
PROJECT DOCUMENT

County of Hawai'i General Plan Comprehensive Review

Analysis Documentation: Existing Conditions, Zoning and LUPAG Densities Technical Report

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Introduction

This technical report documents and describes a CommunityViz analysis built to explore patterns of urbanization in the County of Hawaii (CoH). This analysis was delivered to CoH planners in 2018 to answer questions regarding existing conditions and the patterns of densities allowed by zoning and the county's future land use system, LUPAG.

Density and Capacity

The analysis prepared for planners at CoH was intended to facilitate a greater understanding of existing and proposed urban densities during the update of the County's comprehensive plan. Density is roughly defined as the compactness of urban development. For urban planners, measures of density depending on whether the uses on the parcel are primarily residential or non-residential (e.g., commercial or industrial in nature). The two units of measurement used are dwelling units per acre (du per ac) for residential uses and Floor Area Ratio (FAR) for nonresidential uses. FAR is defined as the built square feet of building divided the area of the parcel in square feet.

Density was calculated for existing development (e.g., the number of houses on a parcel of land) and estimated for the future based on land policy information. This latter case is what planners call "capacity" or "build-out potential". Land use regulations in CoH typically specify a maximum (or minimum) density value, the number of dwelling units or square footage of a given building allowed per acre. Once a density value is established, this value can be multiplied by the area of parcel to calculate the gross capacity. Gross capacity is the maximum development potential of a property as vacant. This treats a property as an undeveloped area to estimate the potential from the ground up. After calculating gross capacity, net capacity can be generated comparing what has already been developed (existing) with this theoretical maximum and calculates the difference between what is there today versus what could be there someday.

The density allowed by land use policy often changes depending on the policy system in question. Like most counties in the USA, land policy regarding density in CoH is stated in the zoning and by the future land use plan. CoH's existing future land use plan is called the General Plan Land Use Pattern Allocation Guide (LUPAG). Capacity for both zoning and LUPAG was estimated as part of an earlier task and published in a separate technical report (Task S1 Capacity Technical Report). This information was used

as a part of the scenario modeling tasks for CoH, which developed locations and quantities of future urban growth depending on different policy assumptions.

This task allowed planners to get a deeper insight into the existing densities and allowed uses and capacities under the zoning and LUPAG system. The analysis provided a method where the user could select one or more parcels and query them for information about existing and planned density.

Using the Analysis

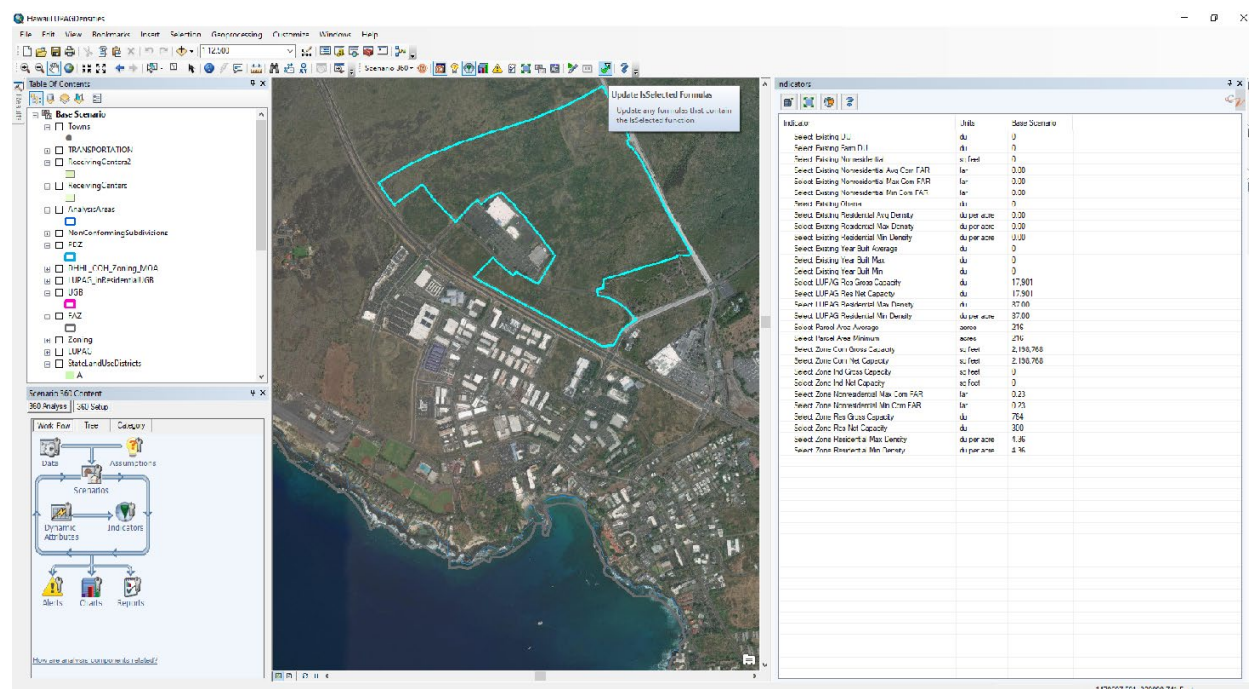
Structure

The analysis described here was set up using the CommunityViz decision-support software. CommunityViz uses geographical databases (GIS) and is an extension to the ArcGIS platform. The analysis was built by the consultant and delivered for review and use by CoH planning staff. The analysis queried a parcel dataset that had been set up as a part of the capacity estimates used for scenario modeling.

The analysis lets a user find specific information about existing development and allowable density by querying one or more parcels. CommunityViz has a set of functions that provide an easy way for a user to select a feature and get set of metrics, displayed in either a table or chart. In this analysis, the metrics are displayed as indicators in the Indicators view and could be exported as a table for use in a spreadsheet program. The analysis was built so that the user could select zoning or LUPAG designations, neighborhoods, or other classifications to inspect a range of metrics. The analysis included a set of "Saved Views" that set up the ArcMap/CommunityViz interface. Saved Views assist users by arranging the screen display to match an arrangement, appearance and map symbology. The saved views included in the analysis allowed the user to examine residential, commercial and industrial capacity as well as current land use for either the windward or leeward side of the island.

The analysis called, "HawaiiLUPAGDensities.mxd" was provided to county planners. The analysis was built on CommunityViz 5.1 for ArcGIS 10.4 but will work with the current production version of CommunityViz (5.2) and ArcGIS 10.7 as of this writing. Appendix 1 contains a description of the fields contained in the Parcels analysis layer.

Figure 1 Screenshot of the tool, focusing on a parcel near Kailua-Kona. A user would select one or more parcels, then click the “Update IsSelected Formulas” button on the CommunityViz Scenario 360 Toolbar. The tool would update the indicator metrics in the window at right.



Existing Development

A set of metrics describing the existing development status are provided to the user. These include the number and type of existing dwelling units, nonresidential space and year built. In the case the user chooses multiple parcels, the tool will identify the maximum and minimum FAR, average residential density and year built. Metrics describing parcel area are also provided in Figure 2.

Future Capacity - Zoning

The zoning capacity is based on the county's zoning policy. The county's zoning code specifies what land uses are allowed. While the county uses a system that bases allowed residential density in terms of minimum lot size, this approach was readily adapted to the more commonly used system of allowed dwelling units per acre. Density for non-residential uses under county zoning was based on a combination of development standards and long term, historical trends (i.e., the density of development typically rendered under the particular zoning classification). Both gross capacity (parcel capacity without factoring in existing development) and net capacity (capacity factoring in existing development) are provided.

Metrics associated with the zoning include gross and net capacity for both residential and non-residential uses. Nonresidential uses are broken further into commercial and industrial uses. As with the existing development, if the user chooses more than one parcel, maximum and minimums will be found.

Figure 2 Metrics created for the density analysis

Existing Dwelling Units
Existing Farm Dwelling Units
Existing Nonresidential
Existing Nonresidential Avg Commercial FAR
Existing Nonresidential Max Commercial FAR
Existing Nonresidential Min Commercial FAR
Existing Ohana Dwelling Units
Existing Residential Avg Density
Existing Residential Max Density
Existing Residential Min Density
Existing Year Built Average
Existing Year Built Max
Existing Year Built Min
LUPAG Res Gross Capacity
LUPAG Res Net Capacity
LUPAG Residential Max Density
LUPAG Residential Min Density
Parcel Area Average
Parcel Area Minimum
Zoning Commercial Gross Capacity
Zoning Commercial Net Capacity
Zoning Ind Gross Capacity
Zoning Ind Net Capacity
Zoning Nonresidential Max Commercial FAR
Zoning Nonresidential Min Commercial FAR
Zoning Residential Gross Capacity
Zoning Residential Net Capacity
Zoning Residential Max Density
Zoning Residential Min Density

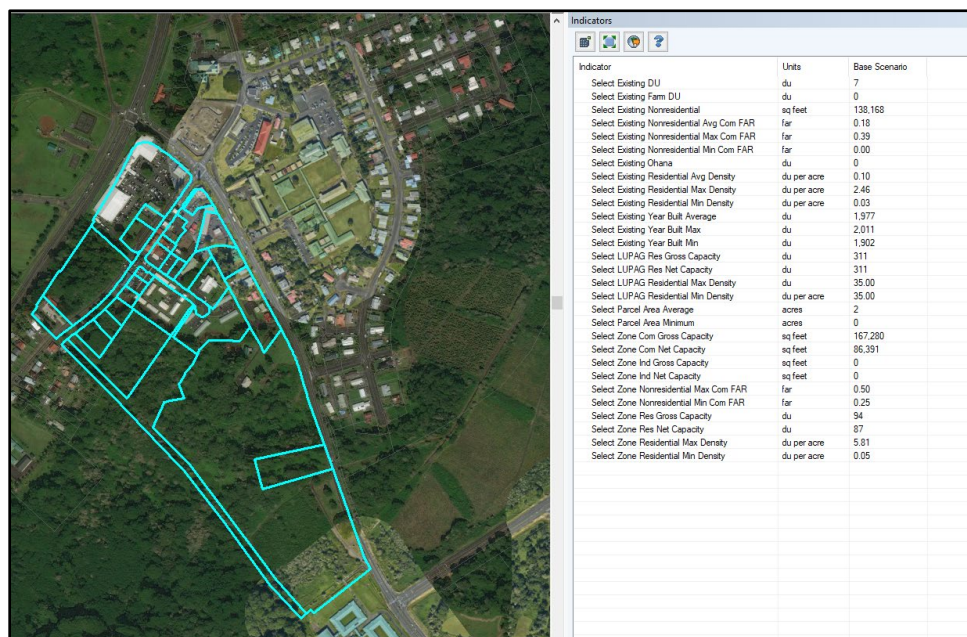
Future Density – LUPAG

The LUPAG capacity is based on the County's existing General Plan. While less explicit than zoning, the LUPAG establishes residential densities for some of its designations but does not suggest non-residential densities. For the creation of the alternate scenario that considers future development guided by LUPAG, only residential densities were estimated; nonresidential densities were guided by zoning. Metrics for residential capacity under LUPAG are provided: gross and net capacity, maximum and minimum densities.

Analysis Limitations

Users of the analysis should be aware that other factors besides existing development status may influence capacity as well. Development limitations such as steep slopes or wetlands may preclude development. Special ownership such as areas properties managed for conservation or recreation may also preclude development. Some properties have defined capacities as stated under an approved master plan. A complete list of these factors are discussed in the Capacity Technical Report. Factors such as the availability and proximity of infrastructure (e.g. potable water or wastewater) generally weren't addressed as a part of capacity. In the future land use scenarios prepared for CoH, infrastructure was factor in but as a component of land suitability for different types and densities of use. The capacity analysis will also not address illegal dwelling units or nontraditional living situations such as group quarters.

Figure 3 Metrics for existing conditions, LUPAG and zoning displayed for an area selected in Kea'au, Puna.



Results

This analysis revealed a couple of trends that development density in CoH rarely approaches what zoning or the LUPAG suggest. In other words, parcels are consistently *underbuilt*, meaning the density of development is routinely less than what the land policy states as a maximum. This is phenomena is fine in certain contexts, for example in rural areas where infrastructure is absent and urban centers are distant. In more urban contexts however, this is an undesirable outcome. In order to efficiently deliver services and to achieve the community goals (e.g., more walkable neighborhoods, provide more people with opportunities to take transit, improve urban sustainability), urban areas must achieve the densities that are specified in documents such as the General Plan. This is true for both residential and non-residential uses. Many factors contribute to this phenomenon but would likely include market preferences, private sector financing preferring some unit types over others, and a lack of experience or traditions building housing such as townhomes, bungalows and low-rise apartments (sometimes referred to as “missing middle” housing).

In Hawaii, a tremendous amount of residential development occurs as single-family detached housing in rural and suburban contexts. However, even in more urban contexts the under built phenomena exists. For example, the tool showed that there are 1,296 dwelling units built on 267 acres since the year 2000 and that have a 2005 LUPAG designation of Medium Density Urban. The tool revealed that these parcels have an existing density of 4.8 units per acre. The Medium Density Urban designation allows for up to 35 units per acre and generally is applied in areas that can support urban development. Even assuming that 20% to 30% of capacity can be lost during the land development process to accommodate roads, parking, utilities, public space, etc., the existing density is well below would could be achieved in areas that have been specifically designated for it.

Appendix 1

Parcel Fields Data Dictionary

The table defines the fields in the Parcels layer in the HawaiiLUPAGDensities.mxd and was requested by CoH staff as documentation.

Name	Units	Description
Acres	acres	Parcel area in acres, derived from the GIS
ComCapacityGrossArea	sq ft	Based on current zoning, commercial gross capacity (capacity of the parcel as vacant) in square feet.
ComCapacityGrossFAR		Based on current zoning, commercial gross capacity (capacity of the parcel as vacant) as FAR.
ComCapacityNetArea	sq ft	Based on current zoning, commercial net capacity (the gross capacity of the parcel minus any built area) in square feet.
ComCapacitySqFtperAcre	sq feet per acre	Based on current zoning, commercial gross capacity (the gross capacity of the parcel minus any built area) in square feet per acre.
ComCapacityType	sq feet	If any capacity on the parcel exists, the type of capacity was classified into one of 11 types. See "Capacity Categories" in the Capacity Technical Report. Capacity is based on current zoning.
ComCapacityTypeCapacity		Process step for ComCapacityType.
ComCapacityTypeEasilyBuildable	sq feet	Loosely defines parcels whose capacity is unconstrained (1, easily buildable) or constrained (0, requires redevelopment due to existing structure).
ComCapacityTypeRedev	sq feet	Process step for ComCapacityType.
CommercialAbsorption	percent	Process step for Commercial Capacity.
CropArea	acres	Area overlapped with the UH Hilo 2012 agriculture maps, defined as agricultural crops.
DHHLzone		DHHL zone name.
DHHLzonelsDifferent		DHHL zone does not match the county zoning (1).
ExistingComSqFt	sq ft	Existing commercial square footage.
ExistingDU	du	Existing number of dwelling units.
ExistingDUFarmAccessory	du	Existing farm accessory dwelling units.
ExistingDUOhana	du	Existing ohana dwelling units.
ExistingDUPerAcre	du per acre	Existing residential density in dwelling units per acre.
ExistingIndSqFt	sq ft	Existing industrial square footage.
ExistingNonResidentialSqFt		Existing total nonresidential (commercial + industrial) square footage.
FAR	FAR	Floor area ratio.

FAZ		Forecast analysis zone numeric code.
FAZname		Forecast analysis zone name.
IndCapacityGrossArea	sq ft	Based on current zoning, industrial gross capacity (capacity of the parcel as vacant) in square feet
IndCapacityNetArea	sq ft	Based on current zoning, Industrial net capacity (the gross capacity of the parcel minus any built area) in square feet.
IndCapacitySqFtperAcre	sq feet per acre	Based on current zoning, industrial gross capacity (the gross capacity of the parcel minus any built area) in square feet per acre.
isActiveAg	acres	If the parcel is under active agriculture per the UH Hilo Agriculture map then 1 else 0.
isCom		If existing use is or includes nonresidential activity, then 1 else 0.
isGovernment		If existing use is government, then 1 else 0.
isHistoric		If existing parcel includes a structure that's older than 1925, then 1 else 0.
IslandSide		Indicates if the parcel is either kona or ko'olau.
isLeased		Indicates if the parcel is government owned but privately leased (1) or not (0).
isNonResCapacityExempt		If the parcel has nonresidential capacity but is private and tax exempt then 1, else 0.
isNonResRedevelopable		If the parcel can be redeveloped with a commercial or industrial use, the 1 else 0.
isResCapacityExempt		If the parcel has residential capacity but is private and tax exempt then 1, else 0.
isResRedevelopable		If the parcel has the ability to redevelop with a residential use then 1, else 0.
isSLUDAgNonconforming		if the parcel is a state land use agriculture designation but has a county zoning designation that allows urban development then 1, else 0.
isUnbuildable	du	If the parcel is unbuildable due to steep slopes or wetlands then 1, else 0.
isUrban		If the parcel is built on with commercial use, high density residential or on sewer service then 1, else 0.
LandUseNew	du	Consultant derived land use type, based on multiple attributes in the model.
LandUseRuralAgConsGov		Designates if the land use is rural, conservation, government or agriculture, based on multiple attributes
LUPAG_ResCapacityGrossDU2	du	Based on LUPAG rules, residential gross capacity (capacity of the parcel as vacant) in dwelling units.

LUPAG_ResCapacityNetDU_UeAlt	du	Based on LUPAG rules, residential net capacity (gross capacity minus any existing structures) in dwelling units.
LUPAG_ResCapacityNetDU2	du	Based on LUPAG rules, residential net capacity (gross capacity minus any existing structures) in dwelling units.
LUPAGarea	sq ft	Estimates the amount of the area of a parcel within the LUPAG urban growth boundary.
LUPAGclass		LUPAG class, applied in this case only to parcels within the UGB.
LUPAGDUperAcre	du per acre	Density allowed by LUPAG rules, unrestrained by any of the validity rules developed by CEI/Placeways with staff.
LUPAGDUperAcreMod2	du	Process step, refines LUPAG residential capacity based on validity rules.
LUPAGinSLUag	du	LUPAG capacity adjusted where it conflicts with SLUD agriculture designation.
LUPAGisCapacityValid	du	Validity rule for the LUPAG capacity, applies LUPAG densities only in instances where CEI/Placeways and County staff felt that LUPAG rules would most likely to be invoked to receive greater densities (mostly greenfield sites). Value of 1 if validity is confirmed.
LUPAGisCapacityValid2	du	Second of two validity rules for the LUPAG capacity, applies LUPAG densities only in instances where CEI/Placeways and County staff felt that LUPAG rules would most likely to be invoked to receive greater densities (mostly greenfield sites). Value of 1 if validity is confirmed.
MinimumLotSize	sq feet	Minimum lot size in square feet, from zoning.
ResCapacityAccessoryDU	du	Residential capacity due to ohana or farm accessory units, in dwelling units.
ResCapacityDUperAcre	sq ft per acre	Based on current zoning, the residential capacity in dwelling units per acre.
ResCapacityFarmDU	acres	Residential capacity due to farm accessory units, in dwelling units.
ResCapacityGrossDU	du	Based on current zoning, residential gross capacity (capacity of the parcel as vacant) in dwelling units.
ResCapacityInSLUag		Residential capacity for agriculture in the state land use areas.
ResCapacityNet2Gross	du	The ratio of net to gross residential capacity.
ResCapacityNetDU	du	Based on current zoning, residential net capacity (gross capacity minus any existing dwellings) in dwelling units.

ResCapacityOhanaDU	du	Residential capacity due to ohana units, in dwelling units.
ResCapacityType	du	If any residential capacity on the parcel exists, the type of capacity was classified into one of 11 types. See "Capacity Categories" in the Capacity Technical Report. Capacity is based on current zoning.
ResCapacityTypeCapacity		Process step for ResCapacityType
ResCapacityTypeGreenfield	du	Process step for ResCapacityType
ResCapacityTypeIsEasilyBuildable	du	Process step for ResCapacityType
ResCapacityTypeRedev	du	Process step for ResCapacityType
ResCapacityTypeUndevelopable	du	Process step for ResCapacityType
ResidentialEfficiency	percent	Residential efficiency is an estimation of the amount of land left over to develop once infrastructure, rights of way and open space requirements are met.
ResidentialEfficiencyZone		Residential efficiency values were assigned using urban and rural, east and west side distinctions.
TMK_ALT1		TMK number
TotalNetTaxable	dollars	Total net taxable value, from RPT.
COM_BLDNUM_NUM		Number of commercial buildings on the parcel. From RPT.
COM_SQFT		Nonresidential square footage. From RPT.
COM_YRBLT		Nonresidential year built. From RPT.
ComCapacitySpotNetCapacity		Process step for commercial capacity.
CropCategory		Crop type category. From UH Hilo crop map.
Distance2SewerService		Distance from parcel to nearest sewer line.
District		Planning district
IndCapacitySpotNetCapacity		Process step for industrial capacity.
isAgZone		Parcel is in an agriculture zone (1).
isConservation		Parcel is in an conservation zone (1).
isInUGB		Parcel is in the UGB.
isLandClassBuilt		Process step.
isNonconformingRegion		Indicates if the parcel is within a nonconforming subdivision.
isZoningUrban		Zoning allows a more urban development pattern (1) as opposed to agricultural or conservation.
LandClass		This is an RPT classification of land use. It includes classes that are relevant to taxation ("HOMEOWNER") and was used as an input to the land use classification developed by CEI/Placeways for the scenario planning process (see LandUseNew).

LANDUSE		This is a draft land use classification type. See LandUseNew for the final land use classification used in the scenario planning process.
MajorOwner		Owner name. From RPT.
OBJECTID_1		Unique identifier
OpenWaterWetland	percent	Parcel is constrained by open water or wetland (1).
OrdinanceCode		Not sure what this, came from RPT?
Owner		Owner name. From RPT.
RES_NUMBER_RPT_Totals		This estimates the number of dwelling units per parcel, from RPT records. This was a process step, see ExistingDU for the final tally.
RES_YRBLT		Residential structure year built. From RPT.
ResCapacitySpotNetCapacity		Process step for capacity estimation.
ReviewIsRoadOW		Process step for identifying parcels that are actually roads or other RoW.
SCENARIO		CommunityViz field defining the active scenario.
Shape_Area		Parcel area in square feet.
Shape_Length		Parcel perimeter in feet.
Slope		Slope in percent slope.
SLUD		State land use classification.
TMK		TMK number, from RPT.
Zoning		Specific zoning classification
ZoningMajorCat		Zoning classification generalized to its general type (zone without minimum lot area distinction).