Appendix B
Water

Appendix - Water System

Criteria

The water system criteria for the HHFDC Keahuolu Lands follows the Hawaii County Department of Water Supply's Standards dated 2002 and revised per discussions with the Department of Water Supply. The applicable criteria are shown below:

1. Water Consumption

Land Use	Average Daily Demand
Single Family (market)	800 gallons per day (gpd) per unit
Single Family (affordable)	400 gpd per unit
Multi-Family	400 gpd per unit
Commercial	3,000 gpd per acre
Schools	4,000 gpd per acre
Parks	4,000 gpd per acre

Notes:
Analysis utilizes the single family (market) consumption of 800 gpd per unit.
DWS indicated that market homes have a higher average daily demand than affordable.
DWS indicated that the project should minimize the use of water for landscaping.

2. Demand Factors:

    a. Maximum daily demand = 1.5 x average daily demand
    b. Peak hour demand = 5.0 x average daily demand

3. Fire Flow Requirements:

    a. 500 gallons per minute (gpm) for two hours for single family homes with a lot size of 10,000 square feet or larger.
    b. 1,000 gpm for one hour for single family homes with a lot size of 10,000 square feet or less.
    c. 1,500 gpm for one hour for multi-family
    d. 2,000 gpm for two hours for schools.

4. Pipeline sizing:

    a. Maximum daily demand plus fire flow with a residual pressure of 20 pounds per square inch (psi) at critical fire hydrant.
    b. Peak hour demand with a residual pressure of 40 psi.
    c. In determining the carrying capacity of the mains, the "C" values to be applied are:

Pipe Diameter	"C"
8", 12"	110
16", 20"	120
24" and larger	130

d. Maximum velocity in distribution main (without fire flow) is 6 feet per second.
e. Maximum velocity in distribution main (with fire flow) is 10 feet per second.
f. Maximum static or pumping pressure, whichever is greater, shall not exceed 125 psi.

5. Reservoirs

Reservoirs shall be sized as follows:

a. Meet maximum day consumption. Reservoir full at the beginning of the 24-hour period with no source input to the reservoir.
b. Meet maximum day rate plus fire flow for duration of the fire. Reservoir ¾ full at start of fire, with credit for incoming flow from pumps, one maximum size pump out of service.
c. Standard size of reservoir is 1.0 million gallons (MG) and in increments of 0.5 MG above 1.0 MG.

6. Wells

a. Yield:

For 2 wells drilled, each producing 1,000,000 gallons per day, each well will provide approximately two-thirds the production or 670,000 gallons per day for the project. The total available water for the project will be 1,340,000 gallons per day.

For 1 well drilled, producing 2,000,000 gallons per day, the well will provide approximately half the production or 1,000,000 gallons per day for the project.

b. Contact reservoir:

Provide a contact reservoir for the well equal to the daily production capacity of the well.

7. Service Zone

The majority of the site is within the service zone of the 595-foot Reservoir. The 595-foot Reservoir service zone extends from the 495-foot elevation to the 225-foot elevation. The portion of the site, along the mauka extension of Keanalehu Drive, above the 495-foot elevation has to be serviced from the 935-foot Reservoir, to provide adequate water pressure. Water lines from both reservoir service zones are designed to stub to the project site along Manawale`a Street.

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Water - Daily Demands

Single Family Residential =	800	gallons/unit	(see note 1.)
Multi-family Residential =	400	gallons/unit	(see note 2.)
Commercial =	3,000	gallons/acre	per DWS Table 100-18
Schools (550 students) =	60	gallons/student	per DWS Table 100-18
(12 Acre School Site) Use	4,000	gallons/acre	per DHHL Water Master Plan
Parks =	4,000	gallons/acre	per DWS Table 100-18

Development	Units	Daily Demand (gallons/unit)	Average Demand (Gallons)
Concept A - LOW			
Single Family	400	800	320,000
Mult-Family	620	400	248,000
Commercial	9.7	3,000	29,100
Schools	12	4,000	48,000
Parks	25.18	4,000	100,720
Total			745,820

Reservoir Sizing:

1) Meet maximum daily consumption (1.5 x Average Day). Reservoir full at the beginning of the 24-hour period with no source input to the reservoir.

1.5 x 745,820 1,118,730 gallons

2) Meet maximum day rate plus fire flow for duration of fire. Reservoir 3/4 full at start of fire, with credit for incoming flow from pumps, one maximum size pump out of service.

Fire Flow (Worst Case is Schools) = 2000 gpm for 2 hours
240,000 gallons
Max Day Rate 93,228
Storage = 444,303 gallons

Condition 1 governs.
Existing 595' elevation reservoir has approximately 482,095 gallons capacity.
Will need to construct new 1.0 MG reservoir. (1.5 MG > 1.1 MG)

Wells:
Well Site No. 4 estimated yield = 2.0 MGD, Well Site No. 3 estimated yield = 1.0 MGD.
One 2.0 MGD yield well can provide approximately 1,000,000 gallons per day.
One 1.0 MGD yield well can provide approximately 500,000 gallons per day.
Two 1.0 MGD yield wells can provide approximately 1,340,000 gallons per day.
Two wells, one 2.0 MGD and one 1.0 MGD well can provide approximately 2,010,000 gallons per day.
Will need to construct 1 well, with 2 MGD yield. (1.0 MGD > 0.75 MGD)

Notes:

1. Per phone conversation 4/16/07 with Kurt Inaba at the Department of Water Supply, water use varies between 400 gpd (1 unit) to 800 gpd (2 units) based on size of lot. HHFDC anticipates the single family homes to be market units and require 800 gpd (2 units).
2. Per phone conversation 4/16/07 with Kurt Inaba at the Department of Water Supply, water use for the multifamily (affordable) units can be set at 400 gpd (1 unit).

Water - Daily Demands

Development	Units	Daily Demand (gallons/unit)	Average Demand (Gallons)
Concept B - MED			
Single Family	600	800	480,000
Mult-Family	1240	400	496,000
Commercial	11.32	3,000	33,960
Schools	12	4,000	48,000
Parks	25.18	4,000	100,720
Total			1,158,680

Reservoir Sizing:

1) Meet maximum daily consumption (1.5 x Average Day). Reservoir full at the beginning of the 24-hour period with no source input to the reservoir.

1.5 x 1,158,680 1,738,020 gallons

2) Meet maximum day rate plus fire flow for duration of fire. Reservoir 3/4 full at start of fire, with credit for incoming flow from pumps, one maximum size pump out of service.

Fire Flow (Worst Case is Schools) = 2000 gpm for 2 hours
240,000 gallons
Max Day Rate 144,835
Storage = 513,113 gallons

Condition 1 governs.

Existing 595' elevation reservoir has approximately 482,095 gallons capacity.

Will need to construct new 1.5 MG reservoir. (2.0 MG > 1.7 MG)

Wells:

Well Site No. 4 estimated yield = 2.0 MGD, Well Site No. 3 estimated yield = 1.0 MGD.
One 2.0 MGD yield well can provide approximately 1,000,000 gallons per day.
One 1.0 MGD yield well can provide approximately 500,000 gallons per day.
Two 1.0 MGD yield wells can provide approximately 1,340,000 gallons per day.
Two wells, one 2.0 MGD and one 1.0 MGD well can provide approximately 2,010,000 gallons per day.

Will need to construct 2 wells. (2.01 MGD > 1.16 MGD)

Water - Daily Demands

Development	Units	Daily Demand (gallons/unit)	Average Demand (Gallons)
Concept C - HIGH			
Single Family	0	800	0
Mult-Family	2330	400	932,000
Commercial	11.32	3,000	33,960
Schools	12	4,000	48,000
Parks	25.18	4,000	100,720
Total			1,114,680

Reservoir Sizing:

1) Meet maximum daily consumption (1.5 x Average Day). Reservoir full at the beginning of the 24-hour period with no source input to the reservoir.

1.5 x 1,114,680 1,672,020 gallons

2) Meet maximum day rate plus fire flow for duration of fire. Reservoir 3/4 full at start of fire, with credit for incoming flow from pumps, one maximum size pump out of service.

Fire Flow (Worst Case is Schools) = 2000 gpm for 2 hours
240,000 gallons
Max Day Rate 139,335
Storage = 505,780 gallons

Condition 1 governs.

Existing 595' elevation reservoir has approximately 482,095 gallons capacity.

Will need to construct new 1.5 MG reservoir. (2.0 MG > 1.67 MG)

Wells:

Well Site No. 4 estimated yield = 2.0 MGD, Well Site No. 3 estimated yield = 1.0 MGD.
One 2.0 MGD yield well can provide approximately 1,000,000 gallons per day.
One 1.0 MGD yield well can provide approximately 500,000 gallons per day.
Two 1.0 MGD yield wells can provide approximately 1,340,000 gallons per day.
Two wells, one 2.0 MGD and one 1.0 MGD well can provide approximately 2,010,000 gallons per day.

Will need to construct 2 wells. (2.01 MGD > 1.11 MGD)

HHFDC Keahuolu Lands
Off-Site Water System Costs

OFF-SITE WATER SYSTEM

Item No.	Estimated Quantity	Description		Unit Price		Total
12-inch Water Line in Kealakaa Street						
1- 1	1,040	Cu. Yds., Unclassified Trench Excavation	$	130.00	$	135,200
1- 2	3,200	Lin. Ft., 12-inch Water Line	$	85.00	$	272,000
1- 3	330	Lin. Ft., 6-inch Water Line	$	60.00	$	19,800
1- 4	7,000	Lbs, Fittings	$	8.00	$	56,000
1- 5	30	Each, Concrete Reaction Blocks	$	500.00	$	15,000
1- 6	11	Fire Hydrant	$	4,000.00	$	44,000
1- 7	6	12" Butterfly Valve and Box	$	3,070.00	$	18,420
1- 8	11	6" Gate Valve and Box	$	1,800.00	$	19,800
1- 9	2	1" Air Relief Valve and Manhole	$	3,100.00	$	6,200
1- 10	2	Each, Connect to existing water line	$	3,000.00	$	6,000
1- 11	1	Lump Sum, Water line testing	$	10,000.00	$	10,000
1- 12	1	Lump Sum, Traffic Control	$	30,000.00	$	30,000
		Subtotal for 12-inch Water Line in Kealakaa Street			$	632,420
		Contingency (20%)			$	126,484
		Construction Total			$	758,904
		Design and Construction Services (15%)			$	113,836
		Total			$	872,740
		SAY			**$**	**873,000**
12-inch Water Line in Manawale'a Street						
2- 1	270	Cu. Yds., Unclassified Trench Excavation	$	130.00	$	35,100
2- 2	800	Lin. Ft., 12-inch Water Line	$	85.00	$	68,000
2- 3	100	Lin. Ft., 6-inch Water Line	$	60.00	$	6,000
2- 4	3,000	Lbs, Fittings	$	8.00	$	24,000
2- 5	12	Each, Concrete Reaction Blocks	$	500.00	$	6,000
2- 6	3	Fire Hydrant	$	4,000.00	$	12,000
2- 7	4	12" Butterfly Valve and Box	$	3,070.00	$	12,280
2- 8	3	6" Gate Valve and Box	$	1,800.00	$	5,400
2- 9	1	1" Air Relief Valve and Manhole	$	3,100.00	$	3,100
2- 10	2	Each, Connect to existing water line	$	3,000.00	$	6,000
2- 11	1	Lump Sum, Water line testing	$	10,000.00	$	10,000
2- 12	1	Lump Sum, Traffic Control	$	20,000.00	$	20,000
		Subtotal for 12-inch Water Line in Manawale'a Street			$	207,880
		Contingency (20%)			$	41,576
		Construction Total			$	249,456
		Design and Construction Services (15%)			$	37,418
		Total			$	286,874
		SAY			**$**	**287,000**

HHFDC Keahuolu Lands
Off-Site Water System Costs

Item No.	Estimated Quantity	Description		Unit Price		Total
12-inch Water Line in Ane Keohokalole Highway						
3- 1	910	Cu. Yds., Unclassified Trench Excavation	$	130.00	$	118,300
3- 2	2,820	Lin. Ft., 12-inch Water Line	$	85.00	$	239,700
3- 3	280	Lin. Ft., 6-inch Water Line	$	60.00	$	16,800
3- 4	7,000	Lbs, Fittings	$	8.00	$	56,000
3- 5	29	Each, Concrete Reaction Blocks	$	500.00	$	14,500
3- 6	10	Fire Hydrant	$	4,000.00	$	40,000
3- 7	7	12" Butterfly Valve and Box	$	3,070.00	$	21,490
3- 8	10	6" Gate Valve and Box	$	1,800.00	$	18,000
3- 9	2	2" Cleanout and Manhole	$	2,000.00	$	4,000
3- 10	3	1" Air Relief Valve and Manhole	$	3,100.00	$	9,300
3- 11	1	Each, Connect to existing water line	$	5,000.00	$	5,000
3- 12	1	Lump Sum, Water line testing	$	15,000.00	$	15,000
3- 13	1	Lump Sum, Traffic Control	$	20,000.00	$	20,000
		Subtotal for 12-inch Water Line in Ane Keohokalole Highway			$	578,090
		Contingency (20%)			$	115,618
		Construction Total			$	693,708
		Design and Construction Services (15%)			$	104,056
		Total			$	797,764
		SAY			**$**	**798,000**

HHFDC Keahuolu Lands
Off-Site Water System Costs

Item No.	Estimated Quantity	Description	Unit Price	Total
Wells				
4- 1	1	Well Site No. 4		
		Construction		
		Clearing, Grading and Access Road	$ 706,000.00	$ 706,000
		Well and Facilities	$ 607,000.00	$ 607,000
		2.0 MG Reservoir	$ 2,588,000.00	$ 2,588,000
		Reservoir Grading	$ 20,000.00	$ 20,000
		Reservoir Excavation	$ 1,376,000.00	$ 1,376,000
		Control Building	$ 656,000.00	$ 656,000
		Water Lines and Valve Stations		
		16" Water Line (1,330 LF)	$ 222,110.00	$ 222,110
		12" Water Line (550 LF)	$ 70,950.00	$ 70,950
		Valve Station	$ 66,000.00	$ 66,000
		Site Electrical	$ 146,000.00	$ 146,000
		Off-Site 16" Water Line (7,000 LF)	$ 1,726,200.00	$ 1,726,200
		Construction Subtotal		$ 8,184,260
		Contingency (20%)		$ 1,636,852
		Construction Total		$ 9,821,112
		Planning and Design (15%)		$ 1,474,000
		Total		$ 11,295,112
		SAY		**$ 11,296,000**
4- 2	1	Well Site No. 3		
		Construction		
		Clearing, Grading and Access Road	$ 700,000.00	$ 700,000
		Well and Facilities	$ 900,000.00	$ 900,000
		1.0 MG Reservoir	$ 2,070,000.00	$ 2,070,000
		Reservoir Grading	$ 8,000.00	$ 8,000
		Reservoir Excavation	$ 421,400.00	$ 421,400
		Control Building	$ 656,000.00	$ 656,000
		Water Lines and Valve Stations		
		16" Water Line (1,000 LF)	$ 167,000.00	$ 167,000
		12" Water Line (500 LF)	$ 64,500.00	$ 64,500
		Valve Station	$ 66,000.00	$ 66,000
		Site Electrical	$ 146,000.00	$ 146,000
		Construction Subtotal		$ 5,198,900
		Contingency (20%)		$ 1,039,780
		Construction Total		$ 6,238,680
		Planning and Design (15%)		$ 936,000
		Total		$ 7,174,680
		SAY		**$ 7,175,000**

Note: Cost for Well Site No. 3 does not include land acquisition cost for reservoir site.

HHFDC Keahuolu Lands
Off-Site Water System Costs

Item No.	Estimated Quantity	Description	Unit Price	Total
595' OF Elevation Reservoir on DHHL Keahuolu Property				
5- 1		1.0 MG Reservoir		
	1	Reservoir Construction	$ 2,070,000.00	$ 2,070,000
	39,000	Cu. Yds, Earthwork	$ 43.00	$ 1,677,000
	1.7	Acres, Grading	$ 8,000.00	$ 13,600
	100	Lin. Ft., Reservoir 16" Water Line	$ 167.00	$ 16,700
	2	Valve Stations	$ 66,000.00	$ 132,000
	1,770	Lin. Ft., Chain Link Fencing, PVC Coated	$ 40.00	$ 70,800
	5,500	Sq. Ft., AC Pavement	$ 8.00	$ 44,000
	14,400	Sq. Ft., Access Road Pavement	$ 8.00	$ 115,200
	22,000	Cu. Yds, Access Road Earthwork	$ 36.00	$ 792,000
	4	Acres, Access Road Grading	$ 8,000.00	$ 32,000
	2,400	Lin. Ft., Access Road 16" Water Line	$ 167.00	$ 400,800
		Subtotal		$ 5,364,100
		Contingency (20%)		$ 1,072,820
		Construction Total		$ 6,436,920
		Planning and Design (15%)		$ 966,000
		Total		$ 7,402,920
		SAY		**$ 7,403,000**
5- 2		1.5 MG Reservoir		
	1	Reservoir Construction	$ 2,300,000.00	$ 2,300,000
	50,000	Cu. Yds, Earthwork	$ 43.00	$ 2,150,000
	2.0	Acres, Grading	$ 8,000.00	$ 16,000
	100	Lin. Ft., Reservoir 16" Water Line	$ 167.00	$ 16,700
	2	Valve Stations	$ 66,000.00	$ 132,000
	1,770	Lin. Ft., Chain Link Fencing, PVC Coated	$ 40.00	$ 70,800
	6,200	Sq. Ft., AC Pavement	$ 8.00	$ 49,600
	14,400	Sq. Ft., Access Road Pavement	$ 8.00	$ 115,200
	22,000	Cu. Yds, Access Road Earthwork	$ 36.00	$ 792,000
	4	Acres, Access Road Grading	$ 8,000.00	$ 32,000
	2,400	Lin. Ft., Access Road 16" Water Line	$ 167.00	$ 400,800
		Subtotal		$ 6,075,100
		Contingency (20%)		$ 1,215,020
		Construction Total		$ 7,290,120
		Planning and Design (15%)		$ 1,094,000
		Total		$ 8,384,120
		SAY		**$ 8,385,000**

Notes: 1) Reservoir construction costs are based on estimates from DYK Inc. and adjusted (1.15) as a subcontractor to a general site contractor.

2) Reservoir construction costs do not include land acquisition from DHHL.

Appendix C
Sewer

Appendix - Sewer System

Criteria

The sewer system criteria for the HHFDC Keahuolu Lands follows the Hawaii County Department of Environmental Managements criteria as shown below:

1. Quantity of Wastewater

   Average Sewer Flow = 80 gallons per capita per day
   School / Park Sewer Flow = 25 gallons per capita per day

Land Use	Densities
Single Family	4 persons per unit
Multi-Family	2.8 persons per unit
Commercial	140 capita per acre
Schools	550 students
Parks	100 capita per 5 acres

2. Pipeline sizing:

   a. Size pipes to convey the design peak flow.
   b. Minimum size of pipe is 8-inches for mains in roadway areas.
   c. Minimum velocity in the sewer line flowing full is 2.0 feet per second.
   d. Maximum velocity in the sewer line flowing full is 10 feet per second.
   e. Minimum and maximum slopes for sewer lines flowing full:

Pipe Diameter	Minimum Slope	Maximum Slope
8”	0.00444	0.1110
10”	0.00331	0.0827
12”	0.00259	0.0648
15”	0.00192	0.0479
18”	0.00160	0.0377
21”	0.00092	0.0231
24”	0.00077	0.0193
27”	0.00066	0.0165
30”	0.00057	0.0143

3. Manhole Spacing:

   a. 350 feet – pipes up to and including 30 inches in diameter in street areas.
   b. 250 feet – pipes up to and including 18 inches in diameter in easement areas.
   c. 350 feet – pipes larger than 18 inches and up to and including 30 inches in diameter in easement areas.

4. Drop Manholes:

   A drop manhole or shallow drop manhole should be provided where a sewer enters a manhole at a height of 18 inches or more above the manhole invert.

5. Sewer Treatment Plant Capacity:

   The sewer treatment plant capacity is based on the design average flow from the development.

Hawaii Housing Finance and Development Corporation June 12, 2007
Keahuolu Affordable Housing Master Plan Prepared by: Belt Collins Hawaii Ltd.

Sewer Flows - Keahuolu Lands - Concept A

Average Sewer Flows	80	gallons/capita per day
School / Park Sewer Flows	25	gallons/capita per day
Single Family Residential =	4	persons/unit
Multi-family Residential =	2.8	persons/unit
Commercial =	140	capita/acre
Schools =	550	students
Parks =	100	persons/5 acres

Development	Units	capita/unit	capita	sewer flow (gallons/day)	average flow (gallons)
Concept A - LOW					
Single Family	400	4	1,600	80	128,000
Mult-Family	620	2.8	1,736	80	138,880
Commercial	9.7	140	1,358	80	108,640
Schools	1	550	550	25	13,750
Parks	25.18	100	504	25	12,590
Total			5,748		401,860

Average Wastewater Flow:	401,860	gallons/day	
Maximum Wastewater Flow:	1,547,161	gallons/day	(Flow Factor = 3.85)
Dry Weather Infiltration/Inflow:	28,738	gallons/day	
Design Average Flow:	**430,598**	gallons/day	**<-- Capacity Required at Plant**
Design Maximum Flow:	1,575,899	gallons/day	
Wet Weather Infiltration/Inflow:	340,000	gallons/day	
Design Peak Flow:	1,915,899	gallons/day	

Capacity at the Wastewater Treatment Plant = 431,360 gallons/day
Therefore, adequate capacity at the treatment plant.

Sewer Flows - Keahuolu Lands - Concept B

Average Sewer Flows	80	gallons/capita per day
School / Park Sewer Flows	25	gallons/capita per day
Single Family Residential =	4	persons/unit
Multi-family Residential =	2.8	persons/unit
Commercial =	140	capita/acre
Schools =	550	students
Parks =	100	persons/5 acres

Development	Units	capita/unit	capita	sewer flow (gallons/day)	average flow (gallons)
Concept B - MED					
Single Family	600	4	2,400	80	192,000
Mult-Family	1240	2.8	3,472	80	277,760
Commercial	11.32	140	1,585	80	126,784
Schools	1	550	550	25	13,750
Parks	25.18	100	504	25	12,590
Total			8,510		622,884

Average Wastewater Flow:	622,884	gallons/day	
Maximum Wastewater Flow:	2,186,323	gallons/day	(Flow Factor = 3.51)
Dry Weather Infiltration/Inflow:	42,552	gallons/day	
Design Average Flow:	**665,436**	gallons/day	**<-- Capacity Required at Plant**
Design Maximum Flow:	2,228,875	gallons/day	
Wet Weather Infiltration/Inflow:	340,000	gallons/day	
Design Peak Flow:	2,568,875	gallons/day	

Capacity at the Wastewater Treatment Plant = 431,360 gallons/day
Additional Capacity Required at the Treatment Plant = 234,076 gallons/day

Sewer Flows - Keahuolu Lands - Concept C

Average Sewer Flows	80	gallons/capita per day
School / Park Sewer Flows	25	gallons/capita per day
Single Family Residential =	4	persons/unit
Multi-family Residential =	2.8	persons/unit
Commercial =	140	capita/acre
Schools =	550	students
Parks =	100	persons/5 acres

Development	Units	capita/unit	capita	sewer flow (gallons/day)	average flow (gallons)
Concept C - HIGH					
Single Family	0	4	0	80	0
Mult-Family	2330	2.8	6,524	80	521,920
Commercial	11.32	140	1,585	80	126,784
Schools	1	550	550	25	13,750
Parks	25.18	100	504	25	12,590
Total			9,162		675,044

Average Wastewater Flow:	675,044	gallons/day	
Maximum Wastewater Flow:	2,315,401	gallons/day	(Flow Factor = 3.43)
Dry Weather Infiltration/Inflow:	45,812	gallons/day	
Design Average Flow:	**720,856**	gallons/day	**<-- Capacity Required at Plant**
Design Maximum Flow:	2,361,213	gallons/day	
Wet Weather Infiltration/Inflow:	340,000	gallons/day	
Design Peak Flow:	2,701,213	gallons/day	

Capacity at the Wastewater Treatment Plant = 431,360 gallons/day
Additional Capacity Required at the Treatment Plant = 289,496 gallons/day

Hawaii Housing Finance and Development Corporation June 12, 2007
Keahuolu Affordable Housing Master Plan Prepared by: Belt Collins Hawaii Ltd.

Sewer Flows - Queen Liliuokalani Trust (QLT), Phases 2A & 2B

Average Sewer Flows	80	gallons/capita per day
School / Park Sewer Flows	25	gallons/capita per day
Single Family Residential =	4	persons/unit
Multi-family Residential =	2.8	persons/unit
Commercial =	140	capita/acre
Schools =	550	students
Parks =	100	persons/5 acres

Development	Units	capita/unit	capita	sewer flow (gallons/day)	average flow (gallons)
QLT - Phase 2A					
Single Family	587	4	2,348	80	187,840
Mult-Family	332	2.8	930	80	74,368
Commercial	5.9	140	823	80	65,856
Schools	1.0	550	550	25	13,750
Parks	13.2	100	264	25	6,600
Total			4,915		348,414

Note: Development units referenced from JZMK Partners Preliminary Residential Program, April 25, 2007.

Total Area:	246	acres
Average Wastewater Flow:	348,414	gallons/day
Flow Factor:	5.00	(See note below)
Maximum Wastewater Flow:	1,742,070	gallons/day
Dry Weather Infiltration/Inflow:	24,574	gallons/day
Design Average Flow:	372,988	gallons/day
Design Maximum Flow:	1,766,644	gallons/day
Wet Weather Infiltration/Inflow:	307,500	gallons/day
Design Peak Flow:	2,074,144	gallons/day

Development	Area (acres)	average flow (gallons/day)	design peak flow (gallons/day)
QLT Phase 2A	218.0	348,414	2,074,144
QLT Phase 2B*	221.5	353,994	2,107,363

*QLT Phase 2B sewer flows are interpolated from Phase 2A. The Phase 2A area used for interpolating was reduced by 28.0 acres (archaeological preserve) in order to match future densities.

Note: Flow factor of 5.00 used to determine a conservative design peak flow.

Sewer Flows - Villages of Laiopua
Existing Village 3 and High School, Proposed Villages 4, 5 and Park

Average Sewer Flows	80	gallons/capita per day
School / Park Sewer Flows	25	gallons/capita per day
Single Family Residential =	4	persons/unit
Multi-family Residential =	2.8	persons/unit
Commercial =	140	capita/acre
Schools =	550	students
Parks =	100	persons/5 acres

Development	Units	capita/unit	capita	sewer flow (gallons/day)	average flow (gallons)
Villages of Laiopua (Existing and Proposed)					
Single Family	362	4	1,448	80	115,840
Mult-Family	680	2.8	1,904	80	152,320
Commercial	0.00	140	0	80	0
Schools	1	1400	1,400	25	35,000
Parks	5	100	100	25	2,500
Total			4,852		305,660

Note: Development units and flows referenced from Villages of Laiopua Planned Community Sewer System Master Plan, August 1994 by Belt Collins Hawaii.

Total Area:	183.2	acres
Average Wastewater Flow:	305,660	gallons/day
Flow Factor:	5.00	(See note below)
Maximum Wastewater Flow:	1,528,300	gallons/day
Dry Weather Infiltration/Inflow:	24,260	gallons/day
Design Average Flow:	329,920	gallons/day
Design Maximum Flow:	1,552,560	gallons/day
Wet Weather Infiltration/Inflow:	229,000	gallons/day
Design Peak Flow:	1,781,560	gallons/day

Note: Flow factor of 5.00 used to determine a conservative design peak flow.

Sewer Flows - Villages of Laiopua
Future Villages 6, 10, 11, Park & Village Center

Average Sewer Flows	80	gallons/capita per day
School / Park Sewer Flows	25	gallons/capita per day
Single Family Residential =	4	persons/unit
Multi-family Residential =	2.8	persons/unit
Commercial =	140	capita/acre
Schools =	550	students
Parks =	100	persons/5 acres

Development	Units	capita/unit	capita	sewer flow (gallons/day)	average flow (gallons)
Villages of Laiopua (Future)					
Single Family	329	4	1,316	80	105,280
Mult-Family	116	2.8	325	80	25,984
Commercial	14.50	40	580	80	46,400
Parks	4.5	100	90	25	2,250
Total			2,311		179,914

Note: Development units and flows referenced from Villages of Laiopua Planned Community Sewer System Master Plan, August 1994 by Belt Collins Hawaii.

Total Area:	114.2	acres
Average Wastewater Flow:	179,914	gallons/day
Flow Factor:	5.00	(See note below)
Maximum Wastewater Flow:	899,570	gallons/day
Dry Weather Infiltration/Inflow:	11,554	gallons/day
Design Average Flow:	191,468	gallons/day
Design Maximum Flow:	911,124	gallons/day
Wet Weather Infiltration/Inflow:	142,750	gallons/day
Design Peak Flow:	1,053,874	gallons/day

Note: Flow factor of 5.00 used to determine a conservative design peak flow.

Miscellaneous Sewer Design Flows

Development	Design Peak Flow (mgd)	Reference
Kealakehe/DHHL	1.987	Villages of Laiopua Planned Community, Sewer System Master Plan, August 1994 by Belt Collins Hawaii.
Queen Liliuokalani Village (QLV)	0.360	Department of Environmental Management
DHHL-Keahuolu	1.290	Villages of Laiopua Planned Community, Sewer System Master Plan, August 1994 by Belt Collins Hawaii. Makalapua Development Sewer System Master Plan, February 1994 (Revised August 1994) by Belt Collins Hawaii.

Note: Design Peak Flows are those shown on the Off-Site Sewer System Figures.

HHFDC Keahuolu Lands
Off-Site Sewer System Costs

SEWER SYSTEM - Through QLT (Concept A)

Item No.	Estimated Quantity	Description		Unit Price		Total
Sewer System						
1- 1	19,300	Cu. Yds., Unclassified Trench Excavation	$	150.00	$	2,895,000
1- 2	1,700	Lin. Ft., 8-inch PVC sewer pipe (ave. 6' cover)	$	23.00	$	39,100
1- 3	2,340	Lin. Ft., 12-inch PVC sewer pipe (ave. 8' cover)	$	37.00	$	86,580
1- 4	3,320	Lin. Ft., 15-inch PVC sewer pipe, (ave. 9' cover)	$	47.00	$	156,040
1- 5	6,850	Lin. Ft., 24-inch PVC sewer pipe (ave. 8' cover)	$	110.00	$	753,500
1- 6	45	Each, Sewer manhole, PVC lined (6-12' deep)	$	11,000.00	$	495,000
1- 7	5	Each, Shallow drop sewer manhole, PVC lined (10' to 13' deep)	$	18,000.00	$	90,000
1- 8	2	Each, Deep drop sewer manhole, PVC lined (13' to 16')	$	26,000.00	$	52,000
1- 9	1	Each, Connect to existing sewer lines	$	3,000.00	$	3,000
1- 10	1	Each, Connect to existing sewer manholes	$	4,000.00	$	4,000
1- 11	1	Lump Sum, Sewer line testing	$	30,000.00	$	30,000
1- 12	1	Lump Sum, Traffic Control	$	20,000.00	$	20,000
		Subtotal for Sewer System - Through QLT			$	4,624,220
		Contingency (20%)			$	924,844
		Subtotal			$	5,549,064
		Design and construction Services (15%)			$	832,360
		Total			$	6,381,424
		SAY			**$**	**6,381,000**

HHFDC Keahuolu Lands
Off-Site Sewer System Costs

SEWER SYSTEM - Through QLT (Concepts B and C)

Item No.	Estimated Quantity	Description		Unit Price		Total
Sewer System						
1- 1	21,000	Cu. Yds., Unclassified Trench Excavation	$	150.00	$	3,150,000
1- 2	1,700	Lin. Ft., 8-inch PVC sewer pipe (ave. 6' cover)	$	23.00	$	39,100
1- 3	1,000	Lin. Ft., 12-inch PVC sewer pipe (ave. 8' cover)	$	37.00	$	37,000
1- 4	4,660	Lin. Ft., 15-inch PVC sewer pipe, (ave. 9' cover)	$	47.00	$	219,020
1- 5	3,630	Lin. Ft., 24-inch PVC sewer pipe (ave. 8' cover)	$	110.00	$	399,300
1- 6	3,220	Lin. Ft., 30-inch HDPE sewer pipe, (ave. 8' cover)	$	90.00	$	289,800
1- 7	45	Each, Sewer manhole, PVC lined (6-12' deep)	$	11,000.00	$	495,000
1- 8	5	Each, Shallow drop sewer manhole, PVC lined (10' to 13' deep)	$	18,000.00	$	90,000
1- 9	2	Each, Deep drop sewer manhole, PVC lined (13' to 16')	$	26,000.00	$	52,000
1- 10	1	Each, Connect to existing sewer lines	$	3,000.00	$	3,000
1- 11	1	Each, Connect to existing sewer manholes	$	4,000.00	$	4,000
1- 12	1	Lump Sum, Sewer line testing	$	30,000.00	$	30,000
1- 13	1	Lump Sum, Traffic Control	$	20,000.00	$	20,000
		Subtotal for Sewer System - Through QLT			$	4,828,220
		Contingency (20%)			$	965,644
		Subtotal			$	5,793,864
		Design and construction Services (15%)			$	869,080
		Total			$	6,662,944
		SAY			**$**	**6,663,000**

HHFDC Keahuolu Lands
Off- Site Sewer System Costs

SEWER SYSTEM - Through Laiopua (Concept A)

Item No.	Estimated Quantity	Description		Unit Price		Total
Sewer System through Laiopua only						
1- 1	19,330	Cu. Yds., Unclassified Trench Excavation	$	150.00	$	2,899,500
1- 2	8,255	Lin. Ft., 21-inch PVC sewer pipe, (ave. 10' cover)	$	85.00	$	701,675
1- 3	2,470	Lin. Ft., 30-inch HDPE sewer pipe, (ave. 8' cover)	$	90.00	$	222,300
1- 4	22	Each, Sewer manhole, PVC lined (ave 9' deep)	$	11,000.00	$	242,000
1- 6	2	Each, Deep drop sewer manhole, PVC lined (14' deep)	$	19,000.00	$	38,000
1- 7	7	Each, Deep drop sewer manhole, PVC lined (20 - 25' deep)	$	25,000.00	$	175,000
1- 8	1	Each, Connect to existing sewer lines	$	3,000.00	$	3,000
1- 9	1	Each, Connect to existing sewer manholes	$	4,000.00	$	4,000
1- 10	1	Lump Sum, Sewer line testing	$	30,000.00	$	30,000
1- 11	1	Lump Sum, Traffic Control	$	20,000.00	$	20,000
		Subtotal for Laiopua sewer only			$	4,335,475
		Contingency (20%)			$	867,095
		Subtotal			$	5,202,570
		Design and construction Services (15%)			$	780,386
		Total			$	5,982,956
		SAY			**$**	**5,983,000**
Sewer through QLT only						
2- 1	13,400	Cu. Yds., Unclassified Trench Excavation	$	150.00	$	2,010,000
2- 2	1,700	Lin. Ft., 8-inch PVC sewer pipe (ave. 6' cover)	$	23.00	$	39,100
2- 3	2,340	Lin. Ft., 12-inch PVC sewer pipe (ave. 8' cover)	$	37.00	$	86,580
2- 4	1,700	Lin. Ft., 15-inch PVC sewer pipe, (ave. 9' cover)	$	47.00	$	79,900
2- 5	2,450	Lin. Ft., 18-inch PVC sewer pipe, (ave. 9' cover)	$	60.00	$	147,000
2- 6	2,290	Lin. Ft., 24-inch PVC sewer pipe, (ave. 10' cover)	$	110.00	$	251,900
2- 7	33	Each, Sewer manhole, PVC lined (ave 9' deep)	$	11,000.00	$	363,000
2- 8	8	Each, Shallow drop sewer manhole, PVC lined (10' to 13' deep)	$	17,000.00	$	136,000
		Subtotal for QLT sewer only			$	3,113,480
		Contingency (20%)			$	622,696
		Subtotal			$	3,736,176
		Design and construction Services (15%)			$	560,426
		Total			$	4,296,602
		SAY			**$**	**4,297,000**
		TOTAL FOR SEWER SYSTEM - THROUGH LAIOPUA				**10,280,000**

HHFDC Keahuolu Lands
Off- Site Sewer System Costs

SEWER SYSTEM - Through Laiopua (Concepts B and C)

Item No.	Estimated Quantity	Description		Unit Price		Total
Sewer System through Laiopua only						
1- 1	19,330	Cu. Yds., Unclassified Trench Excavation	$	150.00	$	2,899,500
1- 2	8,255	Lin. Ft., 21-inch PVC sewer pipe, (ave. 10' cover)	$	85.00	$	701,675
1- 3	2,470	Lin. Ft., 30-inch HDPE sewer pipe, (ave. 8' cover)	$	90.00	$	222,300
1- 4	22	Each, Sewer manhole, PVC lined (ave 9' deep)	$	11,000.00	$	242,000
1- 6	2	Each, Deep drop sewer manhole, PVC lined (14' deep)	$	19,000.00	$	38,000
1- 7	7	Each, Deep drop sewer manhole, PVC lined (20 - 25' deep)	$	25,000.00	$	175,000
1- 8	1	Each, Connect to existing sewer lines	$	3,000.00	$	3,000
1- 9	1	Each, Connect to existing sewer manholes	$	4,000.00	$	4,000
1- 10	1	Lump Sum, Sewer line testing	$	30,000.00	$	30,000
1- 11	1	Lump Sum, Traffic Control	$	20,000.00	$	20,000
		Subtotal for Laiopua sewer only			$	4,335,475
		Contingency (20%)			$	867,095
		Subtotal			$	5,202,570
		Design and construction Services (15%)			$	780,386
		Total			$	5,982,956
		SAY			**$**	**5,983,000**
Sewer through QLT only						
2- 1	14,500	Cu. Yds., Unclassified Trench Excavation	$	150.00	$	2,175,000
2- 2	1,700	Lin. Ft., 8-inch PVC sewer pipe (ave. 6' cover)	$	23.00	$	39,100
2- 3	1,000	Lin. Ft., 12-inch PVC sewer pipe (ave. 8' cover)	$	37.00	$	37,000
2- 4	3,040	Lin. Ft., 15-inch PVC sewer pipe, (ave. 9' cover)	$	47.00	$	142,880
2- 5	2,450	Lin. Ft., 18-inch PVC sewer pipe, (ave. 10' cover)	$	60.00	$	147,000
2- 5	2,290	Lin. Ft., 24-inch PVC sewer pipe, (ave. 10' cover)	$	110.00	$	251,900
2- 6	33	Each, Sewer manhole, PVC lined (ave 9' deep)	$	11,000.00	$	363,000
2- 7	8	Each, Shallow drop sewer manhole, PVC lined (10' to 13' deep)	$	17,000.00	$	136,000
		Subtotal for QLT sewer only			$	3,291,880
		Contingency (20%)			$	658,376
		Subtotal			$	3,950,256
		Design and construction Services (15%)			$	592,538
		Total			$	4,542,794
		SAY			**$**	**4,543,000**
		TOTAL FOR SEWER SYSTEM - THROUGH LAIOPUA				**10,526,000**

Appendix D
Solid Waste Management Plan

SOLID WASTE MANAGEMENT PLAN

FOR THE

KEAHUOLU AFFORDABLE HOUSING PROJECT

Prepared for

Hawaii Housing Finance & Development Corporation
677 Queen Street, Suite 300
Honolulu, Hawai`i 96813

Prepared by

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This work was prepared by me or under my supervision.
Expiration Date of License: April 30, 2008

December 2007

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INTRODUCTION

The purpose of this Solid Waste Management Plan (SWMP) is to develop a plan for the management of solid waste generated during the construction and occupancy of the Keahuolu Affordable Housing project.

The Keahuolu Affordable Housing project would be located on approximately 272 acres of land located at Tax Map Key: (3) 7-4-021:20 in North Kona, Hawai'i. (Figure 1 – Location Map). Nearby developments include the Kealakehe High School, Department of Hawaiian Home Lands Village 3 and the existing Kealakehe community. (Figure 2 – Area Map)

The proposed Keahuolu Affordable Housing project is a master planned community of 1,020 to 2,330 dwelling units (single-family and multi-family residences), 197,000 square feet of commercial/retail space, 11.82 acres of school facilities (550 students and 70 faculty and staff with 8,700 square feet of buildings), neighborhood parks, archaeological preserves, landscape buffers, open space and associated infrastructure.

Three preliminary development plan concepts with varying dwelling unit densities and the projected timeline are summarized in Tables 1-1A, 1-1B and 1-1C.

TABLE 1-1A: PRELIMINARY DEVELOPMENT PLAN – CONCEPT A

Year	Land Use		
	Residential Units (multifamily / single family)	Commercial/Retail (SF)	School (SF)
2010	200 / 100		
2011	200 / 100		
2012	200 / 100		
2013	20 / 100		8,700
2014			
2015			
2016			
2017			
2018		100,000	
2019			
2020		97,000	
Total	**1,020**	**197,000**	**8,700**

TABLE 1-1B: PRELIMINARY DEVELOPMENT PLAN – CONCEPT B

Year	Land Use		
	Residential Units (multifamily / single family)	Commercial/Retail (SF)	School (SF)
2010	200 / 100		
2011	200 / 100		
2012	200 / 100		
2013	200 / 100		8,700
2014	200 / 100		
2015	200 / 100		
2016	40 / 0		
2017			
2018		100,000	
2019			
2020		97,000	
Total	**1,840**	**197,000**	**8,700**

TABLE 1-1C: PRELIMINARY DEVELOPMENT PLAN – CONCEPT C

Year	Land Use		
	Residential Units (multifamily)	Commercial/Retail (SF)	School (SF)
2010	300		
2011	300		
2012	300		
2013	300		8,700
2014	300		
2015	300		
2016	300		
2017	230		
2018		100,000	
2019			
2020		97,000	
Total	**2,330**	**197,000**	**8,700**

The three concepts include a variety of high and medium density multifamily units and low density single-family units. The residential units would be located on approximately 162 acres in all three development concepts. Table 1-2 provides a breakdown of the units and densities.

TABLE 1-2: ALTERNATIVE DEVELOPMENT PLAN CONCEPTS

	Alternative Concepts		
	A	**B**	**C**
Residential Units			
High density – multifamily	400	800	800
Medium density - multifamily	220	440	1,530
Low density – single-family	400	600	0
Total	**1,020**	**1,840**	**2,330**
Density (dwelling units per acre)			
High density – multifamily	12	24	24
Medium density – multifamily	8	16	12
Low density – single-family	4	6	n/a
Commercial/retail	**197,000 SF**	**197,000 SF**	**197,000 SF**
School	**8,700 SF**	**8,700 SF**	**8,700 SF**

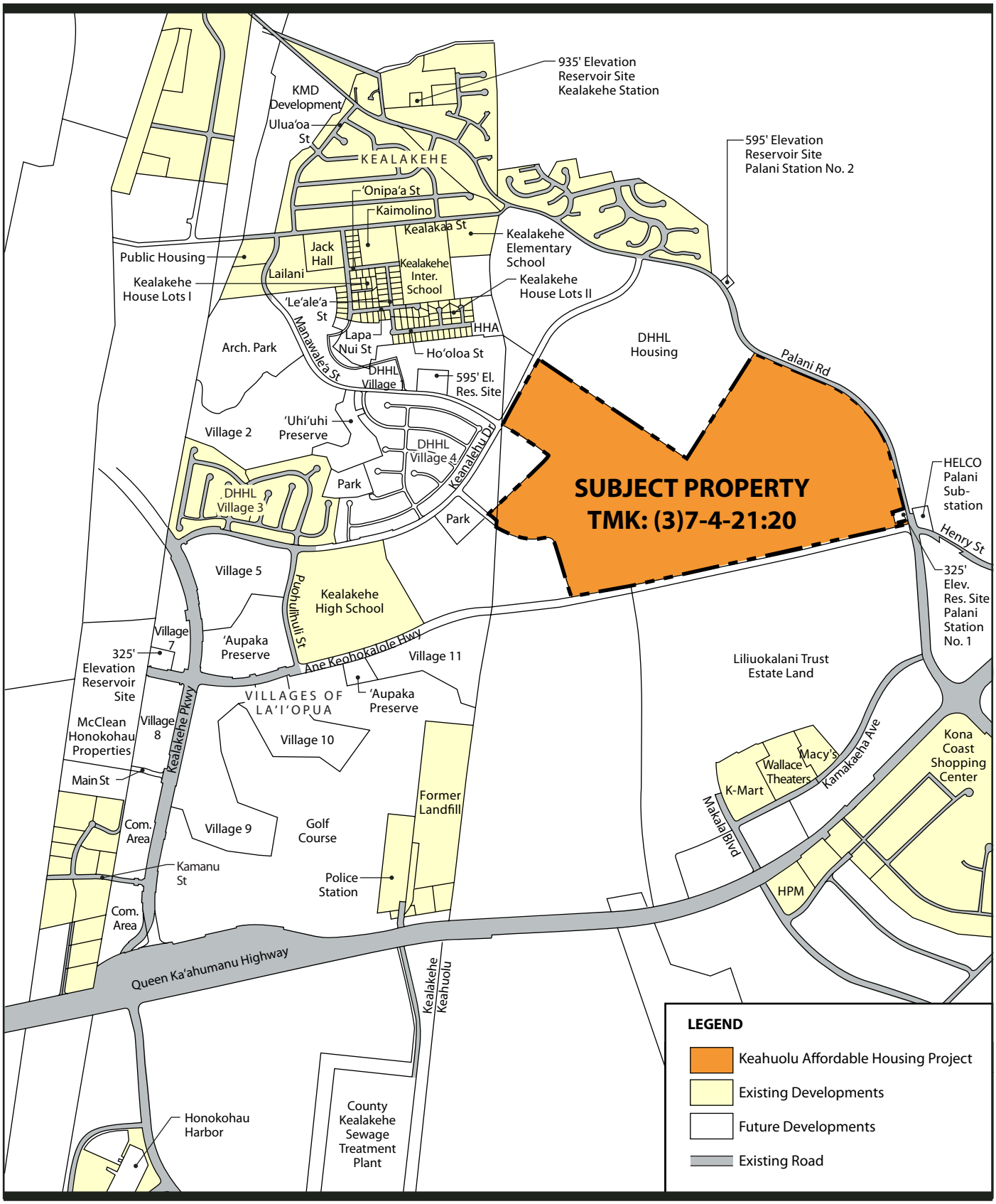
BeltCollins

NORTH

0 3 6 12
SCALE IN MILES

Figure 1
LOCATION MAP

Keahuolu Affordable Housing
Solid Waste Management Plan
December 2007



Belt Collins

NORTH

0 600 1200 1800

SCALE IN FEET

Figure 2
AREA MAP

Keahuolu Affordable Housing
Solid Waste Management Plan
December 2007

This report addresses reduction and recycling of solid wastes generated during the Keahuolu Affordable Housing project construction and occupancy. Occupancy waste collection would involve a centralized system, likely provided by one or more private contractors, where recyclables and wastes from residences, commercial/retail buildings and the school would be collected and taken directly to recycling centers or other licensed solid waste facilities. Waste that is not recycled would be taken directly to the closest landfill, which is the West Hawai'i Landfill in Pu'uanahulu, managed by Waste Management of Hawai'i, Inc. The shortest driving distance from the proposed development to the West Hawai'i Landfill is approximately 22 miles (See Figure 3 – Public Facilities - Landfills / Transfer Stations).

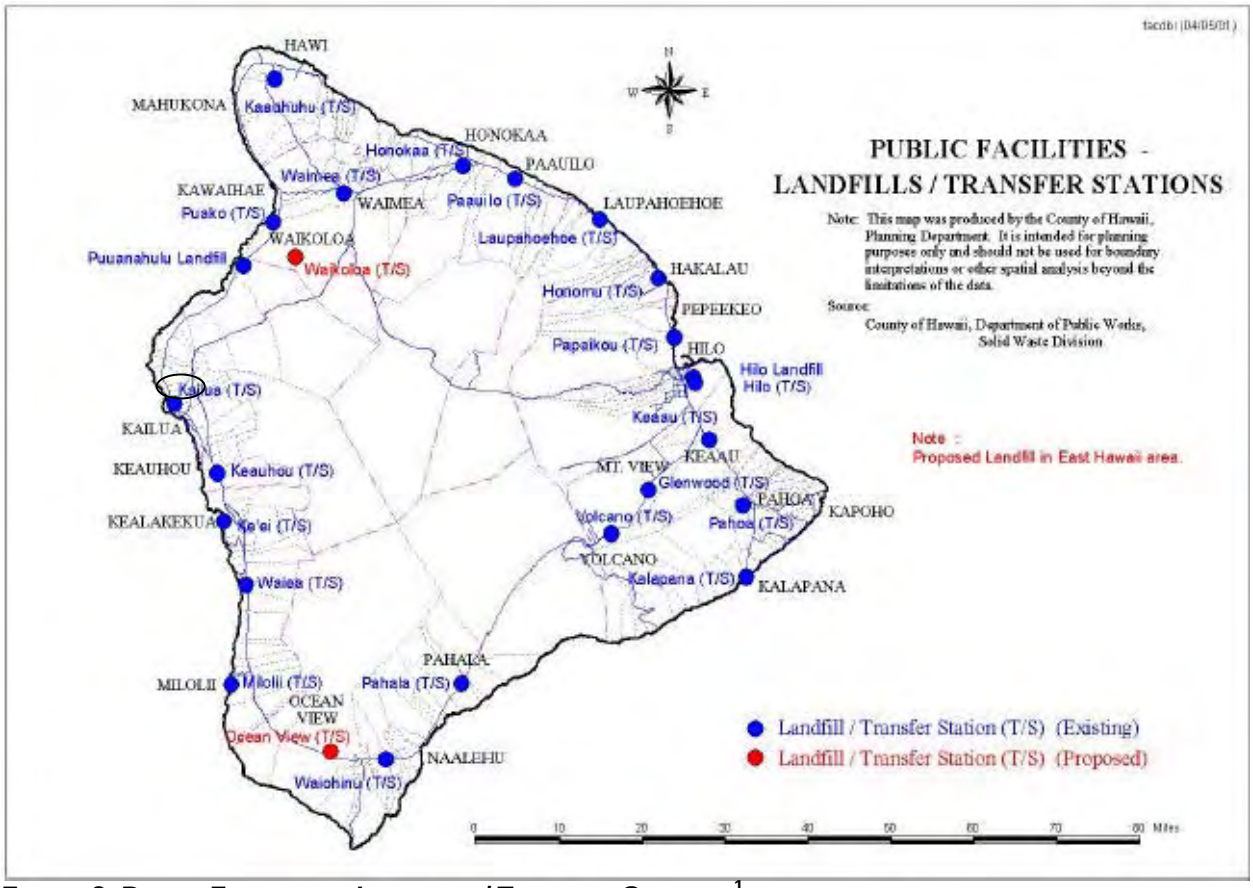


FIGURE 3: PUBLIC FACILITIES – LANDFILLS / TRANSFER STATIONS[1]

Notes:
1. Referenced from the 2002 Updated Integrated Solid Waste Management Plan for the County of Hawai'i.

Arrangements for construction waste recycling and disposal would be formalized once the planned development's construction scheduled is finalized. Likewise, arrangements for operations waste recycling and disposal would be formalized when the planned development is constructed and occupied.

SOLID WASTE GENERATION

According to the Hawai'i County Code, solid waste (also known as rubbish) is defined as "any rejected material including paper and cardboard cartons, straw, excelsior, rags, clothes, shoes….and any other material of similar character". If not properly managed, solid waste can have serious negative effects on the environment which could potentially lead to various public health problems. The County of Hawai'i therefore requires solid waste to be removed from any building or premise and disposed of at an approved solid waste disposal facility.

Quantities of solid waste were estimated for both construction and occupancy phases of the planned development. The "construction phase" of development is anticipated to begin in 2008 and completed in 2020. The "occupancy phase" of development refers to the time at which all facilities have been constructed and are open for use. The construction and occupancy phases are expected to overlap, as construction of later portions of the Keahuolu Affordable Housing project would continue while earlier portions are completed and occupied.

CONSTRUCTION PHASE

The construction of the proposed project is anticipated to start in 2008 and continue for 12 years until 2020. Projected building floor areas were used to estimate the amount of solid waste generated during construction (Tables 2-1 and 2-2). A range of 3.0 to 5.2 pounds (lbs) of construction waste per square foot (ft^2) of building floor area was used to estimate the amount of solid waste generated by construction activities.

TABLE 2-1: BUILDING FLOOR AREA

Building	Area (ft^2)
Multifamily	400 – 1,500 Use Average: 1,000
Single-family	1,000 – 2,000 Use Average: 1,500
Commercial/retail	197,000
School	8,700

TABLE 2-2: CONSTRUCTION WASTE GENERATION PROJECTIONS

Year	Construction Waste (tons/year)		
	Concept A	Concept B	Concept C
2008	525 – 910	525 – 910	450 – 780
2009	1,050 – 1,820	1,050 – 1,820	900 – 1,560
2010	1,050 – 1,820	1,050 – 1,820	900 – 1,560
2011	658 – 1,141	1,063 – 1,843	913 – 1,583
2012	358 – 621	1,063 – 1,843	913 – 1,583
2013	0	1,050 – 1,820	900 – 1,560
2014	0	585 – 1,014	900 – 1,560
2015	0	60 – 104	795 – 1,378
2016	150 – 260	150 – 260	495 – 858
2017	150 – 260	150 – 260	150 – 260
2018	146 – 252	146 – 252	146 – 252
2019	146 – 252	146 – 252	146 – 252
2020	0	0	0

Note:
1. All calculations are based on (3.0 lbs/ft^2) x (area of building) x (number of buildings constructed/year) to (5.2 lbs/ft^2) x (area of building) x (number of buildings constructed/year).
2. Pounds were multiplied by 5 x 10 $^{-4}$ (or 1/2000) to convert to tons.
3. See Appendix A for supporting calculations.

Shown below in Table 2-3 is an estimate of the components of construction waste based upon its typical composition. Tables 2-4A, 2-4B and 2-4C are estimates of the construction waste for the development plan concepts, the composition of construction waste is an estimate as the waste composition would vary according to the material selected for construction (See Appendix A for supporting calculations).

TABLE 2-3: CONSTRUCTION WASTE COMPOSITION

Waste Type	Percent of of Total Waste [1]	100 Percent of Total Waste [2]
Wood	40.4-43.3	41.9
Drywall	23.1-33.3	28.2
Cardboard	3.3-9.6	6.5
Metal	0.7-2.5	1.6
Other [4]	16.7-25.0	21.9
Total	84.2-113.7	100

Notes:
1. HABiT, 2000.
2. Converted "Percent of Total Waste" to 100 percent by taking the average of the range.
3. Calculations based on annual waste generated. See Appendix A for supporting calculations.
4. Composed of plastics, shingles, ceramic, etc.

TABLE 2-4A: CONSTRUCTION WASTE COMPOSITION – CONCEPT A

Year	Construction Waste Type (tons/year)					
	Wood	Drywall	Cardboard	Metal	Other [1]	Total
2008	220 - 381	148 - 257	34 - 59	8 - 15	115 - 199	525 – 910
2009	440 - 763	296 - 513	68 - 118	17 - 29	230 - 399	1,050 – 1,820
2010	440 - 763	296 - 513	68 - 118	17 - 29	230 - 399	1,050 – 1,820
2011	276 - 478	186 - 322	43 - 74	11 - 18	144 - 250	658 – 1,141
2012	150 - 260	101 - 175	23 - 40	6 - 10	78 - 136	358 – 621
2013	0	0	0	0	0	0
2014	0	0	0	0	0	0
2015	0	0	0	0	0	0
2016	63 - 109	42 - 73	10 - 17	2 - 4	33 - 57	150 – 260
2017	63 - 109	42 - 73	10 - 17	2 - 4	33 - 57	150 – 260
2018	61 - 106	41 - 71	9 - 16	2 - 4	32 - 55	146 - 252
2019	61 - 106	41 - 71	9 - 16	2 - 4	32 - 55	146 - 252
2020	0	0	0	0	0	0

TABLE 2-4B: CONSTRUCTION WASTE COMPOSITION – CONCEPT B

Year	Construction Waste Type (tons/year)					
	Wood	Drywall	Cardboard	Metal	Other [1]	Total
2008	220 - 381	148 - 257	34 - 59	8 - 15	115 - 199	525 – 910
2009	440 - 763	296 - 513	68 - 118	17 - 29	230 - 399	1,050 – 1,820
2010	440 - 763	296 - 513	68 - 118	17 - 29	230 - 399	1,050 – 1,820
2011	445 - 772	300 - 520	69 - 120	17 - 29	233 - 404	1,063 – 1,843
2012	445 - 772	300 - 520	69 - 120	17 - 29	233 - 404	1,063 – 1,843
2013	440 - 763	296 - 513	68 - 118	17 - 29	230 - 399	1,050 – 1,820
2014	245 - 425	165 - 286	38 - 66	9 - 16	28 – 222	585 – 1,014
2015	25 - 44	17 - 29	4 - 7	1 - 2	13 - 23	60 - 104
2016	63 - 109	42 - 73	10 - 17	2 - 4	33 - 57	150 – 260
2017	63 - 109	42 - 73	10 - 17	2 - 4	33 - 57	150 – 260
2018	61 - 106	41 - 71	9 - 16	2 - 4	32 - 55	146 - 252
2019	61 - 106	41 - 71	9 - 16	2 - 4	32 - 55	146 - 252
2020	0	0	0	0	0	0

Notes:
1. Composed of plastics, shingles, ceramic, etc.
2 See Appendix A for supporting calculations.

TABLE 2-4C: CONSTRUCTION WASTE COMPOSITION – CONCEPT C

Year	Construction Waste Type (tons/year)					
	Wood	Drywall	Cardboard	Metal	Other [1]	Total
2008	189 - 327	127 - 220	29 - 51	7 - 12	99 - 71	450 - 780
2009	377 - 654	254 - 440	59 - 101	14 - 25	197 - 342	900 – 1,560
2010	377 - 654	254 - 440	59 - 101	14 - 25	197 - 342	900 – 1,560
2011	383 - 663	257 - 446	59 - 103	15 - 25	200 - 347	913 – 1,583
2012	383 - 663	257 - 446	59 - 103	15 - 25	200 - 347	913 – 1,583
2013	377 - 654	254 - 440	59 - 101	14 - 25	197 - 342	900 – 1,560
2014	377 - 654	254 - 440	59 - 101	14 - 25	197 - 342	900 – 1,560
2015	333 - 577	224 - 389	52 - 90	13 - 22	174 - 302	795 – 1,378
2016	207 - 360	140 - 242	32 - 56	8 - 14	108 – 188	495 - 858
2017	63 - 109	42 - 73	10 - 17	2 - 4	33 - 57	150 – 260
2018	61 - 106	41 - 71	9 - 16	2 - 4	32 - 55	146 - 252
2019	61 - 106	41 - 71	9 - 16	2 - 4	32 - 55	146 - 252
2020	0	0	0	0	0	0

Notes:
1. Composed of plastics, shingles, ceramic, etc.
2 See Appendix A for supporting calculations.

OCCUPANCY PHASE

The Keahuolu Affordable Housing project is anticipated to begin its occupancy phase in 2010 and increase continuously until full occupancy is achieved in 2020. During the occupancy phase, solid waste quantities are a function of population. Therefore, the population during the occupancy phase was estimated based upon the following considerations:

- An average of 4 persons per single family unit.
- An average of 2.8 persons per multifamily unit
- 620 students, faculty and staff at the school facility
  - Students, faculty and staff are at the school only 42% of the day
  - Daily population = 260 persons
- 197,000 square feet of commercial / retail
  - 30 to 60 square feet / person for stores (per 1997 Uniform Building Code)
  - 100 square feet / person for office (per 1997 Uniform Building Code)
  - Use 72 square feet / person with 42% occupancy during the day
  - 100,000 square feet daily population = 583 persons
  - 97,000 square feet daily population = 566 persons
- Solid waste generation rate of 6.2 pounds per person per day.

Shown below in Tables 2-5A, 2-5B or 2-5C are population estimates as well as the anticipated amount of solid waste generated during the operations phase for development concepts A, B or C, respectively.

TABLE 2-5A: POPULATIONS AND WASTE GENERATION RATES – CONCEPT A

Year	Average Daily Population	Daily Waste Generated (lbs/day) [1]	Annual Waste Generated (tons/year) [2]
2010	960	5,952	1,086
2011	1,920	11,904	2,172
2012	2,880	17,856	3,259
2013	3,596	22,295	4,069
2014	3,596	22,295	4,069
2015	3,596	22,295	4,069
2016	3,596	22,295	4,069
2017	3,596	22,295	4,069
2018	4,180	25,916	4,730
2019	4,180	25,916	4,730
2020 and Beyond	4,746	29,425	5,370

Notes:
1. Calculation based on (6.2 lbs./person/day) x (total average per day population). See Appendix A for supporting calculations.
2. Calculation based on (daily waste generation) x (365 days) x (1/2000 tons/lb.). See Appendix A for supporting calculations.

TABLE 2-5B: POPULATIONS AND WASTE GENERATION RATES – CONCEPT B

Year	Average Daily Population	Daily Waste Generated (lbs/day) [1]	Annual Waste Generated (tons/year) [2]
2010	960	5,952	1,086
2011	1,920	11,904	2,172
2012	2,880	17,856	3,259
2013	4,100	25,420	4,639
2014	5,060	31,372	5,725
2015	6,020	37,324	6,812
2016	6,132	38,018	6,938
2017	6,132	38,018	6,938
2018	6,716	41,639	7,599
2019	6,716	41,639	7,599
2020 and Beyond	7,282	45,148	8,240

TABLE 2-5C: POPULATIONS AND WASTE GENERATION RATES – CONCEPT C

Year	Average Daily Population	Daily Waste Generated (lbs/day) [1]	Annual Waste Generated (tons/year) [2]
2010	840	5,208	950
2011	1,680	10,416	1,901
2012	2,520	15,624	2,851
2013	3,620	22,444	4,096
2014	4,460	27,652	5,046
2015	5,300	32,860	5,997
2016	6,140	38,068	6,947
2017	6,784	42,061	7,676
2018	7,368	45,682	8,337
2019	7,368	45,682	8,337
2020 and Beyond	7,934	49,191	8,977

Notes:
1. Calculation based on (6.2 lbs./person/day) x (total average per day population). See Appendix A for supporting calculations.
2. Calculation based on (daily waste generation) x (365 days) x (1/2000 tons/lb.). See Appendix A for supporting calculations.

The composition of wastes generated during the occupancy phase of the Keahuolu Affordable Housing project is based upon the 1993 Hawai'i Integrated Solid Waste Management Plan as well as a 2003 Oahu Waste Composition Study. Table 2-6 includes waste composition proportions and Tables 2-7A, 2-7B or 2-7C provides a yearly breakdown of the waste composition anticipated at the Keahuolu project for development concepts A, B or C, respectively. Management of these wastes is discussed in the following section.

TABLE 2-6: OCCUPANCY WASTE COMPOSITION

Waste Type	Percent of Total Waste[1]
Paper	16.7
Yard Waste	12.5
Food Waste	8.4
Plastic	4.4
Other Organic	21.5
Metals	13.1
Glass	1.6
Other Inorganic	21.8
Total	**100.0**

Notes:
1. 1993 County of Hawai'i Integrated Solid Waste Management Plan, 2003 Oahu Waste Composition Study

TABLE 2-7A: OCCUPANCY WASTE COMPOSITION – CONCEPT A

Year	Occupancy Waste (tons/year)								
	Paper	Yard	Food	Plastic	Other Organic	Metals	Glass	Other Inorganic	Total
2010	181	136	91	48	233	142	17	237	**1,086**
2011	363	272	182	96	467	285	35	473	**2,172**
2012	544	407	274	143	701	427	52	710	**3,259**
2013	680	509	342	179	875	533	65	887	**4,069**
2014	680	509	342	179	875	533	65	887	**4,069**
2015	680	509	342	179	875	533	65	887	**4,069**
2016	680	509	342	179	875	533	65	887	**4,069**
2017	680	509	342	179	875	533	65	887	**4,069**
2018	790	591	397	208	1,017	620	76	1,031	**4,730**
2019	790	591	397	208	1,017	620	76	1,031	**4,730**
2020	897	671	451	236	1,155	703	86	1,171	**5,370**

Notes:
1. Calculation based on (annual waste generated from Table 2-5A) x ("Percent of Total Waste" from Table 2-6).

TABLE 2-7B: OCCUPANCY WASTE COMPOSITION – CONCEPT B

Year	Occupancy Waste (tons/year)								
	Paper	Yard	Food	Plastic	Other Organic	Metals	Glass	Other Inorganic	Total
2010	181	136	91	48	233	142	17	237	**1,086**
2011	363	272	182	96	467	285	35	473	**2,172**
2012	544	407	274	143	701	427	52	710	**3,259**
2013	775	580	390	204	997	608	74	1,011	**4,639**
2014	956	716	481	252	1,231	750	92	1,248	**5,725**
2015	1,138	852	572	300	1,465	892	109	1,485	**6,812**
2016	1,159	867	583	305	1,492	909	111	1,512	**6,938**
2017	1,159	867	583	305	1,492	909	111	1,512	**6,938**
2018	1,269	950	638	334	1,634	995	122	1,657	**7,599**
2019	1,269	950	638	334	1,634	995	122	1,657	**7,599**
2020	1,376	1,030	692	363	1,772	1,079	132	1,796	**8,240**

Notes:
1. Calculation based on (annual waste generated from Table 2-5B) x ("Percent of Total Waste" from Table 2-6).

TABLE 2-7C: OCCUPANCY WASTE COMPOSITION – CONCEPT C

Year	Occupancy Waste (tons/year)								
	Paper	Yard	Food	Plastic	Other Organic	Metals	Glass	Other Inorganic	Total
2010	159	119	80	42	204	124	15	207	**950**
2011	317	238	160	84	409	249	30	414	**1,901**
2012	476	356	239	125	613	373	46	622	**2,851**
2013	684	512	344	180	881	537	66	893	**4,096**
2014	843	631	424	222	1,085	661	81	1,100	**5,046**
2015	1,001	750	504	264	1,289	786	96	1,307	**5,997**
2016	1,160	868	584	306	1,494	910	111	1,514	**6,947**
2017	1,282	960	645	338	1,650	1,006	123	1,673	**7,676**
2018	1,392	1,042	700	367	1,792	1,092	133	1,817	**8,337**
2019	1,392	1,042	700	367	1,792	1,092	133	1,817	**8,337**
2020	1,499	1,122	754	395	1,930	1,176	144	1,957	**8,977**

Notes:
1. Calculation based on (annual waste generated from Table 2-5C) x ("Percent of Total Waste" from Table 2-6).

SOLID WASTE MANAGEMENT

Emphasis for the management of solid wastes generated by the Keahuolu Affordable Housing project would be placed on waste diversion and recycling. Solid wastes would be managed in conformance with the applicable Department of Health and County requirements. The landfill nearest to the Keahuolu project is the West Hawai'i Landfill at Pu'uanahulu. Since the County of Hawai'i does not provide waste collection services, recycle and disposal of construction and occupancy wastes generated would be hauled by private contractors or individuals. Specific arrangements for construction and occupancy wastes would be made closer to the project beginning. Recyclables and wastes would be managed in a centralized system or by private individuals, and hauled directly to recycling centers, transfer stations and the landfill.

Although West Hawai'i is located in an area where the annual precipitation does not often exceed the amount of evapotranspiration (water lost to the atmosphere by evaporation and transpiration), all waste should avoid contact with water as best as possible. Waste that comes into contact with water before being hauled to the landfill may result in leachate (liquid produced when water percolates through any permeable material) at the landfill. Leachate could contaminate both ground and surface water, which may lead to various environmental and health problems as well as the degradation of local amenities. It can best be managed by daily covering of all waste to minimize the amount of water percolation.

CONSTRUCTION PHASE

As shown in Table 2-2, approximately 146 – 1,820 tons/year, 60 – 1,843 tons/year or 146 – 1,583 ton/year of construction waste would be generated for development concepts A, B or C, respectively, during the construction of the Keahuolu Affordable Housing project from 2008 to 2019.

The primary method of reducing (or mitigating) the amount of construction waste to be hauled offsite would be recycling. The following items or materials would be recycled to the extent practicable: green waste (processed and used on site), wood waste (processed with green waste when practical, depending on type of wood and ability to chip, and used on site), cardboard (recycled off site), and metals (recycled off site). The remaining categories of wastes (i.e., drywall, other) may be recycled if a local recycling vendor is available. Otherwise, these non-recyclable wastes would be hauled to the landfill. The construction waste composition that may be diverted or recycled is shown in Table 3-1 and Tables 3-2A, 3-2B or 3-2C provides a yearly breakdown of the waste composition for the development concepts, A, B or C, respectively. According to the estimated waste composition information, approximately 73 – 910 tons/year, 30 – 922 tons/year or 73 – 792 tons/year of construction wastes could be recycled for development concepts A, B or C, respectively. The remaining 50% would likely be hauled to the landfill.

TABLE 3-1: WASTE COMPOSITION
DIVERTED OR RECYCLED CONSTRUCTION WASTE

Waste Type	Percent of Total Waste[1]	100 Percent of Total Waste[2]
Wood	40.4-43.3	41.9
Cardboard	3.3-9.6	6.5
Metal	0.7-2.5	1.6
Total	44.4-55.4	49.9

Notes:
1. HABiT, 2000.
2. Converted "Percent of Total Waste" to 100 percent by taking the average of the range.

TABLE 3-2A: DIVERTED OR RECYCLED CONSTRUCTION WASTE COMPOSITION – CONCEPT A

Year	Diverted or Recycled Construction Waste (tons/year)			
	Wood	Cardboard	Metal	Total
2008	220 - 381	34 - 59	8 - 15	**263 – 455**
2009	440 - 763	68 - 118	17 - 29	**525 – 910**
2010	440 - 763	68 - 118	17 - 29	**525 – 910**
2011	276 - 478	43 - 74	11 - 18	**329 – 571**
2012	150 - 260	23 - 40	6 - 10	**179 – 311**
2013	0	0	0	**0**
2014	0	0	0	**0**
2015	0	0	0	**0**
2016	63 - 109	10 - 17	2 - 4	**75 – 130**
2017	63 - 109	10 - 17	2 - 4	**75 – 130**
2018	61 - 106	9 - 16	2 - 4	**73 – 126**
2019	61 - 106	9 - 16	2 - 4	**73 – 126**
2020	0	0	0	**0**

Notes:
1. See Table 2-4A and Appendix A for supporting calculations.

TABLE 3-2B: DIVERTED OR RECYCLED CONSTRUCTION WASTE COMPOSITION – CONCEPT B

Year	Diverted or Recycled Construction Waste (tons/year)			
	Wood	Cardboard	Metal	Total
2008	220 - 381	34 - 59	8 - 15	**263 – 455**
2009	440 - 763	68 - 118	17 - 29	**525 – 910**
2010	440 - 763	68 - 118	17 - 29	**525 – 910**
2011	445 - 772	69 - 120	17 - 29	**532 – 922**
2012	445 - 772	69 - 120	17 - 29	**532 – 922**
2013	440 - 763	68 - 118	17 - 29	**525 – 910**
2014	245 - 425	38 - 66	9 - 16	**293 – 507**
2015	25 - 44	4 - 7	1 - 2	**30 – 52**
2016	63 - 109	10 - 17	2 - 4	**75 – 130**
2017	63 - 109	10 - 17	2 - 4	**75 – 130**
2018	61 - 106	9 - 16	2 - 4	**73 – 126**
2019	61 - 106	9 - 16	2 - 4	**73 – 126**
2020	0	0	0	**0**

Notes:
1. See Table 2-4B and Appendix A for supporting calculations.

TABLE 3-2C: DIVERTED OR RECYCLED CONSTRUCTION WASTE COMPOSITION – CONCEPT C

Year	Diverted or Recycled Construction Waste (tons/year)			
	Wood	Cardboard	Metal	Total
2008	189 - 327	29 - 51	7 - 12	**225 – 390**
2009	377 - 654	59 - 101	14 - 25	**450 – 780**
2010	377 - 654	59 - 101	14 - 25	**450 – 780**
2011	383 - 663	59 - 103	15 - 25	**457 – 792**
2012	383 - 663	59 - 103	15 - 25	**457 – 792**
2013	377 - 654	59 - 101	14 - 25	**450 – 780**
2014	377 - 654	59 - 101	14 - 25	**450 – 780**
2015	333 - 577	52 - 90	13 - 22	**398 – 689**
2016	207 - 360	32 - 56	8 - 14	**248 – 429**
2017	63 - 109	10 - 17	2 - 4	**75 – 130**
2018	61 - 106	9 - 16	2 - 4	**73 – 126**
2019	61 - 106	9 - 16	2 - 4	**73 – 126**
2020	0	0	0	**0**

Notes:
1. See Table 2-4C and Appendix A for supporting calculations.

OCCUPANCY PHASE

The primary method of reducing (or mitigating) the amount of occupancy waste to be hauled offsite is recycling. To the extent practicable, the planned development would arrange for green waste (e.g., yard waste) generated during grounds keeping be collected and processed for use as soil amendment on the site. Wastes that cannot be incorporated into green waste processing on site would be minimized, and recycled or hauled to the landfill as appropriate. Future arrangements for recycling collection (aluminum, paper, newspaper, glass, and plastic containers) in building areas, and waste hauling for the remainder of waste that is not readily recyclable, would be made. The wastes associated with commercial / retail activities would also be recycled (likely to include cardboard, paper, glass, and plastic containers). Specialized materials associated with grounds keeping (e.g., pesticides and fertilizers) would be used according to accepted practices (i.e., pesticide rinsate would be used as product, and fertilizer would be used up or incorporated into green waste processing at the site). Specialized materials associated with maintenance and industrial activities (e.g., motor oil and solvents) would be recycled when possible or disposed according to accepted practices for the County of Hawai'i.

The anticipated recycled waste composition for the occupancy is shown in Table 3-3 and Tables 3-4A, 3-4B or 3-4C provides a yearly breakdown of the recycled waste for the development concepts, A, B or C, respectively. Hawai'i County's recycling rate is approximately 25.8 percent (County of Hawai'i – Solid Waste Disposal Summary 2006 - 2006). Based on the Keahuolu Affordable Housing project having a recycling rate equivalent to that measured by Hawai'i County, 1,385 tons, 2,126 tons or 2,316 tons of the total occupancy waste would be diverted or recycled for development concepts A, B or C, respectively. All other organic and inorganic categories of waste would likely be hauled to the landfill. Contracts with private recyclers and waste haulers would be developed to achieve these ends. In addition, green waste would be processed and used on site as soil amendment to the extent practical. Processing of green waste may involve chipping and passive composting of organic waste, resulting in soil amendment for use at the Keahuolu Affordable Housing project.

TABLE 3-3: WASTE COMPOSITION
DIVERTED OR RECYCLED OCCUPANCY WASTE

Waste Type	Percent of Total Waste[1]
Paper	16.7
Yard Waste	12.5
Plastic	4.4
Metals	13.1
Glass	1.6
Total Recyclable	**48.3**
Total Diverted Waste	**25.8**

Notes:
1. 1993 County of Hawai'i Integrated Solid Waste Management Plan, 2003 Oahu Waste Composition Study

TABLE 3-4A: DIVERTED OR RECYCLED OCCUPANCY WASTE COMPOSITION – CONCEPT A

Year	Occupancy Waste (tons/year)						
	Paper	Yard	Plastic	Metals	Glass	Total Recyclable	Total Diverted Waste [2]
2010	181	136	48	142	17	525	**280**
2011	363	272	96	285	35	1,049	**560**
2012	544	407	143	427	52	1,574	**841**
2013	680	509	179	533	65	1,965	**1,050**
2014	680	509	179	533	65	1,965	**1,050**
2015	680	509	179	533	65	1,965	**1,050**
2016	680	509	179	533	65	1,965	**1,050**
2017	680	509	179	533	65	1,965	**1,050**
2018	790	591	208	620	76	2,285	**1,220**
2019	790	591	208	620	76	2,285	**1,220**
2020	897	671	236	703	86	2,594	**1,385**

Notes:
1. Occupancy waste type (paper, yard, plastic, metals and glass) are referenced from Table 2-7A.
2. Calculation based on (annual waste generated from Table 2-7A) x (25.8 percent recycle rate).

TABLE 3-4B: DIVERTED OR RECYCLED OCCUPANCY WASTE COMPOSITION – CONCEPT B

Year	Occupancy Waste (tons/year)						
	Paper	Yard	Plastic	Metals	Glass	Total Recyclable	Total Diverted Waste [2]
2010	181	136	48	142	17	525	**280**
2011	363	272	96	285	35	1,049	**560**
2012	544	407	143	427	52	1,574	**841**
2013	775	580	204	608	74	2,241	**1,197**
2014	956	716	252	750	92	2,765	**1,477**
2015	1,138	852	300	892	109	3,290	**1,757**
2016	1,159	867	305	909	111	3,351	**1,790**
2017	1,159	867	305	909	111	3,351	**1,790**
2018	1,269	950	334	995	122	3,670	**1,961**
2019	1,269	950	334	995	122	3,670	**1,961**
2020	1,376	1,030	363	1,079	132	3,980	**2,126**

Notes:
1. Occupancy waste type (paper, yard, plastic, metals and glass) are referenced from Table 2-7B.
2. Calculation based on (annual waste generated from Table 2-7B) x (25.8 percent recycle rate).

TABLE 3-4C: DIVERTED OR RECYCLED OCCUPANCY WASTE COMPOSITION – CONCEPT C

Year	Occupancy Waste (tons/year)						
	Paper	Yard	Plastic	Metals	Glass	Total Recyclable	Total Diverted Waste [2]
2010	159	119	42	124	15	459	**245**
2011	317	238	84	249	30	918	**490**
2012	476	356	125	373	46	1,377	**736**
2013	684	512	180	537	66	1,978	**1,057**
2014	843	631	222	661	81	2,437	**1,302**
2015	1,001	750	264	786	96	2,897	**1,547**
2016	1,160	868	306	910	111	3,355	**1,792**
2017	1,282	960	338	1,006	123	3,708	**1,980**
2018	1,392	1,042	367	1,092	133	4,027	**2,151**
2019	1,392	1,042	367	1,092	133	4,027	**2,151**
2020	1,499	1,122	395	1,176	144	4,336	**2,316**

Notes:
1. Occupancy waste type (paper, yard, plastic, metals and glass) are referenced from Table 2-7C.
2. Calculation based on (annual waste generated from Table 2-7C) x (25.8 percent recycle rate).

SUMMARY

Based on the estimated waste generation rates for construction and occupancy at the Keahuolu Affordable Housing project and the solid waste management plans for waste diversion through minimization and recycling of materials, estimated waste diversion and landfilling generation are shown in Tables 4-1A, 4-1B or 4-1C for development concepts A, B or C, respectively.

TABLE 4-1A: SUMMARY OF WASTE DIVERTED AND LANDFILLED – CONCEPT A

Year	Construction Waste				Occupancy Waste				Total Diverted Waste (tons/yr)	Total Landfilled Waste (tons/yr)
	Diverted		Landfilled		Diverted		Landfilled			
	Waste[1] (tons/yr)	# Trucks per week[2]	Waste[3] (tons/yr)	# Trucks per week[2]	Waste[4] (tons/yr)	# Trucks per week[2]	Waste[5] (tons/yr)	# Trucks per week[2]		
2008	263-455	0.5-0.9	262-455	0.5-0.9	0	0	0	0	**263-455**	**262-455**
2009	525-910	1.0-1.8	525-910	1.0-1.8	0	0	0	0	**525-910**	**525-910**
2010	525-910	1.0-1.8	525-910	1.0-1.8	280	0.5	806	1.6	**805-1,190**	**1,331-1,716**
2011	329-571	0.6-1.1	329-570	0.6-1.1	560	1.1	1,612	3.1	**889-1,131**	**1,941-2,182**
2012	179-311	0.3-0.6	179-310	0.3-0.6	841	1.6	2,418	4.7	**1,020-1,152**	**2,597-2,728**
2013	0	0	0	0	1,050	2.0	3,019	5.8	**1,050**	**3,019**
2014	0	0	0	0	1,050	2.0	3,019	5.8	**1,050**	**3,019**
2015	0	0	0	0	1,050	2.0	3,019	5.8	**1,050**	**3,019**
2016	75-130	0.1-0.3	75-130	0.1-0.3	1,050	2.0	3,019	5.8	**1,125-1,180**	**3,094-3,149**
2017	75-130	0.1-0.3	75-130	0.1-0.3	1,050	2.0	3,019	5.8	**1,125-1,180**	**3,094-3,149**
2018	73-126	0.1-0.2	73-126	0.1-0.2	1,220	2.3	3,510	6.8	**1,293-1,346**	**3,583-3,636**
2019	73-126	0.1-0.2	73-126	0.1-0.2	1,220	2.3	3,510	6.8	**1,293-1,346**	**3,583-3,636**
2020 +	0	0	0	0	1,385	2.7	3,985	7.7	**1,385**	**3,985**

Notes:

1. *Diverted waste (tons/year) is waste that would be recycled. Values from total diverted construction waste (Table 3-2A).*
2. *Calculation based on 10-ton capacity for trucks that pick up waste.*
3. *Calculation based on total construction waste (Table 2-4A) – total diverted construction waste (Table 3-2A).*
4. *Diverted waste is waste that would be recycled. Values from total diverted occupancy waste (Table 3-4A).*
5. *Calculation based on total occupancy waste (Table 2-7A) – total diverted occupancy waste (Table 3-4A).*
6. *See Appendix A for supporting calculations.*

TABLE 4-1B: SUMMARY OF WASTE DIVERTED AND LANDFILLED – CONCEPT B

Year	Construction Waste				Occupancy Waste				Total Diverted Waste (tons/yr)	Total Landfilled Waste (tons/yr)
	Diverted		Landfilled		Diverted		Landfilled			
	Waste[1] (tons/yr)	# Trucks per week[2]	Waste[3] (tons/yr)	# Trucks per week[2]	Waste[4] (tons/yr)	# Trucks per week[2]	Waste[5] (tons/yr)	# Trucks per week[2]		
2008	263-455	0.5-0.9	262-455	0.5-0.9	0	0	0	0	**263-455**	**262-455**
2009	525-910	1.0-1.8	525-910	1.0-1.8	0	0	0	0	**525-910**	**525-910**
2010	525-910	1.0-1.8	525-910	1.0-1.8	280	0.5	806	1.6	**805-1,190**	**1,331-1,716**
2011	532-922	1.0-1.8	531-921	1.0-1.8	560	1.1	1,612	3.1	**1,092-1,482**	**2,143-2,533**
2012	532-922	1.0-1.8	531-921	1.0-1.8	841	1.6	2,418	4.7	**1,373-1,763**	**2,949-3,339**
2013	525-910	1.0-1.8	525-910	1.0-1.8	1,197	2.3	3,442	6.6	**1,722-2,107**	**3,967-4,352**
2014	293-507	0.6-1.0	292-507	0.6-1.0	1,477	2.8	4,248	8.2	**1,770-1,984**	**4,540-4,755**
2015	30-52	0.1-0.1	30-52	0.1-0.1	1,757	3.4	5,055	9.7	**1,787-1,809**	**5,085-5,107**
2016	75-130	0.1-0.3	75-130	0.1-0.3	1,790	3.4	5,148	9.9	**1,865-1,920**	**5,223-5,278**
2017	75-130	0.1-0.3	75-130	0.1-0.3	1,790	3.4	5,148	9.9	**1,865-1,920**	**5,223-5,278**
2018	73-126	0.1-0.2	73-126	0.1-0.2	1,961	3.8	5,638	10.8	**2,034-2,087**	**5,711-5,764**
2019	73-126	0.1-0.2	73-126	0.1-0.2	1,961	3.8	5,638	10.8	**2,034-2,087**	**5,711-5,764**
2020 +	0	0	0	0	2,126	4.1	6,114	11.8	**2,126**	**6,114**

Notes:

1. *Diverted waste (tons/year) is waste that would be recycled. Values from total diverted construction waste (Table 3-2B).*
2. *Calculation based on 10-ton capacity for trucks that pick up waste.*
3. *Calculation based on total construction waste (Table 2-4B) – total diverted construction waste (Table 3-2B).*
4. *Diverted waste is waste that would be recycled. Values from total diverted occupancy waste (Table 3-4B).*
5. *Calculation based on total occupancy waste (Table 2-7B) – total diverted occupancy waste (Table 3-4B).*
6. *See Appendix A for supporting calculations.*

TABLE 4-1C: SUMMARY OF WASTE DIVERTED AND LANDFILLED – CONCEPT C

Year	Construction Waste				Occupancy Waste				Total Diverted Waste (tons/yr)	Total Landfilled Waste (tons/yr)
	Diverted		Landfilled		Diverted		Landfilled			
	Waste[1] (tons/yr)	# Trucks per week[2]	Waste[3] (tons/yr)	# Trucks per week[2]	Waste[4] (tons/yr)	# Trucks per week[2]	Waste[5] (tons/yr)	# Trucks per week[2]		
2008	225-390	0.4-0.8	225-390	0.4-0.8	0	0	0	0	**225-390**	**225-390**
2009	450-780	0.9-1.5	450-780	0.9-1.5	0	0	0	0	**450-780**	**450-780**
2010	450-780	0.9-1.5	450-780	0.9-1.5	245	0.5	705	1.4	**695-1,025**	**1,155-1,485**
2011	457-792	0.9-1.5	456-791	0.9-1.5	490	0.9	1,411	2.7	**947-1,282**	**1,867-2,202**
2012	457-792	0.9-1.5	456-791	0.9-1.5	736	1.4	2,115	4.1	**1,193-1,528**	**2,571-2,906**
2013	450-780	0.9-1.5	450-780	0.9-1.5	1,057	2.0	3,039	5.8	**1,507-1,837**	**3,489-3,819**
2014	450-780	0.9-1.5	450-780	0.9-1.5	1,302	2.5	3,744	7.2	**1,752-2,082**	**4,194-4,524**
2015	398-689	0.8-1.3	397-689	0.8-1.3	1,547	3.0	4,450	8.6	**1,945-2,236**	**4,847-5,139**
2016	248-429	0.5-0.8	247-429	0.5-0.8	1,792	3.4	5,155	9.9	**2,040-2,221**	**5,402-5,584**
2017	75-130	0.1-0.3	75-130	0.1-0.3	1,980	3.8	5,696	11.0	**2,055-2,110**	**5,771-5,826**
2018	73-126	0.1-0.2	73-126	0.1-0.2	2,151	4.1	6,186	11.9	**2,224-2,277**	**6,259-6,312**
2019	73-126	0.1-0.2	73-126	0.1-0.2	2,151	4.1	6,186	11.9	**2,224-2,277**	**6,259-6,312**
2020 +	0	0	0	0	2,316	4.5	6,661	12.8	**2,316**	**6,661**

Notes:

1. *Diverted waste (tons/year) is waste that would be recycled. Values from total diverted construction waste (Table 3-2C).*
2. *Calculation based on 10-ton capacity for trucks that pick up waste.*
3. *Calculation based on total construction waste (Table 2-4C) – total diverted construction waste (Table 2-2C).*
4. *Diverted waste is waste that would be recycled. Values from total diverted occupancy waste (Table 3-4C).*
5. *Calculation based on total occupancy waste (Table 2-7C) – total diverted occupancy waste (Table 3-4C).*
6. *See Appendix A for supporting calculations.*

Trucks would most likely be used to haul construction and occupancy waste to either a local recycling vendor, for diverted waste, or to the West Hawai'i Landfill, for landfilled waste. For construction waste the number of trucks is expected to be on an on-call basis, meaning that less than one truck per week to three trucks per week would be required for both diverted and landfilled waste. For occupancy waste the number of trucks is expected to be a set schedule varying from two to about 18 trucks per week for both diverted and landfilled waste. The truck route to the West Hawai'i Landfill would most likely be from the project down Kealakehe Parkway and along Queen Kaahumanu Highway. The truck route to the local recycling vendor (anticipated to be Atlas Recycling Center in Kona town) would most likely be from the project down Kealakehe Parkway to Queen Kaahumanu Highway, Malakala Boulevard, Luhia Street, Kaiwi Street and Pawai Place.

According to the 2002 Updated Integrated Solid Waste Management Plan for the County of Hawai'i, the Pu'uanahulu Landfill is estimated to have 12 million cubic yards of air space which is enough to accommodate the waste generated by West Hawaii for approximately the next 40 years. In 2000, approximately 90,000 tons of waste was deposited at this landfill. Using this quantity of waste, the annual percent waste increase to the West Hawai'i Landfill from the Keahuolu Affordable Housing project were estimated in Table 4-2. The full-build out annual occupancy landfill waste percentage of the annual West Hawaii Landfill waste would be estimated to be 4.43%, 6,79% or 7.40% for the development concepts A, B or C, respectively.

TABLE 4-2: KEAHUOLU AFFORDABLE HOUSING PROJECT
WASTE GENERATION IMPACT ON WEST HAWAI`I LANDFILL

Year	Percent Annual Waste Increase to Landfill[1]		
	Concept A	Concept B	Concept C
2008	0.29 – 0.51	0.29 – 0.51	0.25 – 0.43
2009	0.58 – 1.01	0.58 – 1.01	0.50 – 0.87
2010	1.48 – 1.91	1.48 – 1.91	1.28 – 1.65
2011	2.16 – 2.42	2.38 – 2.81	2.07 – 2.45
2012	2.89 – 3.03	3.28 – 3.71	2.86 – 3.23
2013	3.35	4.41 – 4.84	3.88 – 4.24
2014	3.35	5.04 – 5.28	4.66 – 5.03
2015	3.35	5.65 – 5.67	5.39 – 5.71
2016	3.44 – 3.50	5.80 – 5.86	6.00 – 6.20
2017	3.44 – 3.50	5.80 – 5.86	6.41 – 6.47
2018	3.98 – 4.04	6.35 – 6.40	6.95 – 7.01
2019	3.98 – 4.04	6.35 – 6.40	3.95 – 7.01
2020	4.43	6.79	7.40

Notes:
Calculation based on [(total Landfilled Waste from Tables 4-1A, 4-1B or 4-1C) / (90,000 tons/year)] x 100 percent.

It should be noted that the objectives for waste diversion for both construction and operations at the Keahuolu Affordable Housing project are based upon the assumption that private companies in the vicinity of the development can be contracted to either directly recycle materials on the island of Hawai'i or to economically ship materials to recycling markets elsewhere in Hawai'i, the U.S. mainland, or international countries. If recycling vendors are not immediately available for all materials intended to be recycled, some of these materials may be hauled to the landfill.

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APPENDIX A – CALCULATIONS

Construction Waste Generation - Concept A

Year	Building Type	Number	Building Area (sf)	Construction Waste (tons/year)	
2008	Multifamily	200	200,000	525	min.
	Single Family	100	150,000	910	max.
2009	Multifamily	400	400,000	1,050	min.
	Single Family	200	300,000	1,820	max.
2010	Multifamily	400	400,000	1,050	min.
	Single Family	200	300,000	1,820	max.
2011	Multifamily	400	400,000	658	min.
	Single Family	20	30,000	1,141	max.
	School		8,700		
2012	Multifamily	200	200,000	358	min.
	Single Family	20	30,000	621	max.
	School		8,700		
2013					
2014					
2015					
2016	Commercial/Retail		100,000	150	min.
				260	max.
2017	Commercial/Retail		100,000	150	min.
				260	max.
2018	Commercial/Retail		97,000	146	min.
				252	max.
2019	Commercial/Retail		97,000	146	min.
				252	max.
2020					

Multifamily	1000	square feet	
Single Family	1500	square feet	
Construction Waste	3	lbs / ft^2	min.
Construction Waste	5.2	lbs / ft^2	max.

Construction Waste Generation - Concept B

Year	Building Type	Number	Building Area (sf)	Construction Waste (tons/year)	
2008	Multifamily	200	200,000	525	min.
	Single Family	100	150,000	910	max.
2009	Multifamily	400	400,000	1,050	min.
	Single Family	200	300,000	1,820	max.
2010	Multifamily	400	400,000	1,050	min.
	Single Family	200	300,000	1,820	max.
2011	Multifamily	400	400,000	1,063	min.
	Single Family	200	300,000	1,843	max.
	School		8,700		
2012	Multifamily	400	400,000	1,063	min.
	Single Family	200	300,000	1,843	max.
	School		8,700		
2013	Multifamily	400	400,000	1,050	min.
	Single Family	200	300,000	1,820	max.
2014	Multifamily	240	240,000	585	min.
	Single Family	100	150,000	1,014	max.
2015	Multifamily	40	40,000	60	min.
	Single Family	0	0	104	max.
2016	Commercial/Retail		100,000	150	min.
				260	max.
2017	Commercial/Retail		100,000	150	min.
				260	max.
2018	Commercial/Retail		97,000	146	min.
				252	max.
2019	Commercial/Retail		97,000	146	min.
				252	max.
2020					

Multifamily	1000	square feet	
Single Family	1500	square feet	
Construction Waste	3	lbs / ft^2	min.
Construction Waste	5.2	lbs / ft^2	max.

Notes:

All calculations are based on (3.0 lbs/ft^2) x (area of building) x (number of buildings constructed/year). Pounds were multiplied by 5 x 10^{-4} (or 1/2000) to convert to tons.

Construction Waste Generation - Concept C

Year	Building Type	Number	Building Area (sf)	Construction Waste (tons/year)	
2008	Multifamily	300	300,000	450	min.
	Single Family	0	0	780	max.
2009	Multifamily	600	600,000	900	min.
	Single Family	0	0	1,560	max.
2010	Multifamily	600	600,000	900	min.
	Single Family	0	0	1,560	max.
2011	Multifamily	600	600,000	913	min.
	Single Family	0	0	1,583	max.
	School		8,700		
2012	Multifamily	600	600,000	913	min.
	Single Family	0	0	1,583	max.
	School		8,700		
2013	Multifamily	600	600,000	900	min.
	Single Family	0	0	1,560	max.
2014	Multifamily	600	600,000	900	min.
	Single Family	0	0	1,560	max.
2015	Multifamily	530	530,000	795	min.
	Single Family	0	0	1,378	max.
2016	Multifamily	230	230,000	495	min.
	Single Family	0	0	858	max.
	Commercial/Retail		100,000		
2017	Commercial/Retail		100,000	150	min.
				260	max.
2018	Commercial/Retail		97,000	146	min.
				252	max.
2019	Commercial/Retail		97,000	146	min.
				252	max.
2020					

Multifamily	1000	square feet	
Single Family	1500	square feet	
Construction Waste	3	lbs / ft^2	min.
Construction Waste	5.2	lbs / ft^2	max.

Notes:

All calculations are based on (3.0 lbs/ft^2) x (area of building) x (number of buildings constructed/year). Pounds were multiplied by 5 x 10^{-4} (or 1/2000) to convert to tons.

Construction Waste Composition - Concept A

Year	Construction Waste (tons/year)	Wood (tons/year)	Drywall (tons/year)	Cardboard (tons/year)	Metal (tons/year)	Other (tons/year)
2008	525	220	148	34	8	115
	910	381	257	59	15	199
2009	1,050	440	296	68	17	230
	1,820	763	513	118	29	399
2010	1,050	440	296	68	17	230
	1,820	763	513	118	29	399
2011	658	276	186	43	11	144
	1,141	478	322	74	18	250
2012	358	150	101	23	6	78
	621	260	175	40	10	136
2013	0	0	0	0	0	0
	0	0	0	0	0	0
2014	0	0	0	0	0	0
	0	0	0	0	0	0
2015	0	0	0	0	0	0
	0	0	0	0	0	0
2016	150	63	42	10	2	33
	260	109	73	17	4	57
2017	150	63	42	10	2	33
	260	109	73	17	4	57
2018	146	61	41	9	2	32
	252	106	71	16	4	55
2019	146	61	41	9	2	32
	252	106	71	16	4	55
2020						

	Wood	Drywall	Cardboard	Metal	Other
Waste Composition:	41.9%	28.2%	6.5%	1.6%	21.9%

Construction Waste Composition - Concept B

Year	Construction Waste (tons/year)	Wood (tons/year)	Drywall (tons/year)	Cardboard (tons/year)	Metal (tons/year)	Other (tons/year)
2008	525	220	148	34	8	115
	910	381	257	59	15	199
2009	1,050	440	296	68	17	230
	1,820	763	513	118	29	399
2010	1,050	440	296	68	17	230
	1,820	763	513	118	29	399
2011	1,063	445	300	69	17	233
	1,843	772	520	120	29	404
2012	1,063	445	300	69	17	233
	1,843	772	520	120	29	404
2013	1,050	440	296	68	17	230
	1,820	763	513	118	29	399
2014	585	245	165	38	9	128
	1,014	425	286	66	16	222
2015	60	25	17	4	1	13
	104	44	29	7	2	23
2016	150	63	42	10	2	33
	260	109	73	17	4	57
2017	150	63	42	10	2	33
	260	109	73	17	4	57
2018	146	61	41	9	2	32
	252	106	71	16	4	55
2019	146	61	41	9	2	32
	252	106	71	16	4	55
2020						

	Wood	Drywall	Cardboard	Metal	Other
Waste Composition:	41.9%	28.2%	6.5%	1.6%	21.9%

Construction Waste Composition - Concept C

Year	Construction Waste (tons/year)	Wood (tons/year)	Drywall (tons/year)	Cardboard (tons/year)	Metal (tons/year)	Other (tons/year)
2008	450	189	127	29	7	99
	780	327	220	51	12	171
2009	900	377	254	59	14	197
	1,560	654	440	101	25	342
2010	900	377	254	59	14	197
	1,560	654	440	101	25	342
2011	913	383	257	59	15	200
	1,583	663	446	103	25	347
2012	913	383	257	59	15	200
	1,583	663	446	103	25	347
2013	900	377	254	59	14	197
	1,560	654	440	101	25	342
2014	900	377	254	59	14	197
	1,560	654	440	101	25	342
2015	795	333	224	52	13	174
	1,378	577	389	90	22	302
2016	495	207	140	32	8	108
	858	360	242	56	14	188
2017	150	63	42	10	2	33
	260	109	73	17	4	57
2018	146	61	41	9	2	32
	252	106	71	16	4	55
2019	146	61	41	9	2	32
	252	106	71	16	4	55
2020						

	Wood	Drywall	Cardboard	Metal	Other
Waste Composition:	41.9%	28.2%	6.5%	1.6%	21.9%

Occupancy Waste Generation - Concept A

Year	Building Type	Number	Population	Waste Generated	
				Daily (lbs/day)	Annual (tons/yr)
2010	Multifamily	200	560	3,472	
	Single Family	100	400	2,480	1,086
	Total		960	5,952	
2011	Multifamily	400	1,120	6,944	
	Single Family	200	800	4,960	2,172
	Total		1,920	11,904	
2012	Multifamily	600	1,680	10,416	
	Single Family	300	1,200	7,440	3,259
	Total		2,880	17,856	
2013	Multifamily	620	1,736	10,763	
	Single Family	400	1,600	9,920	4,069
	School	1	260	1,612	
	Total		3,596	22,295	
2014	Multifamily	620	1,736	10,763	
	Single Family	400	1,600	9,920	4,069
	School	1	260	1,612	
	Total		3,596	22,295	
2015	Multifamily	620	1,736	10,763	
	Single Family	400	1,600	9,920	4,069
	School	1	260	1,612	
	Total		3,596	22,295	
2016	Multifamily	620	1,736	10,763	
	Single Family	400	1,600	9,920	4,069
	School	1	260	1,612	
	Total		3,596	22,295	
2017	Multifamily	620	1,736	10,763	
	Single Family	400	1,600	9,920	4,069
	School	1	260	1,612	
	Total		3,596	22,295	
2018	Multifamily	620	1,736	10,763	
	Single Family	400	1,600	9,920	
	School	1	260	1,612	4,730
	Commercial/Retail	100,000	584	3,621	
	Total		4,180	25,916	
2019	Multifamily	620	1,736	10,763	
	Single Family	400	1,600	9,920	
	School	1	260	1,612	4,730
	Commercial/Retail	100,000	584	3,621	
	Total		4,180	25,916	
2020	Multifamily	620	1,736	10,763	
	Single Family	400	1,600	9,920	
	School	1	260	1,612	5,370
	Commercial/Retail	197,000	1,150	7,130	
	Total		4,746	29,425	

Multifamily		2.8	persons / unit
Single Family		4	persons / unit
School	620 students/faculty/staff at the school for 42% of the day		
		260	persons
Commercial/Retail	30 to 60 sf/person for stores (per 1997 UBC)		
	100 sf/person for office (per 1997 UBC)		
	Use 72 sf/person for 42% of the day		
		0.005833	persons/sf
Waste Generation		6.2	lbs/person/day

Occupancy Waste Generation - Concept B

Year	Building Type	Number	Population	Waste Generated	
				Daily (lbs/day)	Annual (tons/yr)
2010	Multifamily	200	560	3,472	
	Single Family	100	400	2,480	1,086
	Total		960	5,952	
2011	Multifamily	400	1,120	6,944	
	Single Family	200	800	4,960	2,172
	Total		1,920	11,904	
2012	Multifamily	600	1,680	10,416	
	Single Family	300	1,200	7,440	3,259
	Total		2,880	17,856	
2013	Multifamily	800	2,240	13,888	
	Single Family	400	1,600	9,920	4,639
	School	1	260	1,612	
	Total		4,100	25,420	
2014	Multifamily	1,000	2,800	17,360	
	Single Family	500	2,000	12,400	5,725
	School	1	260	1,612	
	Total		5,060	31,372	
2015	Multifamily	1,200	3,360	20,832	
	Single Family	600	2,400	14,880	6,812
	School	1	260	1,612	
	Total		6,020	37,324	
2016	Multifamily	1,240	3,472	21,526	
	Single Family	600	2,400	14,880	6,938
	School	1	260	1,612	
	Total		6,132	38,018	
2017	Multifamily	1,240	3,472	21,526	
	Single Family	600	2,400	14,880	6,938
	School	1	260	1,612	
	Total		6,132	38,018	
2018	Multifamily	1,240	3,472	21,526	
	Single Family	600	2,400	14,880	
	School	1	260	1,612	7,599
	Commercial/Retail	100,000	584	3,621	
	Total		6,716	41,639	
2019	Multifamily	1,240	3,472	21,526	
	Single Family	600	2,400	14,880	
	School	1	260	1,612	7,599
	Commercial/Retail	100,000	584	3,621	
	Total		6,716	41,639	
2020	Multifamily	1,240	3,472	21,526	
	Single Family	600	2,400	14,880	
	School	1	260	1,612	8,240
	Commercial/Retail	197,000	1,150	7,130	
	Total		7,282	45,148	

Multifamily		2.8	persons / unit
Single Family		4	persons / unit
School	620 students/faculty/staff at the school for 42% of the day		
		260	persons
Commercial/Retail	30 to 60 sf/person for stores (per 1997 UBC)		
	100 sf/person for office (per 1997 UBC)		
	Use 72 sf/person for 42% of the day		
		0.005833	persons/sf
Waste Generation		6.2	lbs/person/day

Occupancy Waste Generation - Concept C

Year	Building Type	Number	Population	Waste Generated	
				Daily (lbs/day)	Annual (tons/yr)
2010	Multifamily	300	840	5,208	950
	Single Family	0	0	0	
	Total		840	5,208	
2011	Multifamily	600	1,680	10,416	1,901
	Single Family	0	0	0	
	Total		1,680	10,416	
2012	Multifamily	900	2,520	15,624	2,851
	Single Family	0	0	0	
	Total		2,520	15,624	
2013	Multifamily	1,200	3,360	20,832	4,096
	Single Family	0	0	0	
	School	1	260	1,612	
	Total		3,620	22,444	
2014	Multifamily	1,500	4,200	26,040	5,046
	Single Family	0	0	0	
	School	1	260	1,612	
	Total		4,460	27,652	
2015	Multifamily	1,800	5,040	31,248	5,997
	Single Family	0	0	0	
	School	1	260	1,612	
	Total		5,300	32,860	
2016	Multifamily	2,100	5,880	36,456	6,947
	Single Family	0	0	0	
	School	1	260	1,612	
	Total		6,140	38,068	
2017	Multifamily	2,330	6,524	40,449	7,676
	Single Family	0	0	0	
	School	1	260	1,612	
	Total		6,784	42,061	
2018	Multifamily	2,330	6,524	40,449	8,337
	Single Family	0	0	0	
	School	1	260	1,612	
	Commercial/Retail	100,000	584	3,621	
	Total		7,368	45,682	
2019	Multifamily	2,330	6,524	40,449	8,337
	Single Family	0	0	0	
	School	1	260	1,612	
	Commercial/Retail	100,000	584	3,621	
	Total		7,368	45,682	
2020	Multifamily	2,330	6,524	40,449	8,977
	Single Family	0	0	0	
	School	1	260	1,612	
	Commercial/Retail	197,000	1,150	7,130	
	Total		7,934	49,191	

Multifamily		2.8	persons / unit
Single Family		4	persons / unit
School	620 students/faculty/staff at the school for 42% of the day		
		260	persons
Commercial/Retail	30 to 60 sf/person for stores (per 1997 UBC)		
	100 sf/person for office (per 1997 UBC)		
	Use 72 sf/person for 42% of the day		
		0.005833	persons/sf
Waste Generation		6.2	lbs/person/day

Occupancy Waste Composition - Concept A

Year	Occupancy Waste (tons/year)								
	Paper	Yard	Food	Plastic	Other Organic	Metals	Glass	Inorganic	Total
2010	181	136	91	48	233	142	17	237	1,086
2011	363	272	182	96	467	285	35	473	2,172
2012	544	407	274	143	701	427	52	710	3,259
2013	680	509	342	179	875	533	65	887	4,069
2014	680	509	342	179	875	533	65	887	4,069
2015	680	509	342	179	875	533	65	887	4,069
2016	680	509	342	179	875	533	65	887	4,069
2017	680	509	342	179	875	533	65	887	4,069
2018	790	591	397	208	1,017	620	76	1,031	4,730
2019	790	591	397	208	1,017	620	76	1,031	4,730
2020	897	671	451	236	1,155	703	86	1,171	5,370
Waste Composition	16.7%	12.5%	8.4%	4.4%	21.5%	13.1%	1.6%	21.8%	100.0%

Occupancy Waste Composition - Concept B

Year	Occupancy Waste (tons/year)								
	Paper	Yard	Food	Plastic	Other Organic	Metals	Glass	Inorganic	Total
2010	181	136	91	48	233	142	17	237	1,086
2011	363	272	182	96	467	285	35	473	2,172
2012	544	407	274	143	701	427	52	710	3,259
2013	775	580	390	204	997	608	74	1,011	4,639
2014	956	716	481	252	1,231	750	92	1,248	5,725
2015	1,138	852	572	300	1,465	892	109	1,485	6,812
2016	1,159	867	583	305	1,492	909	111	1,512	6,938
2017	1,159	867	583	305	1,492	909	111	1,512	6,938
2018	1,269	950	638	334	1,634	995	122	1,657	7,599
2019	1,269	950	638	334	1,634	995	122	1,657	7,599
2020	1,376	1,030	692	363	1,772	1,079	132	1,796	8,240
Waste Composition	16.7%	12.5%	8.4%	4.4%	21.5%	13.1%	1.6%	21.8%	100.0%

Occupancy Waste Composition - Concept C

Year	Occupancy Waste (tons/year)								
	Paper	Yard	Food	Plastic	Other Organic	Metals	Glass	Inorganic	Total
2010	159	119	80	42	204	124	15	207	950
2011	317	238	160	84	409	249	30	414	1,901
2012	476	356	239	125	613	373	46	622	2,851
2013	684	512	344	180	881	537	66	893	4,096
2014	843	631	424	222	1,085	661	81	1,100	5,046
2015	1,001	750	504	264	1,289	786	96	1,307	5,997
2016	1,160	868	584	306	1,494	910	111	1,514	6,947
2017	1,282	960	645	338	1,650	1,006	123	1,673	7,676
2018	1,392	1,042	700	367	1,792	1,092	133	1,817	8,337
2019	1,392	1,042	700	367	1,792	1,092	133	1,817	8,337
2020	1,499	1,122	754	395	1,930	1,176	144	1,957	8,977
Waste Composition	16.7%	12.5%	8.4%	4.4%	21.5%	13.1%	1.6%	21.8%	100.0%

Construction Waste - Diverted or Recycled - Concept A

Year	Construction Waste (tons/year)	Wood (tons/year)	Cardboard (tons/year)	Metal (tons/year)	Total (tons/year)
2008	525	220	34	8	263
	910	381	59	15	455
2009	1,050	440	68	17	525
	1,820	763	118	29	910
2010	1,050	440	68	17	525
	1,820	763	118	29	910
2011	658	276	43	11	329
	1,141	478	74	18	571
2012	358	150	23	6	179
	621	260	40	10	311
2013	0	0	0	0	0
	0	0	0	0	0
2014	0	0	0	0	0
	0	0	0	0	0
2015	0	0	0	0	0
	0	0	0	0	0
2016	150	63	10	2	75
	260	109	17	4	130
2017	150	63	10	2	75
	260	109	17	4	130
2018	146	61	9	2	73
	252	106	16	4	126
2019	146	61	9	2	73
	252	106	16	4	126
2020					

	Wood	Cardboard	Metal	Other
Waste Composition:	41.9%	6.5%	1.6%	49.9%

Construction Waste - Diverted or Recycled - Concept B

Year	Construction Waste (tons/year)	Wood (tons/year)	Cardboard (tons/year)	Metal (tons/year)	Total (tons/year)
2008	525	220	34	8	263
	910	381	59	15	455
2009	1,050	440	68	17	525
	1,820	763	118	29	910
2010	1,050	440	68	17	525
	1,820	763	118	29	910
2011	1,063	445	69	17	532
	1,843	772	120	29	922
2012	1,063	445	69	17	532
	1,843	772	120	29	922
2013	1,050	440	68	17	525
	1,820	763	118	29	910
2014	585	245	38	9	293
	1,014	425	66	16	507
2015	60	25	4	1	30
	104	44	7	2	52
2016	150	63	10	2	75
	260	109	17	4	130
2017	150	63	10	2	75
	260	109	17	4	130
2018	146	61	9	2	73
	252	106	16	4	126
2019	146	61	9	2	73
	252	106	16	4	126
2020					

		Wood	Cardboard	Metal	Total
Recycled Waste	Waste Composition:	41.9%	6.5%	1.6%	49.9%

Construction Waste - Diverted or Recycled - Concept C

Year	Construction Waste (tons/year)	Wood (tons/year)	Cardboard (tons/year)	Metal (tons/year)	Total (tons/year)
2008	450	189	29	7	225
	780	327	51	12	390
2009	900	377	59	14	450
	1,560	654	101	25	780
2010	900	377	59	14	450
	1,560	654	101	25	780
2011	913	383	59	15	457
	1,583	663	103	25	792
2012	913	383	59	15	457
	1,583	663	103	25	792
2013	900	377	59	14	450
	1,560	654	101	25	780
2014	900	377	59	14	450
	1,560	654	101	25	780
2015	795	333	52	13	398
	1,378	577	90	22	689
2016	495	207	32	8	248
	858	360	56	14	429
2017	150	63	10	2	75
	260	109	17	4	130
2018	146	61	9	2	73
	252	106	16	4	126
2019	146	61	9	2	73
	252	106	16	4	126
2020					

	Wood	Cardboard	Metal	Other
Waste Composition:	41.9%	6.5%	1.6%	21.9%

Occupancy Waste Composition - Diverted or Recycled - Concept A

Year	Occupancy Waste (tons/year)							
	Paper	Yard	Plastic	Metals	Glass	Total Recyclable	Total Diverted	Total Waste
2010	181	136	48	142	17	525	280	1,086
2011	363	272	96	285	35	1,049	560	2,172
2012	544	407	143	427	52	1,574	841	3,259
2013	680	509	179	533	65	1,965	1,050	4,069
2014	680	509	179	533	65	1,965	1,050	4,069
2015	680	509	179	533	65	1,965	1,050	4,069
2016	680	509	179	533	65	1,965	1,050	4,069
2017	680	509	179	533	65	1,965	1,050	4,069
2018	790	591	208	620	76	2,285	1,220	4,730
2019	790	591	208	620	76	2,285	1,220	4,730
2020	897	671	236	703	86	2,594	1,385	5,370

Waste Composition

16.7%	12.5%	4.4%	13.1%	1.6%	48.3%	25.8%

Occupancy Waste Composition - Diverted or Recycled - Concept B

Year	Occupancy Waste (tons/year)							
	Paper	Yard	Plastic	Metals	Glass	Total Recyclable	Total Diverted	Total Waste
2010	181	136	48	142	17	525	280	1,086
2011	363	272	96	285	35	1,049	560	2,172
2012	544	407	143	427	52	1,574	841	3,259
2013	775	580	204	608	74	2,241	1,197	4,639
2014	956	716	252	750	92	2,765	1,477	5,725
2015	1,138	852	300	892	109	3,290	1,757	6,812
2016	1,159	867	305	909	111	3,351	1,790	6,938
2017	1,159	867	305	909	111	3,351	1,790	6,938
2018	1,269	950	334	995	122	3,670	1,961	7,599
2019	1,269	950	334	995	122	3,670	1,961	7,599
2020	1,376	1,030	363	1,079	132	3,980	2,126	8,240

Waste Composition

16.7%	12.5%	4.4%	13.1%	1.6%	48.3%	25.8%

Occupancy Waste Composition - Diverted or Recycled - Concept C

Year	Occupancy Waste (tons/year)							
	Paper	Yard	Plastic	Metals	Glass	Total Recyclable	Total Diverted	Total Waste
2010	159	119	42	124	15	459	245	950
2011	317	238	84	249	30	918	490	1,901
2012	476	356	125	373	46	1,377	736	2,851
2013	684	512	180	537	66	1,978	1,057	4,096
2014	843	631	222	661	81	2,437	1,302	5,046
2015	1,001	750	264	786	96	2,897	1,547	5,997
2016	1,160	868	306	910	111	3,355	1,792	6,947
2017	1,282	960	338	1,006	123	3,708	1,980	7,676
2018	1,392	1,042	367	1,092	133	4,027	2,151	8,337
2019	1,392	1,042	367	1,092	133	4,027	2,151	8,337
2020	1,499	1,122	395	1,176	144	4,336	2,316	8,977

Waste Composition

16.7%	12.5%	4.4%	13.1%	1.6%	48.3%	25.8%

Summary of Waste Diverted and Landfilled - Concept A

Year	Construction Waste				Occupancy Waste				Total Diverted Waste (tons/year)	Total Landfilled Waste (tons/yr)
	Diverted		Landfilled		Diverted		Landfilled			
	Waste (tons/yr)	# Trucks per week	Waste (tons/yr)	# Trucks per week	Waste (tons/yr)	# Trucks per week	Waste (tons/yr)	# Trucks per week		
2008	263	0.5	262	0.5	0	0.0	0	0.0	263	262
	455	0.9	455	0.9					455	455
2009	525	1.0	525	1.0	0	0.0	0	0.0	525	525
	910	1.8	910	1.8					910	910
2010	525	1.0	525	1.0	280	0.5	806	1.6	805	1,331
	910	1.8	910	1.8					1,190	1,716
2011	329	0.6	329	0.6	560	1.1	1,612	3.1	889	1,941
	571	1.1	570	1.1					1,131	2,182
2012	179	0.3	179	0.3	841	1.6	2,418	4.7	1,020	2,597
	311	0.6	310	0.6					1,152	2,728
2013	0	0.0	0	0.0	1,050	2.0	3,019	5.8	1,050	3,019
	0	0.0	0	0.0					1,050	3,019
2014	0	0.0	0	0.0	1,050	2.0	3,019	5.8	1,050	3,019
	0	0.0	0	0.0					1,050	3,019
2015	0	0.0	0	0.0	1,050	2.0	3,019	5.8	1,050	3,019
	0	0.0	0	0.0					1,050	3,019
2016	75	0.1	75	0.1	1,050	2.0	3,019	5.8	1,125	3,094
	130	0.3	130	0.3					1,180	3,149
2017	75	0.1	75	0.1	1,050	2.0	3,019	5.8	1,125	3,094
	130	0.3	130	0.3					1,180	3,149
2018	73	0.1	73	0.1	1,220	2.3	3,510	6.8	1,293	3,583
	126	0.2	126	0.2					1,346	3,636
2019	73	0.1	73	0.1	1,220	2.3	3,510	6.8	1,293	3,583
	126	0.2	126	0.2					1,346	3,636
2020	0	0.0	0	0.0	1,385	2.7	3,985	7.7	1,385	3,985
	0	0.0	0	0.0					1,385	3,985

Company Pacific Waste **Phone:** **(808) 882-7295** **Contact Info:** Rich Truax (Sales Manager)
Construction Truck Volume: 20'x8'x7' (LxWxH) = 41.5 CY (Max Load is 10 tons) email: richtruax@pacificwasteinc.com
Operations Bin Volume: 72"x43"x45" (LxWxH) = 3 CY Use Truck Capacity: 10 tons / truck

Summary of Waste Diverted and Landfilled - Concept B

Year	Construction Waste				Occupancy Waste				Total Diverted Waste (tons/year)	Total Landfilled Waste (tons/yr)
	Diverted		Landfilled		Diverted		Landfilled			
	Waste (tons/yr)	# Trucks per week	Waste (tons/yr)	# Trucks per week	Waste (tons/yr)	# Trucks per week	Waste (tons/yr)	# Trucks per week		
2008	263	0.5	262	0.5	0	0.0	0	0.0	263	262
	455	0.9	455	0.9					455	455
2009	525	1.0	525	1.0	0	0.0	0	0.0	525	525
	910	1.8	910	1.8					910	910
2010	525	1.0	525	1.0	280	0.5	806	1.6	805	1,331
	910	1.8	910	1.8					1,190	1,716
2011	532	1.0	531	1.0	560	1.1	1,612	3.1	1,092	2,143
	922	1.8	921	1.8					1,482	2,533
2012	532	1.0	531	1.0	841	1.6	2,418	4.7	1,373	2,949
	922	1.8	921	1.8					1,763	3,339
2013	525	1.0	525	1.0	1,197	2.3	3,442	6.6	1,722	3,967
	910	1.8	910	1.8					2,107	4,352
2014	293	0.6	292	0.6	1,477	2.8	4,248	8.2	1,770	4,540
	507	1.0	507	1.0					1,984	4,755
2015	30	0.1	30	0.1	1,757	3.4	5,055	9.7	1,787	5,085
	52	0.1	52	0.1					1,809	5,107
2016	75	0.1	75	0.1	1,790	3.4	5,148	9.9	1,865	5,223
	130	0.3	130	0.3					1,920	5,278
2017	75	0.1	75	0.1	1,790	3.4	5,148	9.9	1,865	5,223
	130	0.3	130	0.3					1,920	5,278
2018	73	0.1	73	0.1	1,961	3.8	5,638	10.8	2,034	5,711
	126	0.2	126	0.2					2,087	5,764
2019	73	0.1	73	0.1	1,961	3.8	5,638	10.8	2,034	5,711
	126	0.2	126	0.2					2,087	5,764
2020	0	0.0	0	0.0	2,126	4.1	6,114	11.8	2,126	6,114
	0	0.0	0	0.0					2,126	6,114

Company Pacific Waste **Phone:** **(808) 882-7295** **Contact Info:** Rich Truax (Sales Manager)
Construction Truck Volume: 20'x8'x7' (LxWxH) = 41.5 CY (Max Load is 10 tons) email: richtruax@pacificwasteinc.com
Operations Bin Volume: 72"x43"x45" (LxWxH) = 3 CY Use Truck Capacity: 10 tons / truck

Summary of Waste Diverted and Landfilled - Concept C

Year	Construction Waste				Occupancy Waste				Total Diverted Waste (tons/year)	Total Landfilled Waste (tons/yr)
	Diverted		Landfilled		Diverted		Landfilled			
	Waste (tons/yr)	# Trucks per week	Waste (tons/yr)	# Trucks per week	Waste (tons/yr)	# Trucks per week	Waste (tons/yr)	# Trucks per week		
2008	225	0.4	225	0.4	0	0.0	0	0.0	225	225
	390	0.8	390	0.8					390	390
2009	450	0.9	450	0.9	0	0.0	0	0.0	450	450
	780	1.5	780	1.5					780	780
2010	450	0.9	450	0.9	245	0.5	705	1.4	695	1,155
	780	1.5	780	1.5					1,025	1,485
2011	457	0.9	456	0.9	490	0.9	1,411	2.7	947	1,867
	792	1.5	791	1.5					1,282	2,202
2012	457	0.9	456	0.9	736	1.4	2,115	4.1	1,193	2,571
	792	1.5	791	1.5					1,528	2,906
2013	450	0.9	450	0.9	1,057	2.0	3,039	5.8	1,507	3,489
	780	1.5	780	1.5					1,837	3,819
2014	450	0.9	450	0.9	1,302	2.5	3,744	7.2	1,752	4,194
	780	1.5	780	1.5					2,082	4,524
2015	398	0.8	397	0.8	1,547	3.0	4,450	8.6	1,945	4,847
	689	1.3	689	1.3					2,236	5,139
2016	248	0.5	247	0.5	1,792	3.4	5,155	9.9	2,040	5,402
	429	0.8	429	0.8					2,221	5,584
2017	75	0.1	75	0.1	1,980	3.8	5,696	11.0	2,055	5,771
	130	0.3	130	0.3					2,110	5,826
2018	73	0.1	73	0.1	2,151	4.1	6,186	11.9	2,224	6,259
	126	0.2	126	0.2					2,277	6,312
2019	73	0.1	73	0.1	2,151	4.1	6,186	11.9	2,224	6,259
	126	0.2	126	0.2					2,277	6,312
2020	0	0.0	0	0.0	2,316	4.5	6,661	12.8	2,316	6,661
	0	0.0	0	0.0					2,316	6,661

Company Pacific Waste **Phone:** **(808) 882-7295** **Contact Info:** Rich Truax (Sales Manager)
Construction Truck Volume: 20'x8'x7' (LxWxH) = 41.5 CY (Max Load is 10 tons) email: richtruax@pacificwasteinc.com
Operations Bin Volume: 72"x43"x45" (LxWxH) = 3 CY Use Truck Capacity: 10 tons / truck

Summary of Waste Diverted and Landfilled - Concept A

Year	Construction Waste		Occupancy Waste		Total Diverted Waste (tons/year)	Total Landfilled Waste (tons/yr)	Percent Annual Waste Increase to Landfill
	Diverted Waste (tons/yr)	Landfilled Waste (tons/yr)	Diverted Waste (tons/yr)	Landfilled Waste (tons/yr)			
2008	263	262	0	0	263	262	0.29%
	455	455			455	455	0.51%
2009	525	525	0	0	525	525	0.58%
	910	910			910	910	1.01%
2010	525	525	280	806	805	1,331	1.48%
	910	910			1,190	1,716	1.91%
2011	329	329	560	1,612	889	1,941	2.16%
	571	570			1,131	2,182	2.42%
2012	179	179	841	2,418	1,020	2,597	2.89%
	311	310			1,152	2,728	3.03%
2013	0	0	1,050	3,019	1,050	3,019	3.35%
	0	0			1,050	3,019	3.35%
2014	0	0	1,050	3,019	1,050	3,019	3.35%
	0	0			1,050	3,019	3.35%
2015	0	0	1,050	3,019	1,050	3,019	3.35%
	0	0			1,050	3,019	3.35%
2016	75	75	1,050	3,019	1,125	3,094	3.44%
	130	130			1,180	3,149	3.50%
2017	75	75	1,050	3,019	1,125	3,094	3.44%
	130	130			1,180	3,149	3.50%
2018	73	73	1,220	3,510	1,293	3,583	3.98%
	126	126			1,346	3,636	4.04%
2019	73	73	1,220	3,510	1,293	3,583	3.98%
	126	126			1,346	3,636	4.04%
2020	0	0	1,385	3,985	1,385	3,985	4.43%
	0	0			1,385	3,985	4.43%

Company Pacific Waste Phone: Rich Truax (Sales Manager)
Construction email: richtruax@pacificwasteinc.com
Operations Use Truck Capacity: 10 tons / truck

Summary of Waste Diverted and Landfilled - Concept B

Year	Construction Waste		Occupancy Waste		Total Diverted Waste (tons/year)	Total Landfilled Waste (tons/yr)	Percent Annual Waste Increase to Landfill
	Diverted Waste (tons/yr)	Landfilled Waste (tons/yr)	Diverted Waste (tons/yr)	Landfilled Waste (tons/yr)			
2008	263	262	0	0	263	262	0.29%
	455	455			455	455	0.51%
2009	525	525	0	0	525	525	0.58%
	910	910			910	910	1.01%
2010	525	525	280	806	805	1,331	1.48%
	910	910			1,190	1,716	1.91%
2011	532	531	560	1,612	1,092	2,143	2.38%
	922	921			1,482	2,533	2.81%
2012	532	531	841	2,418	1,373	2,949	3.28%
	922	921			1,763	3,339	3.71%
2013	525	525	1,197	3,442	1,722	3,967	4.41%
	910	910			2,107	4,352	4.84%
2014	293	292	1,477	4,248	1,770	4,540	5.04%
	507	507			1,984	4,755	5.28%
2015	30	30	1,757	5,055	1,787	5,085	5.65%
	52	52			1,809	5,107	5.67%
2016	75	75	1,790	5,148	1,865	5,223	5.80%
	130	130			1,920	5,278	5.86%
2017	75	75	1,790	5,148	1,865	5,223	5.80%
	130	130			1,920	5,278	5.86%
2018	73	73	1,961	5,638	2,034	5,711	6.35%
	126	126			2,087	5,764	6.40%
2019	73	73	1,961	5,638	2,034	5,711	6.35%
	126	126			2,087	5,764	6.40%
2020	0	0	2,126	6,114	2,126	6,114	6.79%
	0	0			2,126	6,114	6.79%

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Operations Use Truck Capacity: 10 tons / truck

Summary of Waste Diverted and Landfilled - Concept C

Year	Construction Waste		Occupancy Waste		Total Diverted Waste (tons/year)	Total Landfilled Waste (tons/yr)	Percent Annual Waste Increase to Landfill
	Diverted Waste (tons/yr)	Landfilled Waste (tons/yr)	Diverted Waste (tons/yr)	Landfilled Waste (tons/yr)			
2008	225	225	0	0	225	225	0.25%
	390	390			390	390	0.43%
2009	450	450	0	0	450	450	0.50%
	780	780			780	780	0.87%
2010	450	450	245	705	695	1,155	1.28%
	780	780			1,025	1,485	1.65%
2011	457	456	490	1,411	947	1,867	2.07%
	792	791			1,282	2,202	2.45%
2012	457	456	736	2,115	1,193	2,571	2.86%
	792	791			1,528	2,906	3.23%
2013	450	450	1,057	3,039	1,507	3,489	3.88%
	780	780			1,837	3,819	4.24%
2014	450	450	1,302	3,744	1,752	4,194	4.66%
	780	780			2,082	4,524	5.03%
2015	398	397	1,547	4,450	1,945	4,847	5.39%
	689	689			2,236	5,139	5.71%
2016	248	247	1,792	5,155	2,040	5,402	6.00%
	429	429			2,221	5,584	6.20%
2017	75	75	1,980	5,696	2,055	5,771	6.41%
	130	130			2,110	5,826	6.47%
2018	73	73	2,151	6,186	2,224	6,259	6.95%
	126	126			2,277	6,312	7.01%
2019	73	73	2,151	6,186	2,224	6,259	6.95%
	126	126			2,277	6,312	7.01%
2020	0	0	2,316	6,661	2,316	6,661	7.40%
	0	0			2,316	6,661	7.40%

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Operations Use Truck Capacity: 10 tons / truck