staff and/or stakeholders.
- Tier Two. The tier two analysis refers to the CommunityViz analysis developed to house the full set of indicators developed to support the CoH Comprehensive Planning process.
- Tier Three. The tier three analysis was conceived an analysis and set of techniques to “set up” the tier two analysis in the case of a significant update, such as the development of new parcel or reference data.

This report will cover the development of the tier two analysis. The tier one and three analyses are described in greater detail in separate technical reports.

Forecasts

To understand future growth and develop future land use scenarios, growth projections or forecasts were estimate by SMS, a Hawai'i-based research and consulting company (see their report "General Plan Comprehensive Review Trends and Forecast Analysis Final Report (2015)"). These projections are broken out by 13 geographic areas called "forecast analysis zones" or FAZs and by use type (residential dwelling units and non-residential square feet). In order to add additional land use information to the allocation, the SMS forecasts were further broken down into two residential categories (single family dwelling units, multifamily dwelling units) and two non-residential categories (commercial square feet, industrial square feet). These four forecasts were inputs to a land use allocation model that also used land capacity and market desirability to create future development scenarios. The forecasts, land capacity and market desirability are all topics documented at much greater length in other technical reports.

Scale

The County of Hawai'i CommunityViz indicators model is built on Real Property Tax (RPT) parcels and provides countywide scale for most impact indicator calculations for project scenarios in the Scenarios Report Card. This means that it is summarizing the impacts generated by scenarios at the countywide scale, but most input calculations function at the parcel level. An example is energy use: The model estimates energy use per day generated by a given parcel, but the overall indicator tracks total scenario energy use, a combination of all parcels.

In addition to parcel and countywide level, most indicator values can be summarized at interim scales, such as district or FAZ level.

Scale	Countywide	Districts	FAZ/TAZ	Neighborhood	Parcel
Indicator Summarized at this Scale	✓	✓	✓	✓	✓

The County model is an impact measurement tool. To calculate impacts, it often multiplies the number of impact *generators* (i.e., residential dwelling units, non-residential square footage) by an impact *coefficient* (e.g., trip generation per household for a given land use). When this calculation occurs in a model, the number of impact generators comes from specific data about a site or property, but the coefficients are often generalized at higher scale such as FAZs, districts (e.g. South Kohala) or at county level. Whenever possible coefficient data from CoH subject matter experts, such as the County Department of Water Supply. In some cases however, coefficients have been identified from a 3rd party source such as a published study or rule of thumb. In most cases, coefficients represent current conditions but in some cases (e.g. employees per 1,000 sq ft of commercial space) these coefficients were forecast to estimate future values. A complete list of coefficient assumptions can be found in Appendix 3.

Timeframe

Estimating future impacts involves a good understanding of present day conditions and historic trends. Many of the calculations about future scenarios use existing information (e.g. energy use rates, water use rates, trip generation rates, etc.) from published sources (e.g. US Census, County reports, State

research, etc.). It's possible that coefficient rates remain relatively constant, but the generators change: population increases, businesses expand, etc.. Another possibility is that coefficient rates change, for better or worse, based on some anticipated changes (e.g. energy efficiency increases, water use decreases as conservation measures are implemented). Most likely, in the future both the generators and the coefficient values change. Depending on the indicator and available information, the question of "when" and "what" is being estimated is an important consideration. There will be times when all three of the below options are reported. The following table will be used to identify the temporal level for indicators.

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓	✓	✓

Indicators reporting on existing data will provide insight into current conditions, possible things which may be of interest to change in scenarios, but may not be easily or appropriately measured for future scenarios. An example might be traffic incidents. While data may be helpful for present day to understand where traffic improvements might prevent future incidence, it will not be in the model's capability to predict the amount of future incidents.

Indicators reporting on future changes (net new) are generally helpful to understand and compare change. For example, sometimes a value like water use may be estimated for future additional development. Since existing water use is a measurable given for all scenarios, the net change is what will most influence a scenario performance.

Indicators reporting on overall future will be presenting the total gross impact, existing plus future changes. When the overall value will be more beneficial to understanding policy or other necessary actions. For instance, the net new number of homes in a volcanic risk zone helps a planner compare how different scenarios perform as each scenario places a different number of new homes in risk areas. However, emergency management planners will want to know the total number of homes (existing plus new) within a lava flow zone to comprehensively assess risks and address potential needs.

In sum, while the formula or model for each indicator variation above will usually be the same, the data used may vary:

- For the existing scenario, the data is based on some existing data source. For example, the US Census, RPT data, CoH or other source which reports on current or recent conditions.
- For future scenarios, the land use patterns will change as the amount of new residential and non-residential (i.e. the generators) development in any given location will fluctuate.
- The data for impact coefficients (e.g., water use per household) is estimated from best available sources.

In the indicator descriptions below:

- **Description** is general and refers to all variations of the indicator (scale and timeframe)
- **Methodology** provides a description of the actual calculation steps.
- **Formula or Model** is general but uses example names for impact generators, such as parcels or buildings, whose source may vary across indicator variations
- **Timeframe** as described above, reflects the temporal application of the indicator
- **Unit** is the spatial unit of the indicator, where applicable

CONSERVATION

Conservation indicators examine factors such as critical habitat, watersheds, viewsheds, open space and historic and cultural sites.

ACRES OF CRITICAL HABITAT

Description: Critical habitat as defined by the US Fish and Wildlife Service¹ designation for threatened and endangered species. This indicator summarizes areas within this definition.

Methodology: Sum acres of critical habitat layer.

Formula or Model: Sum ([Attribute : Critical Habitat : Acres])

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓		

Unit: Acres

ACRES OF SENSITIVE ECOLOGICAL AREAS

Description: Summary of sensitive ecological areas, including:

- Reserves²
 - National Parks
 - National Wildlife Refuge
 - Natural Area Reserves
 - Forest Reserves
 - Marine Life Conservation Districts
- State Land Use Conservation District
- Watershed Protection Areas

Methodology: Sum acres of sensitive ecological areas.

Formula or Model: Sum ([Attribute : Sensitive Ecological Areas : Acres])

Timeframe:

¹ <http://www.fws.gov/endangered/what-we-do/critical-habitats.html>

² http://files.hawaii.gov/dbedt/op/gis/data/reserves_fgdc_metadata.html

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓		

Unit: Acres

RESIDENTIAL DEVELOPMENT IN SENSITIVE ECOLOGICAL AREAS

Description: This indicator summarizes existing and future added dwelling units to areas previously defined as sensitive ecological areas.

Methodology: Using CommunityViz spatial functions, sum the overlapping area with SEAs. Assume a proportional share of dwelling units on a feature is within the SEA based on overlap.

Formula or Model: Sum ([Attribute : Parcels : dwelling units within SEAs])

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓	✓	✓

Unit: count of dwelling units

RESIDENTIAL DEVELOPMENT IN VIEWSHEDS

Description: Viewsheds are spatial representations of areas that are visible from one or multiple points. They are useful measuring change (especially urbanization) that may impact scenic places. Planning Consultants of Hawaii (PCH), a contractor to the County, identified a set of viewpoints from which an initial set of viewsheds was developed. CoH staff decided to refine the viewsheds using the following criteria:

- Exceptional Viewsheds. PCH had assigned ratings to all the views they inventoried. A decision was made to include only those viewsheds ranked as exceptional.
- Protected and undevelopable lands. Many of the most spectacular views in the island are already protected or have little capacity to develop because state zoning would preclude it. These lands were removed from the viewsheds in order to focus on viewsheds that are at greater risk of developing.
- Removing developed neighborhoods. Neighborhoods that had largely been built out or neighborhoods that consisted of underserved subdivision were removed from the viewsheds. These refinements created a set of viewsheds that were largely undeveloped, in private hands and were at some risk of land use change leading to a degradation of the viewshed. The indicator counts the number of dwelling units found in the refined viewsheds.

Methodology: Based on results of the scenic study, this measures the count of dwelling units with potential to impact highly rated viewshed areas.

Formula or Model: $\left(\frac{\text{viewshed area}}{\text{total parcel area}} \right) \times \text{Number of buildings}$

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓	✓	✓

Unit: count of dwelling units

RESIDENTIAL DEVELOPMENT NEAR ANCHIALINE POOLS

Description: Anchialine pools are small bodies of water, typically adjacent to the ocean but not directly connected to it. These brackish pools often support an high amount of endemic and rare aquatic species, especially crustaceans and other invertebrates. As wetlands, they provide important habitat for native waterfowl. Anchialine pools are threatened by land use change and nonnative species. Residential development that encroaches on anchialine pools would be detrimental to their health.

Methodology: Using a minimum distance function, with a default value of 500 ft, dwelling units are counted that fall within the minimum distance to anchialine pools.

Formula or Model: Sum ([Attribute : Parcels : Dwelling Units], where ([Attribute : Parcels : Distance to Place] < 500 feet))

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓	✓	✓

Unit: count of dwelling units

ACRES OF OPEN SPACE

Description: This indicator will estimate overall open space areas, both protected lands (State Land Use conservation, conservation easements³, publicly owned conservation areas⁴, and TNC⁵ and TPL⁶ owned lands) and general (includes protected areas and privately owned lands and agricultural areas over 5 acres).

Methodology: Sum acres of open space by type (protected, general).

Formula or Model: Sum ([Attribute : Open Space : Acres])

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓		

Unit: acres

RESIDENTIAL DEVELOPMENT IN OPEN SPACE AND SPECIAL MANAGEMENT AREAS

Description: This indicator considers development on two types of open space: protected and unprotected (i.e. general open space) as well as Special Management Areas. Protected open space will be treated as no growth areas in scenarios but a small amount of growth may occur. General open space may allow for new development. Special Management Areas, or SMAs, are areas of the island that are in close proximity to the shoreline. This indicator will report on any areas currently defined as open space where future scenario development is shown to occur.

Methodology: Using data on where scenario development has occurred (new dwelling units > 0), sum dwelling units.

Formula or Model: Sum ([Attribute : Parcels : dwelling units] , where (*open space*))

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
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³ http://conservationeasement.us/reports/easements?report_state=Hawaii&report_type=All

⁴ <http://dlnr.hawaii.gov/ecosystems/llcp/projects/>

⁵

http://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/hawaii/placesweprotect/index.htm?siteInks=ProtectedPlacesinHI&src=sea.AWP&gclid=CjwKEAiAhaqzBRDNltaS0pW5mWgSJADd7cYDSjE6W5t8G3qGNluuaa8POvL-GpIBoycRSEH5XAvYeohoCIT_w_wcB

⁶ <https://www.tpl.org/our-work/land-and-water/hawaiian-heritage-lands>

Indicator Summarized at this Timeframe	✓	✓	✓
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Unit: count of dwelling units

NEW RESIDENTIAL DEVELOPMENT NEAR IDENTIFIED HISTORIC/CULTURAL RESOURCES

Description: This indicator looks at registered historic places and districts⁷ and identified historic and/or cultural sites and trails and summarizes the amount of new development within a certain distance (default is 500 feet – historic districts measure “within” district, or zero feet).

Methodology: Using a minimum distance function, with a default value of 500 ft, dwelling units are counted that fall within the minimum distance to places, sites, districts and trails.

Formula or Model: Sum ([Attribute : Parcels : Dwelling Units], where ([Attribute : Parcels : Distance to Place] < 500 feet))

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓	✓	✓

Unit: count of dwelling units

NUMBER OF IDENTIFIED HISTORIC/CULTURAL RESOURCES

Description: Taking into account known and mapped historic and/or cultural resources, this indicator will count the number of places, sites and districts. Historic trails are measured in miles of trail.

Methodology: Count historic/cultural resources in GIS data layer.

Formula or Model: Count ([Layer : Historic/Cultural Sites])

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
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⁷ GIS data based on draft digitized data from the historic registry, Planning Division, Hawaii County Planning Department.

Indicator Summarized at this Timeframe	✓		
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Unit: count of historic or cultural resources

ACRES OF CRITICAL HABITAT AND SENSITIVE ECOLOGICAL AREAS OUTSIDE PROTECTED LANDS

Description: Critical habitat and sensitive ecological areas are not necessarily protected under fee simple ownership or conservation easements. This indicator looks at the areas protected (State Land Use Conservation or conservation easement) and summarizes the remainder.

Methodology: Sum of land area where conservation designation and/or easement does not exist.

Formula or Model: Sum ([Layer : SEA : Acres] , where ([attribute : SEA : IsConserved] = 0))

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓		

Unit: acres

HAZARDS

This category of indicators addresses the multitude of hazards affecting the County of Hawai'i related to the General Plan. Hazards addressed include: sea level rise, volcanic activity, wildfire, tsunamis, floods, and tsunami inundation in addition to sea level rise.

RESIDENTIAL DEVELOPMENT IN AREAS AT RISK OF SEA LEVEL RISE

Description: Summary calculation of housing units that are within the NOAA projected area of sea level rise⁸. Projections cover 1 to 6 feet of sea level rise. Recent projections show as much as 1 foot of rise by 2050 and a between 2.5 and 6.3 feet of rise by 2100. The NOAA elevation model has some known issues for the Big Island, so calculations add 1 foot of rise per time interval to account for issues in elevation. Sea level rise for 2050 is measured as 2 feet (1 foot actual) from the NOAA data. For 2100, it was assumed that 4 feet (3 feet actual) would represent the low end and 6 feet (5 feet actual - the highest rise available) would represent the high end.

Methodology: Using CommunityViz spatial functions, calculate relationship between parcels and sea level rise layers. Based on the amount of overlap area, this indicator is a sum of proportional units that are in features which intersect the sea level rise areas (e.g. a parcel with 50% overlap with sea level rise of up to 2 feet and containing 10 dwelling units would be calculated as having 5 units affected by 2050 SLR).

Formula or Model:

Parcels:

$$\frac{\text{OverlapArea ([layer : sea level rise])}}{[\text{attribute : shape area}]} \times [\text{attribute : number of units}]$$

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓	✓	✓

Unit: dwelling units

RESIDENTIAL DEVELOPMENT IN VOLCANO HAZARD ZONES

Description: Summary calculation of housing units that are within high hazard zones (zones 1 and 2) for volcanic activity⁹.

⁸ <https://coast.noaa.gov/digitalcoast/tools/slr>

⁹ http://files.hawaii.gov/dbedt/op/gis/data/vhzones_n83.txt

Methodology: Using CommunityViz spatial functions, calculate relationship between hazard zones (1 & 2) and parcels. Indicator is a sum of units that are in features which intersect high hazard zones.

Formula or Model:

Polygon (e.g. parcels):

$$\frac{\text{OverlapArea ([layer : Volcano hazard zones])}}{[\text{attribute : shape area}]} \times [\text{attribute : number of units}]$$

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓	✓	✓

Unit: dwelling units

RESIDENTIAL DEVELOPMENT IN 100-YEAR FLOODPLAIN

Description: Summary calculation of housing units that are within the 100-year floodplain¹⁰.

Methodology: Using CommunityViz spatial functions, calculate relationship between layer(s) with building data and layer for flood data. Indicator is a sum of units that are in features which intersect the flood areas.

Formula or Model:

Polygon (e.g. parcels):

$$\frac{\text{OverlapArea ([layer : 100-year floodplain])}}{[\text{attribute : shape area}]} \times [\text{attribute : number of units}]$$

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓	✓	✓

Unit: dwelling units

¹⁰ Hawaii County's 2nd preliminary DFIRM (Digital FIRM) and GIS shapefiles are available on the FEMA Map Service Center, August 2015. Made available for planning purposes. Preliminary maps are used in County development regulation, but FEMA has not made this data effective as of the date of this report.

RESIDENTIAL DEVELOPMENT IN WILDFIRE RISK AREAS

Description: Summary calculation of housing units by wildfire risk zones¹¹ classified as “high risk”.

Methodology: Using CommunityViz spatial functions, classify parcels by wildfire risk zone. Indicator is a sum of dwelling units wildfire risk zone (low, medium and high).

Formula or Model:

Polygon (e.g. parcels):

Sum ([attribute : dwelling units], where ([attribute : wildfire zone] = “High”))

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓	✓	✓

Unit: dwelling units

RESIDENTIAL DEVELOPMENT IN TSUNAMI INUNDATION AREAS

Description: Summary calculation of housing units that are within tsunami inundation areas¹². Several similar indicators examine the amount of new development near tsunami inundation areas (near is defined as within 50 ft but could be adjusted in the model) and the tsunami zones given an additional 6 ft of sea level rise.

Methodology: Using CommunityViz spatial functions, calculate relationship between parcels and tsunami inundation areas. Indicator is a sum of units that are in features which overlap the tsunami inundation areas based on amount of overlap. Tsunami inundation zones plus 6 ft of sea level rise were estimated by county planning staff using aerial imagery, sea level rise maps and elevation contours.

Formula or Model:

Polygon (e.g. parcels):

$$\frac{\text{OverlapArea ([layer : tsunami inundation])}}{[\text{attribute : shape area}]} \times [\text{attribute : number of units}]$$

Timeframe:

¹¹ <http://files.hawaii.gov/dbedt/op/gis/data/firerisk.txt>

¹² 2010, based on 2-D inundation modeling by the University of Hawaii, School of Ocean and Earth Science and Technology (UH SOEST) - ftp://ftp.soest.hawaii.edu/volker/Tsunami/Hawaii_Final_Report/Hawaii_Report_2010.pdf

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓	✓	✓

Unit: dwelling units

RESIDENTIAL DEVELOPMENT IN RECENT LAVA FLOWS

Description: Summary calculation of housing units that are within lava flow areas tied to date of flow. For recent flows, the default value was set to 1990 and more recent.

Methodology: Using CommunityViz spatial functions, calculate relationship between parcels and lava flow areas which occurred from 1990 (default) to present. Indicator is a sum of units that are in features which overlap the recent lava flow areas based on amount of overlap. The default value is an adjustable assumption and can be set as early as 1800.

Formula or Model:

Polygon (e.g. parcels):

$$\frac{\text{OverlapArea} ([\text{layer:lava flows}], \text{where} ([\text{attribute:date}] \leq 1990))}{[\text{attribute : shape area}]} \times [\text{attribute : number of units}]$$

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓	✓	✓

Unit: dwelling units

ENERGY

Energy indicators look at usage and types of energy in use in the County of Hawai'i.

RESIDENTIAL ENERGY USE

Description: Energy use is an estimate of the amount of energy consumed by residences in the study area. Residential dwelling units are multiplied by assumptions about residential energy consumption¹³. Commercial and industrial energy use information was unavailable.

The model assumes a residential energy rate of 14.7 kwh per housing unit per day based on an average of one year (October 2014 through September 2015). The model does not assume a different energy usage rate in the future.

Methodology: Energy rate estimate by land use type multiplied by the number of residential units.

Formula or Model: Residential example:
[attribute : dwelling units] x [assumption : kWh per dwelling unit]

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓	✓	✓

Unit: kilowatt hours per day

¹³ <http://dbedt.hawaii.gov/economic/energy-trends-2/>

AGRICULTURAL LAND

Agricultural land indicators looks at the available supply of viable agricultural land and impacts to areas from future development.

ACRES OF AGRICULTURAL LANDS OF IMPORTANCE

Description: This indicator measures the existing land area classified as important agricultural lands in the LUPAG.

Methodology: Sum parcel land area which overlaps GIS layer LUPAG IAL.

Formula or Model: Sum ([Attribute : parcels : LUPAG_IAL overlap])

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓		

Unit: acres

DEVELOPMENT IN PRODUCTIVE AGRICULTURAL LANDS

Description: Summary calculation of housing units within defined productive agricultural lands (PAL). PAL was defined using two separate sources: areas defined in the LUPAG as Important Agricultural Lands plus pasture lands identified in a 2015 University of Hawai'i – Hilo (UHH) study that mapped areas of active agricultural and ranching. This covered the existing General Plan policy areas and expanded it to include pasture lands identified in the UHH study.

Methodology: Using CommunityViz spatial functions, calculate relationship between layer(s) with building data and layer for productive agricultural lands. Indicator is a sum of units that are in features which intersect the productive agricultural lands.

Formula or Model:

Polygon (e.g. parcels):

$$\frac{\text{OverlapArea ([layer : Productive Agricultural Lands])}}{[\text{attribute : shape area}]} \times [\text{attribute : number of units}]$$

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
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Indicator Summarized at this Timeframe	✓	✓	✓
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Unit: dwelling units

ACRES OF PRODUCTIVE AGRICULTURAL LANDS

Description: This indicator measures the existing land area defined as productive agricultural lands. Productive agricultural lands comes from a scenario exploring agricultural land protection. This includes LUPAG IAL and pasture lands identified by the 2015 University of Hawaii study¹⁴ on active agricultural uses.

Methodology: Sum parcel land area which overlaps GIS layer Productive Agricultural Lands.

Formula or Model: Sum ([Attribute : parcels : PAL Area])

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓		

Unit: acres

ACRES OF PASTURE LANDS

Description: This indicator measures the existing land area within pasture lands identified by the 2015 University of Hawaii study¹⁵ on active agricultural uses.

Methodology: Sum parcel land area which overlaps GIS layer Pasture Lands.

Formula or Model: Sum ([Attribute : parcels : Pasture])

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓		

¹⁴ http://files.hawaii.gov/dbedt/op/gis/data/2015AgBaseline_meta.pdf

¹⁵ http://files.hawaii.gov/dbedt/op/gis/data/2015AgBaseline_meta.pdf

Unit: acres

ACRES OF PUBLIC HUNTING AREAS

Description: This indicator measures the existing land area within public hunting areas¹⁶.

Methodology: Sum parcel land area which overlaps GIS layer Public Hunting Areas.

Formula or Model: Sum ([Attribute : parcels : Hunting Area])

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓		

Unit: acres

ACRES OF CROPLANDS

Description: This indicator measures the existing land area within crop lands identified by the 2015 University of Hawaii study¹⁷ on active agricultural uses.

Methodology: Sum parcel land area which overlaps GIS layer Crop Lands.

Formula or Model: Sum ([Attribute : parcels : Crop Area])

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓		

Unit: acres

¹⁶ <https://www.arcgis.com/home/item.html?id=395f0231b98e412e9d79b8dab513b26d>

¹⁷ http://files.hawaii.gov/dbedt/op/gis/data/2015AgBaseline_meta.pdf

RURAL RESIDENTIAL

Rural residential explores impacts of development outside of urbanized areas, including nonconforming subdivisions and infrastructure access.

RURAL RESIDENTIAL LOTS

Description: This is a summary of rural residential properties based on the following criteria:

- Lot is not within the State Land Use Urban district
- Public water service is not available to the property
- Lot fronts on a private roadway
- Lot is less than 5 acres in size

This indicator is summarized by all rural residential lots and is also broke out into vacant and occupied. Vacant rural lots is forecast in the future.

Methodology: Count lots which meet the above criteria.

Formula or Model: Count ([Layer : Parcels], where ([Attribute : isRuralRes] = 1)

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓		✓

Unit: number of lots

HOUSING UNITS ON RURAL RESIDENTIAL LOTS

Description: Based on the previous definition of rural residential, this indicator sums the existing dwelling units on rural residential lots.

Methodology: Sum of dwelling units on rural residential lots.

Formula or Model: Sum ([Attribute : Parcels : Dwelling Units], where ([Attribute : isRuralRes] = 1)

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓	✓	✓

Unit: dwelling units

HOUSING UNITS IN UNSERVICED SUBDIVISIONS

Description: A subset of rural residential lots defined as unserviced or non-conforming subdivisions (e.g., Hawaii Paradise Park (HPP), Orchidland, Hawaii Ocean View Estates). These places are of particular concern to planners given their lack of municipal services, including water, wastewater and public roads. These areas were identified by CoH staff. This indicator sums the existing dwelling units in unserviced subdivisions.

Methodology: Sum of dwelling units in unserviced subdivisions.

Formula or Model: Sum ([Attribute:Parcels:Dwelling Units], where ([Attribute:isUnserviced] = 1)

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓	✓	✓

Unit: dwelling units

VACANT LOT RATIO

Description: There are numerous platted subdivisions where development has not come close to build-out. This indicator explores the ratio of vacant properties with residential potential to the overall development. While its calculated for the entire county, its primarily utility is at the neighborhood or community scale.

Methodology: Count of vacant properties with residential potential (as defined by the capacity analysis) divided by all residential lots (Count of developed (has a residence) residential (or agricultural with residential) properties plus vacant).

Formula or Model:

$$\frac{\sum \text{Vacant Lots}}{\sum (\text{Developed Lots} + \text{Vacant Lots})}$$

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓	✓	✓

Unit: not applicable (ratio)

AVERAGE DISTANCE TO URBAN CENTERS FROM RURAL RESIDENTIAL (WEIGHTED BY POPULATION)

Description: This indicator measures proximity to urban centers (State Land Use District Urban) for population within rural residential lots.

Methodology: Using CommunityViz spatial formulas, calculate distance to urban centers. Multiply the distance times the parcel population. Sum the weighted distances and divide by total area population to get weighted average distance.

Formula or Model:

$$\frac{\sum_n p_n r_n}{\sum_n p_n}$$

Where n is the number of features, p is the number of people within a feature, and r is the straight-line distance from the feature to the nearest destination.

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓	✓	✓

Unit: miles

RESIDENTIAL DEVELOPMENT OUTSIDE URBANIZED AREAS

Description: This indicator summarizes the number of dwelling units outside of urban areas. Two boundaries were used for this to compare results - LUPAG urban land classes and the State Land Use District urban.

Methodology: Using CommunityViz spatial formulas attribute parcels which are outside of the defined urban area boundary. Sum dwelling units outside of the urban area boundary.

Formula or Model:

$$\frac{\text{Parcel Area - SLUD Area Overlap}}{\text{Shape Size}} \times \text{Dwelling Units}$$

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓	✓	✓

Unit: dwelling units

WATER

Water indicators examine the usage and types of water service within the County and its potential impacts to at risk aquifers. It also considers the proximity of new growth to existing water infrastructure.

WATER DEMAND

Description: Water use is an estimate of the amount of water consumed per day by residential, commercial, industrial uses. Residential and resort water use is estimated on a per unit basis, schools on a per student basis and other uses on a per acre of land area basis.

Water Use Rates¹⁸

Name	Rate	Unit
Single Family Dwelling Unit Water Equivalent Unit - North Kona, South Kohala	1000	GPD per unit
Single Family Dwelling Unit Water Equivalent Unit - South Kona	400	GPD per unit
Single Family Dwelling Unit Water Equivalent Unit - All other areas of the island		GPD per unit
Commercial Water Equivalent Unit	3000	GPD per acre
Light Industrial Water Equivalent Unit	4000	GPD per acre
Resort Water Equivalent Unit	400	GPD per unit
Multifamily Dwelling Unit Water Unit Discount	60% of Single Family Usage	

Methodology: This value is calculated using a coefficient that estimates water consumption per housing unit, resort unit or nonresidential structure. These coefficients are specific to land or building use.

Formula or Model:

Residential Example:

[(Attribute : dwelling units)* [Assumption : Potable Water Gallons Per Day Per Unit]]

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓	✓	✓

¹⁸ Domestic Consumption Guidelines from the Water System Standards 2002

Unit: million gallons per day

NUMBER OF HOMES BY TYPE OF WATER SERVICE

Description: Many houses in the County are outside of water service areas. This indicator will summarize housing units being served by municipal providers versus private means (well, storage, etc.). Future parcels will be assumed to be on central service if on water lines (both existing and planned future).

Methodology: Houses on water lines (measured using spatial overlap functions) will be assumed to be on central water service.

Formula or Model:

Water Served Parcels Example:

Sum ([Attribute : Parcels : Dwelling Units], where ([Attribute : On Water] = 1))

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓	✓	✓

Unit: dwelling units

DEVELOPMENT NEAR EXISTING WATER INFRASTRUCTURE

Description: The most likely expansion of water service will be within range of existing infrastructure due to cost and capacity limitations. This indicator measures housing units and non-residential square footage within close proximity to existing water service areas.

Methodology: Using CommunityViz spatial functions, measure distance from parcels to water service areas. Summarize new housing units and non-residential space within a defined distance of existing service areas (300 ft is default).

Formula or Model: Sum ([Attribute : Parcels : Dwelling Units], where ([Attribute : DistanceToServiceArea] <= 300ft))

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓	✓	✓

Unit: dwelling units

USE RATES VERSUS SUSTAINABLE YIELD

Description: Understanding water service demand and the capacity of the County’s aquifers to supply that demand is helpful for infrastructure planning and policy. This set of indicators compare estimated water demand from residential, commercial and industrial uses to an estimated sustainable yield by aquifer¹⁹. This comparison takes into account development within the geographic limits of the “at risk” aquifers: Hawi, Keauhou, Kiholo, Mahukona, Waimanu and Waimea. It does not account for basin transfers or interconnected systems which may take or supplement water in a given aquifer. At risk aquifers were defined by County staff as those where long term estimates of urban growth water usage might exceed the sustainable yield of the aquifer as estimated by the Dept. of Water Supply. Only development connected to private and public centralized systems and does not consider water demand by development that relies on catchments or residential private wells. The indicators report the sustainable yield, estimated demand by scenario and remaining yield.

Methodology: Add existing and projected water demand estimates (by aquifer). Compare with system capacity (existing and potential planned).

Formula or Model:
$$\frac{\text{Existing Demand} + \text{New Proposed Demand}}{\text{Capacity}}$$

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓		✓

Unit: million gallons per day

¹⁹ Hawaii County Water Use & Development Plan. 2015.

WASTEWATER

The County of Hawai'i has limited central wastewater service. Much growth in recent times has happened in areas where the only viable option is cesspool or septic system. These indicators will examine wastewater generation and infrastructure options.

RESIDENTIAL WASTEWATER GENERATION VOLUME

Description: This indicator looks at average wastewater generation rates by residential uses and estimates potential future generation from new residential development.

Methodology: Based on best available data on typical wastewater generation, assign coefficients to each land use type. Residential generation is based on households connected to wastewater treatment system. Wastewater generated by houses not connected to a wastewater treatment system are not included here.

Formula or Model:

Residential:

Wastewater generation rate (378 gpd) * number of households (connected to treatment facilities)

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓	✓	✓

Unit: million gallons per day (mgpd)

NUMBER OF HOMES BY TYPE OF WASTEWATER SERVICE

Description: This indicator examines the type of wastewater service available to residential homes – public centralized service, private centralized service, or onsite disposal systems by type. Onsite disposal systems are broken into four classes:

- Class I - Any system receiving soil treatment. This includes disposal types listed as bed, trench, and infiltration/chambers.
- Class II - Septic systems discharging to a seepage pit*. The effluent receives primary treatment only.
- Class III - Aerobic units discharging to a seepage pit. The effluent receives primary and secondary treatment.
- Class IV - All cesspools where the effluent receives no treatment.

*Note: A seepage pit is a dry well that disperses effluent from septic tanks. The effluent receives no treatment other than settling of solids that occurs in the septic tank.

For purposes of reporting, classes 1-3 are labeled septic systems and class 4 represents cesspools.

Several locations where residential and non-residential development exist do not have identified service, either public or OSDS. For the purpose of this analysis, it was assumed that parcels would be using the service type closest to that property (i.e. my neighbor has a cesspool, I am likely to use a cesspool). This same process was used to estimate future service types for allocated development.

Methodology: Based primarily on the location of homes, assign each parcel with the type of likely or known wastewater service available. Sum houses by type.

Formula or Model:

Sum ([Attribute : Parcels : Dwelling Units], where ([Attribute : WWType] = "Cesspool"))

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓	✓	✓

Unit: dwelling units

COUNT OF ONSITE DISPOSAL SYSTEMS

Description: This indicator examines looks specifically at onsite disposal systems (OSDS) by class: septic, cesspool and large private onsite systems (effluent per onsite disposal system is estimated to be greater than 5,000 mgpd).

Several locations where residential and non-residential development exist do not have identified service, either public or OSDS. For the purpose of this analysis, it was assumed that parcels would be using the service type closest to that property (i.e. my neighbor has a cesspool, I am likely to use a cesspool). This same process was used to estimate future service types for allocated development.

The average system per housing unit and system per 1,000 square feet of non-residential development was used to estimate unknown or future OSDS. For existing identified systems, these rates are:

- 1 OSDS per housing unit
- 0.5 OSDS per 1,000 square feet of non-residential

Methodology: Sum number of OSDS by class.

Formula or Model:

Sum ([Attribute : Parcels : OSDS], where ([Attribute : WWType] = "Cesspool"))

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
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Indicator Summarized at this Timeframe	✓	✓	✓
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Unit: count of onsite disposal systems

DEVELOPMENT NEAR EXISTING WASTEWATER INFRASTRUCTURE

Description: The most likely expansion of water service will be within range of existing infrastructure due to cost and capacity limitations. This indicator measures housing units and non-residential square footage within close proximity to existing wastewater service areas.

Methodology: Using CommunityViz spatial functions, measure distance from parcels to wastewater service areas. Summarize new housing units and non-residential space within a defined distance of existing service areas (300 ft is default).

Formula or Model: Sum ([Attribute : Parcels : Dwelling Units], where ([Attribute : DistanceToServiceArea] <= 300ft))

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓	✓	✓

Unit: dwelling units

RESIDENTIAL DEVELOPMENT ON SMALL LOTS

Description: DOH rules restrict use of individual wastewater systems (IWS, also called septic systems) on lots less than 10,000 square feet (unless the lot was created before August 30, 1991). This indicator estimates the amount of new residential development on (currently) undeveloped lots less than 10,000 sq ft in size and without any access to a centralized sewer service system. This set of indicators counts the number of undeveloped parcels less than 10,000 sq ft and the number of new residences estimated on these lots in each scenario.

Methodology: The indicator identifies existing parcels less than 10,000 sq ft and counts the number of new dwelling units that are allocated to these parcels in each scenario.

Formula or Model: Sum ([Attribute : Parcels : Dwelling Units], where ([Attribute:Parcels:Area] < 10,000))

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓*	✓**	

* Existing undeveloped lots, < 10,000 sq ft only

** New dwelling units on lots, < 10,000 sq ft only

Unit: dwelling units

SOLID WASTE

Much of the County's waste is currently going to landfills. There are questions about capacity and possible future efforts to increase recycling and reuse.

SOLID WASTE GENERATION

Description: This indicator uses average solid waste generation and diversion rates for population and employment to estimate potential future generation from new development. This set of indicators estimates the amount of waste. Separate indicators report the amount of existing waste being delivered to the county's major landfills: South Hilo Sanitary Landfill and West Hawaii Sanitary Landfill.

Methodology: Based on best available data on typical waste generation, assign waste generation and diversion rates to population and employment.

Formula or Model:

Waste generation rate * number of persons-employees

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓	✓	✓

Unit: tons per year

EXISTING WASTE BY STREAM (LANDFILL, RECYCLING, COMPOST)

Description: This indicator looks at best available data on how waste is streamed (landfill, recycle, compost, reuse). Based on existing percentages and potential policies for future efforts, streams will be assigned adjustable percentages so users can test effectiveness of policy choices.

Methodology: The indicator uses adjustable assumptions for each waste stream percent. Default values to estimated existing streams. The total existing and estimated future waste stream is multiplied by percentages proposed waste generation to yield stream quantities.

Formula or Model:

Percent recycled * Total Waste Generated

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓	✓	✓

Unit: tons per year

TRANSPORTATION

Transportation indicators analyze various transportation networks (roads, transit, bike, pedestrian) and their service relative to new land use patterns.

ROAD MILES BY JURISDICTION/FUNCTIONAL CLASSIFICATION

Description: These indicators will summarize the road network by jurisdiction (State, County, Other Government, Private, Roads in Limbo and Unknown) and by Functional Classification (Arterial, Collector and Local).

Methodology: Bringing in data from Public Works. RPT and HDOT, build a road network layer with jurisdiction and functional classification attributed. Sum length of each type.

Formula or Model:

Example Calculation:

Sum ([Attribute : Roads : Length], where ([Attribute : FC] = "Arterial"))

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓		

Unit: miles

NUMBER OF HOUSES FRONTING ON ROADS BY MAINTENANCE TYPE

Description: Many existing and platted subdivisions have private road networks in varying levels of maintenance. This indicator estimates how many housing units in these subdivisions are near roads of various maintenance types (State, County, other government, private, road-in-limbo, unknown). This indicator will reveal the number of residences who are dependent on certain road types.

Methodology: Using CommunityViz spatial formulas, parcels are attributed with the maintenance type of the nearest road type, called the primary frontage road. Using this field, housing units on these parcels are counted for each maintenance type.

Formula or Model:

Private Roads:

Count ([Layer : Parcels], where ([Attribute : Frontage] = "Private"))

County Roads:

Count ([Layer : Parcels], where ([Attribute : Frontage] = "County of Hawaii"))

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓	✓	✓

Unit: dwelling units

MILES OF ROADS FAILING LOS

Description: This indicator focuses on roads maintained by the state, which is the only road type with level-of-service (LOS) data available. The HDOT transportation models have run scenarios for 2007 baseline and projected 2035 growth. This indicator analyzes reports network conditions based on the 2035 state transportation model scoring. The set of indicators simplifies the scores into three categories:

- Under capacity, (passing LOS, roads graded A, B or C)
- Near capacity, (near failing LOS, roads graded D or E)
- Over capacity, (failing LOS roads graded F).

Methodology: Using the HDOT road network data, sum miles of roadway with failing LOS for existing and future projections.

Formula or Model:

Sum ([Attribute : Roads : Length], where ([Attribute : LOS] = "F"))

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓		

Unit: miles

RESIDENTIAL DEVELOPMENT NEAR CONGESTED ROADS

Description: This indicator summarizes the number of housing units by the closest road's level of service. This measure of congestion is based on the same categories used above (under, near and over capacity) but rather than use the HDOT 2035 LOS scoring, it uses the current HDOT (2014) LOS scoring.

Methodology: Using CommunityViz spatial formulas, parcels are attributed with the LOS score of the nearest road (frontage road). Using this field, housing units on these parcels are counted for each capacity category.

Formula or Model:

Over capacity roads:

Count ([Layer : Parcels], where ([Attribute : ClosestRoadVolume] = "F"))

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓	✓	✓

Unit: dwelling units

HOUSING UNITS, JOBS AND POPULATION NEAR ROAD INFRASTRUCTURE

Description: This indicator summarizes housing units, jobs and population near road infrastructure (within 500 feet).

Methodology: Calculate distance to roads. Sum housing units within a specified distance (default 500 feet) of roads.

Formula or Model:

Sum ([Attribute : Parcels : Dwelling Units] , where ([Attribute : Distance to Roads] < 500))

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓	✓	✓

Unit: dwelling units, jobs, population

AVERAGE DISTANCE TO BUS ROUTES (WEIGHTED BY HOUSING UNITS)

Description: Using a weighted average distance, this indicator looks at how close housing units are to the existing bus route network.

Methodology: The indicator is a weighted average distance for all housing units to the nearest bus route.

Formula or Model:

$$\frac{\sum_n u_n r_n}{\sum_n u_n}$$

Where n is the number of features, u is the number of housing units within a feature, and r is the straight line distance from the feature to the nearest bus route.

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓	✓	✓

Unit: miles

RESIDENTIAL UNITS NEAR EXISTING BUS ROUTES

Description: This indicator summarizes housing units near bus routes (within ¼ mile, ½ mile and beyond).

Methodology: Calculate distance to bus routes. Sum housing units within a specified distance (default ¼ mile and ½ mile) of roads.

Formula or Model:

Sum ([Attribute : Parcels : Dwelling Units] , where ([Attribute : Distance to Bus] < 1320))

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓	✓	✓

Unit: dwelling units

MILES OF BIKE ROUTES AND SIDEWALKS

Description: These indicators will summarize the amount of dedicated bike routes and sidewalks, using the best information that the county has available.

Methodology: Sum length of each type.

Formula or Model:

Example Calculation:

Sum ([Attribute : Bike_Facilities : Length])

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓		

Unit: miles

EMERGENCY SERVICES

Emergency services include police, fire and ems. These indicators will look at how scenarios population, households and employees are being served today and into the future.

NUMBER OF HOUSING UNITS WITHIN RESPONSE ZONES (1, 5 AND 10 MILES)

Description: Timely response in an emergency can be a matter of critical importance to life and safety. This indicator will examine existing emergency facilities by their service areas to examine timely coverage and any gaps in the network.

Methodology: Using CommunityViz spatial functions, attribute parcels with distance to each facility type. Summarize housing units within 1, 5 and 10 miles distances.

Formula or Model:

Sum ([Attribute : Parcels : Dwelling Units], where ([Attribute : Distance to Facility] <= 1 Mile))

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓	✓	✓

AVERAGE DISTANCE TO EMERGENCY SERVICES (WEIGHTED BY HOUSING UNITS)

Description: Using a weighted average distance, this indicator looks at how close housing units are to the existing emergency service facility (fire stations, police stations, hospitals).

Methodology: The indicator is a weighted average distance for all housing units to emergency service facilities.

Formula or Model:

$$\frac{\sum_n u_n r_n}{\sum_n u_n}$$

Where n is the number of features, u is the number of housing units within a feature, and r is the straight line distance from the feature to the nearest emergency service facility.

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓	✓	✓

Unit: miles

PARKS

Parks in the CoH are a recreation and aesthetic asset for residents and a leading draw for visitors. These indicators will look at how well the existing park areas are serving the population.

ACRES OF PARK SPACE PER CAPITA

Description: This measure will summarize total park area overall and by type (County, State, National) divided by population.

Methodology: Sum acres of the parks GIS data layer by population.

Formula or Model:

$$\text{Sum} ([\text{Attribute} : \text{Parks} : \text{Shape_Area}]) / \text{Sum} ([\text{Attribute} : \text{Parcels} : \text{Population}])$$

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓		

Unit: acres

AVERAGE DISTANCE TO PARKS AND COASTAL ACCESS POINTS

Description: This indicator estimates the minimum distance from Parcel features to their nearest Park feature weighted by the number of residents in the Parcel feature.

Methodology: Using CommunityViz spatial functions, measure the minimum distance to Park features from Parcel features. Multiply the distance times the parcel population. Sum the weighted distances and divide by total area population to get weighted average distance.

Formula or Model:

$$\frac{\sum_n p_n r_n}{\sum_n p_n}$$

Where n is the number of features, p is the number of people within a feature, and r is the straight-line distance from the feature to the nearest destination.

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓	✓	✓

Unit: miles

ACRES OF PARKS BY TYPE, FACILITY

Description: This measure will summarize total park area by manager and type of park/available facilities. Park managers include state, federal and county. Type of park/facility types include: active, passive, regional, community, playground/neighborhood, beach/beach park, facility, district, community center, general use, cemetery, scenic/undeveloped, senior facilities.

Methodology: Using attributed data in the Parks layer for type and facilities, summarize the various types and available facilities.

Formula or Model:

Example Calculation:

Sum ([Attribute : Parks : Shape_Area] , where ([Attribute : Type] = "Beach Park"))

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓		

Unit: acres

NUMBER OF PEOPLE WITHIN 1 MILE OF A PARK

Description: This measure looks at the number of people served by nearby parks. Similar to the average distance, but this measure will provide for the overall percent of the population within 1 mile of parks.

Methodology: Using CommunityViz spatial functions, measure the minimum distance to Park features from Parcel features. Summarize population which is in Parcel features less than 1 mile.

Formula or Model:

Sum ([Attribute : Parcels : Population] , where ([Attribute : Dist2Parks] <= 5280))

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓	✓	✓

Unit: persons

RESIDENTIAL

Residential indicators explore the existing and future residential supply and look at factors like affordability, balance with jobs, mix, and context.

HOUSING UNITS

Description: Total housing units by type, single family or multifamily (apartment, condo, etc.).

Methodology: Sum housing units by type.

Formula or Model:

Sum ([Attribute : Parcels : Dwelling Units])

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓	✓	✓

Unit: dwelling units

AVERAGE RESIDENTIAL DENSITY AND STANDARD DEVIATION OF DENSITY

Description: This indicate examines residential density and the standard deviation (indicating the extent of deviation of residential density as a whole). The area under consideration is not the area of the entire island, but rather just the area of all parcels under development. This is provides a metric of density more sensitive to additional development that is manifest in the future scenarios.

Methodology: Calculate the sum of housing units divided by area.

Formula or Model:

Sum ([Attribute : Parcels : Dwelling Units]) / Sum ([Attribute : Parcels : Area] ,
Where ([Attribute:Parcels:ResDensityExistOnDevelopedParcels] > 0))
StdDev([Attribute:Parcels:ResDensityExistOnDevelopedParcels] ,
Where ([Attribute:Parcels:ResDensityExistOnDevelopedParcels] > 0))

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓	✓	✓

Unit: dwelling units per acre

Description: Housing affordability is an important theme in Hawaii. In order to address it within the scenario planning context, several information sources were consulted. Both the US Department of Housing and Urban Development (HUD) and the non-profit Center for Neighborhood Technology have datasets reflecting housing affordability. Both sources include data on housing plus transportation costs (H+T) which are fundamental to understanding costs borne by families by considering the dual expenses of housing plus transportation. Both sources offered data at the census block group level, the finest resolution available. Both data sources depicted affordability as the percentage of income spent on housing (or spent on transportation or the combined H+T) rather than the number of affordable units. The demographic and forecast consultant SMS Hawaii provided data to CoH that estimated the number of affordable units but at the scale of forecast analysis zone (FAZ) a much coarser spatial scale.

After consulting with CoH staff, it was decided that the HUD data showed a more accurate picture of housing and H+T costs. These indicators show the number of new residential units in affordable areas, by affordability type (housing, transportation and H+T). The percent of income spent on housing, based on existing housing affordability patterns were also estimated for new residential development. The cutoff levels were selected for affordability, using the industry standard of >30% of income for housing, >20% for transportation and >50% for H+T. Where families were spending less than this percentage for these items, these areas were deemed to be affordable areas. The HUD data provided various options for calculating affordability based on family size and income and a family of four making 80% of the area median income (AMI) was used as the best available representation. For the estimate of percent of income spent on housing, transportation and H+T, the family of four at 100% AMI was chosen.

This method does not predict the number of affordable units but rather uses the geographical context to suggest more or less affordability of existing or new development. There are many limitations to this method, including changes in geographic affordability (areas that are affordable now, may not be in the future), the variation of costs within the census block group, the development of affordable housing (by housing agencies), new transportation options, changes to definitions of affordability (including income levels), among other limitations.

Methodology: Sum dwelling units in areas that are currently defined as more affordable by affordability type (housing, transportation and H+T).

Formula or Model:

Sum ([Attribute : Parcels : Dwelling Units],
Where ([Attribute:Parcels:HUDisHousingAffordable] = 1))

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓	✓	✓

Unit: dwelling units, % of income

‘OHANA HOUSING UNITS

Description: In 1981 the State of Hawai‘i passed a bill permitting second dwelling units called ‘ohana units to be built on single-family lots as a means to improve the affordable housing market and allow homeowners to accommodate extended family on their property. The counties were then given the authority to regulate these accessory dwelling units. This indicator estimates the total number of existing and new ‘ohana housing units.

Methodology: Sum ‘ohana housing units.

Formula or Model:

Sum ([Attribute : Parcels : Ohana Dwelling Units])

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓	✓	✓

Unit: dwelling units

RESIDENTIAL DEVELOPMENT IN URBAN AREAS

Description: This indicator summarizes development that is within urban areas. Multiple boundaries were used for this to compare results - LUPAG urban land classes, Urban State Land Use District and infrastructure priority zones (IPAs).

Methodology: Using CommunityViz spatial formulas attribute parcels which are within the defined urban area boundary. Sum dwelling units within the urban area boundary.

Formula or Model:

$$\frac{\text{SLUD Area Overlap}}{\text{Shape Size}} \times \text{Dwelling Units}$$

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓	✓	✓

Unit: dwelling units

NEW RESIDENTIAL DEVELOPMENT BY CAPACITY TYPE

Description: Capacity was addressed in this analysis by primarily looking at two separate but related factors: historical trends and density standards established by land use regulation. Quantifying historic trends required analyzing the number and size of existing built structures on the landscape and identifying general patterns of growth. Density standards were calculated using numerical values taken from land use development regulations, primarily the CoH zoning. Capacity categories were developed to look at capacity within the context of type of unit, subdivision status and redevelopment potential. Capacity types were originally developed to calibrate and confirm that the Trend scenario was in line with historic building patterns. It's use expanded to explore and describe the type and context of new development (e.g. development occurring in existing subdivisions, as new subdivisions or as redevelopment of existing developed areas). A complete list of capacity types are listed in Appendix 4 and discussed in greater detail in the Capacity Technical Report.

Methodology: Sum dwelling units by capacity type.

Formula or Model:

For the "greenfield subdivided" type:

Sum ([Attribute : Parcels : Dwelling Units],

Where ([Attribute:Parcels:ResCapacityType] = "Greenfield Subdivided"))

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe		✓	

Unit: dwelling units

COMMERCIAL

Commercial indicators looks at commercial services in terms of location and quantity.

AVERAGE DISTANCE TO COMMERCIAL CENTERS

Description: This indicator measures how close residents (and visitors) are to commercial centers. Commercial centers are defined by commercial zoning. This indicator measures distance to all commercial centers and breaks it into types (General, Neighborhood, Village).

Methodology: Using CommunityViz spatial functions, measure the minimum distance to Commercial Center features from Parcel features. Multiply the distance times the parcel population (or visitors). Sum the weighted distances and divide by total area population to get weighted average distance.

Formula or Model:

$$\frac{\sum_n p_n r_n}{\sum_n p_n}$$

Where n is the number of features, p is the number of people within a feature, and r is the straight-line distance from the feature to the nearest destination.

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓	✓	✓

Unit: miles

SQUARE FEET OF COMMERCIAL

Description: This indicator will report how much commercial square footage is present in the scenario. Commercial encompasses a wide range of employment types, including retail, office and services.

Methodology: This calculates the sum of commercial jobs. Existing is defined from RPT data while future is estimated for each scenario.

Formula or Model:

Sum ([Attribute : Parcels : Commercial Square Feet])

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓	✓	✓

Unit: square feet

COMMERCIAL JOBS

Description: This indicator estimates the number of commercial jobs. Commercial encompasses a wide range of employment types, including retail, office and services.

Methodology: This calculates the sum of commercial jobs. This analysis estimates jobs based on the amount of commercial square footage, using a density assumptions, i.e., employees per 1000 square feet by FAZ for both the existing and future scenarios. Existing and forecast jobs by FAZ were provided by SMS Hawaii as a part of their 2040 forecast data.

Formula or Model:

Sum ([Attribute : Parcels : Commercial Jobs])

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓	✓	✓

Unit: square feet

INDUSTRIAL

Industrial indicators will look at industrial uses in terms of type, location and market.

SQUARE FEET OF INDUSTRIAL

Description: This indicator will report how much industrial square footage is present in the scenario. Industrial encompasses a narrower range of employment types, including light industrial, manufacturing, shipping and warehousing.

Methodology: This calculates the sum of industrial jobs. Existing is defined from RPT data while future is estimated for each scenario.

Formula or Model:

Sum ([Attribute : Parcels : Industrial Square Feet])

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓	✓	✓

Unit: square feet

INDUSTRIAL JOBS

Description: This indicator will report how many industrial jobs are present in the scenario. Industrial encompasses a narrower range of employment types, including light industrial, manufacturing, shipping and warehousing.

Methodology: This calculates the sum of industrial jobs. This analysis estimates jobs based on the amount of industrial square footage, using a density assumptions, i.e., employees per 1000 square feet by FAZ for both the existing and future scenarios. Existing conditions and forecast jobs by FAZ were provided by SMS Hawaii as a part of their 2040 forecast data.

Formula or Model:

Sum ([Attribute : Parcels : Industrial Jobs])

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓	✓	✓

Unit: jobs

VISITOR

Visitation to the island is a major economic engine but visitors also create impacts and require extensive infrastructure.

NUMBER OF VISITOR UNITS BY TYPE

Description: Based on a defined classification, summarize the type of visitor accommodation (hotel, condo-hotel, timeshare, visitor rental unit (VRU). A VRU is a private apartment or house, used for short term rent and typically advertised via a 3rd party internet site (VRBO, AirBnB, etc.). Visitor unit estimates were provided by SMS Hawaii as a part of their 2040 forecast data but data was refined by heads up digitizing based on online sources.

Methodology: Classify the type of visitor units by parcel and sum the number of visitor units by type.

Formula or Model:

Example Calculation:

Sum ([Attribute : Parcels : Visitor Units], where ([Attribute : Visitor Unit Type] = "Hotel"))

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓	✓	✓

Unit: visitor units

EMPLOYMENT

Employment indicators focus on the ratio of jobs to housing.

JOBS/HOUSING RATIO

Description: Based on previous calculations for total jobs and total housing units, calculate the ratio between jobs and housing. The indicator looks at two spatial scales, the jobs/housing ratio by the entire FAZ and the jobs/housing ratio within just the infrastructure priority areas.

Methodology: Divide total jobs by total housing units.

Formula or Model: Jobs / Housing Units

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓		✓

Unit: ratio of jobs to houses

GENERAL INTEREST

These indicators fall in no particular category but summarize basic information about each scenario.

POPULATION, HOUSEHOLDS AND JOBS

Description: These indicators display the total number of persons, households and employees for.

Methodology: Sum households, people and employment.

Formula or Model: Sum([Attribute:CensusBlocks:Households])

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓	✓	✓

Units: population, households, jobs

SCHOOL AGED CHILDREN

Description: Using percentage rates from SMS data on children age groups, estimate existing and future children.

- 2015 rate is 17.95%
- 2040 rate is 19.73%

Methodology: Children are measured as a percentage of population.

Formula or Model:

Sum([Attribute : Parcels : Children])

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
Indicator Summarized at this Timeframe	✓	✓	✓

Units: school aged children

DASHBOARD INDICATORS

Dashboard indicators summarize multiple indicators by thematic area

DASHBOARD INDICATORS

Description: Dashboard indicators are a way of summarizing multiple indicators into one indicator which represents a particular theme. Dashboard indicators were used to summarize information for the public sessions along the following thematic areas: conservation, hazards, building blocks (infrastructure), settlement patterns, affordability and mixed use. These indicators were displayed in “double doughnut” charts for the public. Each scenario had a double doughnut chart. This style of chart made it possible to compare current conditions (the inner doughnut) to future conditions represented by the scenario (the outer doughnut) as well as compare one scenario to another. The following table shows the dashboard indicator and the component indicators.

Conservation	
	Residences in sensitive ecological areas
	Residences on open space
	Residences on productive agricultural land
Hazard Avoidance	
	Residences in lava high hazard zones
	Residences in sea level rise/tsunami caution areas
	Residences in high wildfire risk zones
Building Blocks	
	Residences in water service area

	Nonresidential near water infrastructure
	Residences in wastewater service area
	Nonresidential on wastewater infrastructure
	Residences on public roads
	Residences within 1 mile of a County active park
	Residences within 1/2 mile of bus route
	New residences near congested arterials
Settlement Patterns	
	Accessory and 'ohana units
	Number of vacant lots
	Development outside urban boundaries
	Housing units in underserved growth subdivisions
Affordability	
	Housing affordability
	Transportation affordability
	Homes in areas that are currently H+T affordable
Mixed Use Centers	
	Development outside urban boundaries
	Housing units in underserved growth subdivisions

Methodology: While the component indicators are calculated in the CommunityViz analysis, the dashboard indicators indicated in this methodology were created in a separate excel spreadsheet in order to take advantage of the charting tools available in that tool. Each dashboard indicator had multiple component indicators. Each component indicator was turned into a percentage for each scenario using the gross value (existing plus net new development). The maximum and minimum percentages from a group of scenarios (e.g., Existing, Trend, CDP, Agriculture) could then be identified. Using the maximum and minimum values, the indicator percentages can be rescaled to a unitless scale from 0 – 100. Once in the unitless scale, the component indicators can be averaged together by scenario to yield a final dashboard value.

Formula or Model:

1. Using the building block dashboard indicator as an example, for all scenarios and using the component indicator Residences in Water Service Areas (WSAs): $[\text{Residences in WSAs}] / [\text{All Residences}] = [\% \text{ of Residences in WSAs}]$
2. Find the maximum and minimum percentage values in all scenarios.
3. For all scenarios, rescale the values; $[\% \text{ of Res in WSAs}] - [\text{Minimum of All Scenarios}] / [\text{Max of All Scenarios}] - [\text{Minimum of All Scenarios}]$
4. Find the average of all component indicator values in the building block dashboard indicator (i.e. Residences in WSAs, NonRes in WSAs, etc.)

Timeframe:

Timeframe	Existing	Net New	Overall (existing plus future)
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Indicator Summarized at this Timeframe	✓		✓
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Units: dashboard values are unitless

APPENDIX 1 INDICATORS CONSIDERED (BUT NOT ADDRESSED)

The following table lists indicators that were proposed but had to be shelved due to lack of available data or methodological issues.

Indicator
Wastewater
CWDA Wastewater types
Solid Waste
Capacity of existing facilities by district
Transportation
Intersection density by neighborhood
Residential
Number of existing homes by cost
Jobs by wage category compared to housing by cost
Use Mix
Housing Mix
Income Mix
Commercial
Commercial occupancy rates
Industrial
Industrial occupancy rates
Visitors
Number of visitors
Number of jobs by type - accommodation
Visitor unit occupancy rates
Employment
Number of employees by job
Number of employees by wage bracket
Unemployment rate
Poverty rates
Public assistance rates
Gini coefficients
Mean travel time to work
Revenue-Planning-Finance Alignment
Current assessment revenue
Revenue from more “True” assessments
General Interest
School Capacity
School Demand (number of children) to School Capacity

APPENDIX 2 TIER ONE INDICATORS

The Tier One analysis has over 25 indicators which were established to guide and inform the development of planner driven scenarios. Most of the Tier One indicators have an analogous indicator in the Tier Two analysis and this is indicated in the table below. Because the two analyses operate at different scales (Tier One uses neighborhoods called analysis units while Tier Two uses finer scaled parcels) there are some methodological differences that could result in differences when comparing indicator results.

Tier One Indicator	Present in Tier Two?	Description
Housing Adjustment Balance		Shows the balance of allocated new residential units. For sketching purposes and not applicable in the Tier Two analysis.
Distance to Emergency Services	✓	Three indicators displayed the average weighted distance of all dwelling units (new and existing) to existing fire stations, hospitals and police stations.
Adjusted Housing Units by FAZ		Shows the balance of allocated new residential units. For sketching purposes and not applicable in the Tier Two analysis.
Urban vs. Rural	✓	The number of new allocated units in areas of the island classified as either rural or urban, using the existing LUPAG urban growth boundaries to distinguish between the two types.
Rural Residential Development	✓	The number of new housing units located in underserved subdivisions, defined as older nonconforming subdivisions without public water, public roads and with lot sizes between 1 and 5 ac.
Distance to Schools		The average weighted distance of all dwelling units (new and existing) to existing public schools.
Distance to Parks	✓	Two indicators address this issue. The first indicator finds the average weighted distance of all dwelling units (new and existing) to existing public parks. The second indicators identifies the number of existing and new residences within one mile of a public park.
Distance to Public Transportation	✓	Two indicators address this issue. The first indicator finds the average weighted distance of all dwelling units (new and existing) to existing bus routes. The second indicators identifies the number of existing and new residences within ¼, ½ and more than ½ mile to existing bus routes.
Distance to Urban Centers	✓	This indicator finds the average weighted distance of all dwelling units (new and existing) to identified urban centers.
Ag Land	✓	The number of new residential units estimated to be developed on productive agricultural land.
Hazards	✓	This consisted of three related indicators. The number of new units estimated to be developed in areas with a high wildfire; in areas of high volcanic (lava flow) risk and in areas at risk of sea level rise.
New Houses near WW Service	✓	Two indicators showing the number of new housing units located in areas that are served and not served by county wastewater (sanitary sewer) service.
Development Costs		This indicator estimates development costs for new residential units, in millions of dollars. Provides an estimation of the costs

		incurred by developers to provide services to new homes, including water and wastewater tap fees, and other costs by unit type and geographic location.
Solid Waste	✓	Estimates the solid waste generation for existing and new residential development.
UGB Status	✓	The number of new and existing residential units inside the LUPAG defined urban growth boundary.
SLUD Status	✓	The number of new and existing residential units inside the State Land Used Urban designation.
Residential Unit Type	✓	The number of new and existing residential units by building type, either single family or multifamily residence.
New and Existing Nonresidential Sq Ft and Jobs	✓	The Trend Scenario included models of both residential and nonresidential development. This set of indicators displayed the amount of new and existing nonresidential square footage. Using the nonresidential square footage, the number of jobs was estimated as well.
Parks Dedication Requirement		The County's Park Dedication Code (Chapter 8, Hawaii County Code) provides standards for the dedication of land, facilities or assessment of in-lieu fees for recreational purposes upon the subdivision of land or the development of multiple family residential units. The code requires a minimum ratio of five acres of land for park and playground purposes for every 1,000 persons in each district. This indicator was established to track the attainment of this standard by planning district.
Nonresidential development on Water and Wastewater Service	✓	In the workshop analysis, the number of existing and new residences on public water and wastewater was displayed as a charted indicator. This set of indicators was expanded to encompass the number of nonresidential square feet (displayed in KSF) that have and don't have these public services.
New Dwellings in Unserved Subdivisions	✓	While indicators in the workshop analysis looked at the number of new houses in rural and urban areas, the unserved (sometimes called underserved or nonconforming) subdivisions (e.g., HPP, Ocean View) represented a special class of land use. These places are of particular concern to planners given their lack of municipal services, including water, wastewater and public roads.
Distance to Centers		This indicator identifies the distance from neighborhood analysis area and finds the distance to the nearest analysis area that demonstrates the characteristic of being a central location. The distance is weighed by the amount of existing and new residential development in each analysis area. Three different types of centers are defined: commercial, industrial and visitor centers. What qualifies as a center is controlled by the user, who can specify the amount of commercial or industrial space or the number of visitor units which establish which analysis area is a center. The amounts in each center include both existing and new development in each center.
New Capital Expenses and Capital Budget		The water, wastewater and road sketching activities all estimated costs to be borne by CoH as capital expenses. In order to frame the accumulation of these costs by the user, the 2015 annual capital budgets for DWS and Public Works/Wastewater Treatment were included in the model, multiplied by the 20 year implementation horizon. These values provided a rough

		"budget" for participants to plan their investments in future infrastructure.
Dashboard Indicators		Dashboard indicators are a way of summarizing multiple indicators into one indicator which represents a particular theme. The dashboard indicators in Tier One are incorporated into the CommunityViz analysis while in Tier Two, these are incorporated into a separate Excel spreadsheet.
Jobs to Housing Ratio	✓	Using Trend Scenario forecast amount of new (plus existing) nonresidential square footage, the number of jobs is estimated and compared against the number of new and existing residences to provide the jobs to housing ratio for the entire island.

APPENDIX 3 ASSUMPTION VALUES

Assumption	Description/Source	Details
Residential		
Percent Income Spent on H and T Threshold	Income level spent on housing and transportation, above which housing becomes a significant burden on the household.	Type: Number Range: 0 - 100 Default: 50 Units: %
Percent Income Spent on Housing Threshold	Income level spent on housing, above which housing becomes a significant burden on the household.	Type: Number Range: 0 - 100 Default: 30 Units: %
Percent Income Spent on Transportation Threshold	Income level spent on transportation, above which housing becomes a significant burden on the household.	Type: Number Range: 0 - 100 Default: 20 Units: %
Ratio of Existing Development to Gross Capacity	This attribute is used to manage the ratio of existing development to gross capacity for purposes of identifying residential capacity types.	Type: Number Range: 0 - 1 Default: 0.5 Units: NA
Energy		
Residential Energy Use	Estimated residential energy use, based on assumed use per housing unit per day. Source: DBEDT Hawaii (state energy trends)	Type: Number Range: 10 - 50 Default: 14.7 Units: kwh per day
Transportation		
Near Roads	For estimating housing units close to existing roads. Default is 500 feet.	Type: Number Range: 0 - 1500 Default: 500 Units: feet
Solid Waste		
Commercial Waste Percent Island	Estimated waste originating from nonresidential sources across the entire island. Source: CoH Public Works	Type: Number Range: 0 - 100 Default: 61 Units: percent
Commercial Waste Percent SHSL	Estimated waste originating from nonresidential sources estimated for the South Hilo Sanitary Landfill. Source: CoH Public Works	Type: Number Range: 0 - 100

		Default: 52 Units: percent
Commercial Waste Percent WHSL	Estimated waste originating from nonresidential sources estimated for the West Hawaii Sanitary Landfill. Source: CoH Public Works	Type: Number Range: 0 - 100 Default: 67 Units: percent
Solid Waste Generation Rate	Coefficient rate of waste generation in tons per person or per employee per year. Source: CoH Public Works	Type: Number Range: 0.2 - 2 Default: 0.77 Units: tons per person - employee per year
Waste Diversion Rate	Estimated rate of waste diverted to recycling or compost from the waste stream. Source: CoH Public Works	Type: Number Range: 0 - 75 Default: 25 Units: percent
Wastewater		
Residential Wastewater Generation Rate	Estimated wastewater generation rate. Source: CoH Public Works	Type: Number Range: 100 - 1000 Default: 378 Units: gallons per day
Wastewater Average Cost of New Septic Tank	Estimated wastewater generation rate. Source: CoH Planning	Type: Number Range: 5000 - 12000 Default: 8500 Units: \$
Wastewater WW Distribution Cost per Linear Ft	Estimated of a linear foot of WW line, including labor. Source: CoH Public Works	Type: Number Range: 0 - 200 Default: 100 Units: \$
Water		
Commercial Water Equivalent Unit	Estimated commercial water consumption. Source: CoH Water Supply	Type: Number Range: 1000 - 6000 Default: 3000 Units: gpd per acre
Housing Water Equivalent Unit	Estimated residential water consumption (everywhere but South Kona, North Kona, South Kohala). Source: CoH Water Supply	Type: Number Range: 100 - 1000 Default: 400 Units: gpd per unit
Housing Water Equivalent Unit SKNK	Residential water multiplier for South Kohala and North Kona. Source: CoH Water Supply	Type: Number Range: 0 - 1500 Default: 1000 Units: gpd

Housing Water Equivalent Unit South Kona	Residential water multiplier for South Kohala and North Kona. Source: CoH Water Supply	Type: Number Range: 0 - 1000 Default: 600 Units: gpd
Light Industrial Water Equivalent Unit	Estimated light industrial water consumption. Source: CoH Water Supply	Type: Number Range: 1000 - 6000 Default: 4000 Units: gpd per acre
Multifamily Residential Water Use Adjustment	This assumption adjusts the housing water equivalent consumption for multifamily units. Multifamily units consistently use less water than single family houses due to the lack of outdoor watering needs and their tendency to have a smaller number of persons per household. The default value is based on a 2014 study of water usage in Tampa Bay, Florida but is widely reflected in water studies across the continental USA. No local source of information were available.	Type: Number Range: 0 - 1 Default: 0.6 Units: %
Water Catchment System Cost	Estimated wastewater generation rate. Source: CoH Planning	Type: Number Range: 0 - 5000 Default: 3500 Units: \$
Water Distribution Cost per Linear Foot	Estimated of a linear foot of water line, including labor. Source: CoH Water Supply	Type: Number Range: 0 - 200 Default: 100 Units: \$
Hazards		
Caution Distance to Tsunami Inundation	Distance from the tsunami inundation line to still be considered "near" a tsunami inundation area	Type: Number Range: 0 - 500 Default: 50 Units: feet
Recent Lava Flow	Date which defines "recent" lava flow.	Type: Number Range: 1800 - 2015 Default: 1990 Units: year
Conservation		
Distance to Historic and Cultural	Assumption used to establish the level of "nearness" for historic, cultural and conservation indicators. If features located less than this threshold, they are considered near for the purposes of the indicators which depend on this assumption.	Type: Number Range: 0 - 5000 Default: 500 Units: feet
General		
		Type: Number

2015 Average Persons per Housing Unit	Average number of persons per housing unit in 2015. Source: SMS Hawaii	Range: 2 - 3 Default: 2.62 Units: persons per house
2015 Percent School Aged	Average percent of household members that could attend primary or secondary school in 2015. Source: SMS Hawaii	Type: Number Range: 0 - 100 Default: 17.95 Units: percent
2040 Average Persons per Housing Unit	Average number of persons per housing unit in 2040. Source: SMS Hawaii	Type: Number Range: 2 - 3 Default: 2.62 Units: persons per house
2040 Percent School Aged	Average percent of household members that could attend primary or secondary school in 2040. Source: SMS Hawaii	Type: Number Range: 0 - 100 Default: 19.73 Units: percent

APPENDIX 4 RESIDENTIAL CAPACITY TYPES

Capacity has been categorized using the types listed and summarized by acres of each type below. These types are visible using the “HawaiiCapacity” CommunityViz Analysis. This classification is for the internal review team to help understand the different types of capacity that the model is using.

- **Greenfield Subdivided.** There are no existing residential or nonresidential units on the parcel, according to RPT records. The parcel can be developed to its full capacity but minimum parcel areas prevent further subdivision.
- **Rural Greenfield with Subdivision Potential.** There are no existing residential or nonresidential units on the parcel according to RPT records, and the parcel has agricultural type zoning (A, FA, etc.). The parcel can be developed to its full capacity and the parcel can be further subdivided (i.e., the parcel area is greater than two times the minimum parcel area).
- **Urban Greenfield with Subdivision Potential.** There are no existing residential or nonresidential units on the parcel according to RPT records, and the parcel is not in Agriculture, Conservation, or Open zoning (i.e., C, M, R, V, etc.). The parcel can be developed to its full capacity, and the parcel can be further subdivided (the parcel area is greater than two times the minimum parcel area).
- **Farm Dwelling Unit.** In zones that allow an extra farm dwelling unit, there is one residential structure on the parcel and capacity for one additional farm dwelling.
- **Ohana Dwelling Unit.** Residential only. In zones that allow an ‘ohana dwelling unit, there is one residential structure on the parcel and capacity for one ‘ohana unit.
- **High Additional Redevelopment Capacity.** This class uses the term “redevelopment” very loosely and describes areas where additional development could likely occur by subdivision of the existing parcel or with very little change to the existing structure on the parcel. There are one or more existing structures on the parcel and the zoning allows for greater density than what currently exists. In this case, the existing residential or non-residential structures exist at low densities relative to the gross capacity. Specifically, the existing development is less than ½ of the gross capacity .
- **Low Additional Redevelopment Capacity.** Similar to the category above, one or more structures exist on the parcel, and the zoning allows for greater density than what currently exists. In this case, the existing residential or non-residential structures exist at higher densities than found in High Additional Redevelopment Capacity (the existing development is more than ½ of the gross capacity).
- **At or Over Capacity.** The number of units (dwelling units or non-residential square feet) on the parcel meets or exceeds the allowed capacity.
- **Government or Conservation.** The land ownership is government or dedicated to conservation uses. Note that DHHL and HPHA properties are not included in this category for this analysis.
- **Unbuildable.** Physical limitations—either steep slopes or wetlands—are restricting the capacity of the parcel.
- **Other No Capacity.** The parcel has no capacity. This is usually occurs for one of the following reasons: 1) the zoning does not allow either residential or non-residential development; 2) tax-exempt properties (churches, private schools, etc.) that have been excluded from the analysis areas; or 3) the zoning type has not been established.