

# WAIHE`E STREAM FLOW SUMMARIES

EXHIBIT 1

**Waihe'e Stream Flow  
(1910-1917)  
USGS Station # 16614000 and # 16613000**

Waihe'e Stream Flow for 1910-1912 as calculated  
by adding the Stream Post-Diversion Flow to the Canal Flow<sup>1</sup>

in millions of gallons per day		1910												For the Year	
		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.		
Stream Post- Diversion	Max	--	--	--	--	--	--	--	--	--	--	--	140.00	249.00	249.00
	Min	--	--	--	--	--	--	--	--	--	--	--	0.00	0.00	0.00
	Mean	--	--	--	--	--	--	--	--	--	--	--	24.30	87.90	56.10
Canal	Max	--	--	--	--	--	--	--	--	--	--	--	42.00	52.00	52.00
	Min	--	--	--	--	--	--	--	--	--	--	--	25.00	0.00	0.00
	Mean	--	--	--	--	--	--	--	--	--	--	--	32.30	31.20	31.75
Total Flow		--	--	--	--	--	--	--	--	--	--	--	56.60	119.10	87.85

in millions of gallons per day		1911												For the Year
		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	
Stream Post- Diversion	Max	170.00	178.00	133.00	240.00	427.00	126.00	98.00	133.00	637.00	185.00	105.00	84.00	637.00
	Min	18.70	7.80	14.20	14.20	23.50	23.50	23.50	23.50	23.50	14.20	3.00	0.00	0.00
	Mean	95.70	54.00	41.40	80.80	93.10	67.90	46.10	61.00	106.00	33.50	37.60	13.60	60.80
Canal	Max	38.00	42.00	38.00	72.00	67.00	50.00	63.00	58.00	63.00	54.00	54.00	42.00	72.00
	Min	20.00	20.00	0.00	0.00	28.00	38.00	32.00	32.00	32.00	46.00	38.00	34.00	0.00
	Mean	31.70	33.30	28.10	26.60	50.00	40.70	47.60	41.90	54.00	53.30	45.00	37.40	40.80
Total Flow		127.40	87.30	69.50	107.40	143.10	168.60	93.70	102.90	60.00	86.80	82.60	51.00	101.60

**Waihe'e Stream Flow  
(1910-1917)  
USGS Station # 16614000 and # 16613000**

Waihe'e Stream Flow for 1910-1912 as calculated  
by adding the Stream Post-Diversion Flow to the Canal Flow<sup>1</sup>

in millions of gallons per day		1912												For the Year
		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	
Stream Post Diversion	Max	7.80	98.00	185.00	281.00	78.00	98.00	273.00	46.00	14.20	46.00	170.00	126.00	281.00
	Min	0.00	0.00	3.00	18.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Mean	0.97	19.00	46.50	64.60	14.80	15.20	24.90	6.72	0.95	9.05	25.20	10.90	19.90
Canal	Max	--	--	--	--	--	--	--	--	--	--	--	--	--
	Min	--	--	--	--	--	--	--	--	--	--	--	--	--
	Mean	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Flow	Max	--	--	--	--	--	--	--	--	--	--	--	--	--
	Min	--	--	--	--	--	--	--	--	--	--	--	--	--
	Mean	--	--	--	--	--	--	--	--	--	--	--	--	--

<sup>1</sup> "Stream post-diversion" data from Territorial Planning Board, Surface Water Resources of the Territory of Hawaii, 1901-1938 (1939) ("Surface Water Resources") at 219. Data originally collected by USGS station called "Waihe'e Stream At Dam Near Waihe'e, Maui" in W. Martin & C. Pierce, USGS, Water Resources of Hawaii, 1909-1911 (1913) ("Martin & Pierce") at 199, and identified as Station No. 16614000 in Fontaine, USGS, Evaluation of the Surface Water Quality, Surface-Water Quality, and Rainfall Data-Collection Programs in Hawaii, 1994 (1996) ("Fontaine") at 94. "[R]ecords at this point show only the amount of water passing down the main stream after Waihe'e canal has been supplied." Martin & Pierce at 199.

"Canal" data from Surface Water Resources at 219. Data originally collected by station called "Waihe'e Canal Near Waihe'e, Maui" in Martin & Pierce at 202, and identified as Station No. 16613000 in Fontaine at 94.

As explained in Martin & Pierce at 202, "[t]he discharge at [canal] station added to that of the station on Waihe'e Stream at the dam gives the total discharge of Waihe'e Stream."

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**Waihe'e Stream Flow  
(1910-1917)  
USGS Station # 16612000**

Waihe'e Stream Flow for 1913-1917 as measured  
by the USGS gage located above all diversions.<sup>2</sup>

in millions of gallons per day		1913												For the Year (9 months)
		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	
Waihe'e Stream	Max	--	--	--	204.00	73.00	204.00	92.00	122.00	105.00	32.00	302.00	377.00	377.00
	Min	--	--	--	21.00	28.00	28.00	28.00	24.00	26.00	25.00	25.00	27.00	21.00
	Mean	--	--	--	49.30	44.00	49.50	45.30	36.60	32.70	26.90	63.80	50.90	45.30

in millions of gallons per day		1914												For the Year
		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	
Waihe'e Stream	Max	185.00	43.00	81.00	156.00	283.00	318.00	106.00	124.00	403.00	318.00	306.00	163.00	403.00
	Min	28.00	28.00	26.00	26.00	36.00	76.00	68.00	83.00	90.00	83.00	76.00	50.00	26.00
	Mean	48.50	30.90	30.90	61.10	88.30	118.00	86.60	94.70	185.00	113.00	115.00	86.40	87.45

in millions of gallons per day		1915										For the Year (10 months)		
		Jan.	Feb.	Mar.	Apr. (19 days)	May	Jun.	Jul. (18 days)	Aug.	Sept. (19 days)	Oct. (20 days)		Nov.	Dec. (12 days)
Waihe'e Stream	Max	115.00	226.00	124.00	248.00	--	--	143.00	90.00	90.00	215.00	215.00	98.00	248.00
	Min	41.00	41.00	45.00	41.00	--	--	34.00	29.00	27.00	34.00	37.00	34.00	27.00
	Mean	49.60	77.90	58.30	75.40	--	--	57.20	40.20	43.20	77.80	79.40	50.60	57.75

**Waihe'e Stream Flow  
(1910-1917)  
USGS Station # 16612000**

Waihe'e Stream Flow for 1913-1917 as measured  
by the USGS gage located above all diversions<sup>2</sup>

in millions of gallons per day		1916												For the Year (335 days)
		Jan. (25 days)	Feb. (7 days)	Mar. (28 days)	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	
Waihe'e Stream	Max	553.00	112.00	244.00	183.00	470.00	151.00	95.00	224.00	75.00	102.00	26.00	284.00	553.00
	Min	41.00	40.00	36.00	36.00	58.00	58.00	42.00	42.00	38.00	38.00	38.00	38.00	36.00
	Mean	116.00	54.90	58.70	50.80	13.30	77.00	59.50	67.50	51.00	47.50	52.30	81.70	56.80

in millions of gallons per day		1917												For the Year (6 months)
		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	
Waihe'e Stream	Max	69.00	58.00	134.00	244.00	110.00	95.00	--	--	--	--	--	--	244.00
	Min	33.00	30.00	23.00	26.00	33.00	26.00	--	--	--	--	--	--	23.00
	Mean	41.10	34.60	44.30	48.50	44.40	41.70	--	--	--	--	--	--	48.50

<sup>2</sup> Territorial Planning Board, Surface Water Resources of the Territory of Hawaii 1901-1938 (1939) ("Surface Water Resources") at 218, N. Grover, Surface Water Supply of Hawaii July 1, 1913, to June 30, 1915 (1917) ("Grover") at 215-17, and N. Grover, Surface Water Supply of Hawaii July 1, 1915 to June 30, 1916 at 147-48. Data originally collected by USGS station called "Waihe'e Stream Near Waihe'e, Maui" (see, e.g., Grover at 215), and identified as Station No. 16612000 in Fontaine, USGS, Evaluation of the Surface-Water Quantity, Surface-Water Quality, and Rainfall Data-Collection Programs in Hawaii I, 1994 (1996) ("Fontaine") at 94.

Station located "[a]bout 300 feet above intake of Waihe'e Canal"; there were "[n]o diversions] above station." Grover at 215.

**Waihe`e Stream Flow  
(1910-1917)  
USGS Station # 16612000 and # 16613000**

Approximate baseflow  
of Waihe`e Stream for 1911-1917

in millions of gallons per day	<u>Q 90</u>	<u>Q75</u>	<u>Q50</u>
1911 post-diversion only	10 to 15	20 to 25	45 to 50
1912 post-diversion only	0 to 5	0 to 5	0 to 5
1913 (275 days) pre-diversion only	26 to 28	28 to 30	28 to 30
1914 pre-diversion only	30 to 35	45 to 50	80 to 100
1915 (239 days) pre-diversion only	35	40 to 45	50
1916 (335 days) pre-diversion only	35 to 40	40 to 45	50 to 60
1917 (181 days) pre-diversion only	26 to 30	35 to 40	35 to 40
Overall (1395 days) pre-diversion only	28 to 30	30 to 35	45 to 50

Data from Surface Water Resources at 218-19; see notes 1 and 2.

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**Waihe'e Stream Flow  
(1983-2002)  
USGS Station # 16614000**

Waihe'e Stream Monthly Mean Flow for 1983-2002<sup>5</sup>

in millions of gallons per day	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
1983	--	--	--	--	--	--	--	--	--	--	56.01	18.63
1984	49.81	51.74	32.11	44.90	31.78	28.04	35.40	29.78	21.25	17.70	23.77	20.22
1985	18.99	33.53	75.58	46.12	57.69	28.49	42.48	39.60	40.70	59.24	51.68	44.90
1986	38.11	31.65	102.07	92.33	86.56	74.94	57.88	59.17	37.40	57.88	61.11	-8.64
1987	55.81	52.39	36.50	59.37	92.38	76.23	65.89	47.42	41.67	52.20	90.44	70.41
1988	20.16	68.48	63.18	68.48	79.46	47.61	50.90	50.32	35.92	35.98	49.10	57.49
1989	40.89	41.28	62.66	178.30	64.60	58.66	83.33	63.18	54.88	52.20	29.07	31.65
1990	55.81	53.10	60.72	36.24	54.72	44.83	53.04	50.90	48.71	58.40	96.90	69.12
1991	47.61	41.09	79.46	45.80	37.27	42.89	61.05	64.34	51.16	38.18	32.36	50.97
1992	42.36	31.78	28.23	23.64	29.07	31.78	60.72	51.42	103.36	51.74	58.98	52.13
1993	34.04	27.33	51.10	52.78	43.09	39.28	73.64	59.88	48.51	54.13	60.14	51.29
1994	71.71	63.57	115.63	70.41	47.09	65.89	87.86	61.95	69.77	49.99	49.48	36.11
1995	47.35	30.56	33.46	43.48	34.88	38.50	56.01	47.87	33.20	42.44	45.61	32.62
1996	37.15	48.45	60.79	55.23	26.81	31.72	36.82	32.04	31.20	22.80	44.77	41.25
1997	49.92	28.29	47.35	41.34	49.81	38.08	67.18	39.99	37.86	31.85	70.41	64.60
1998	37.66	34.75	29.91	60.21	50.00	65.89	48.58	44.83	49.55	51.03	55.17	40.25
1999	30.00	67.18	64.34	44.19	30.94	30.75	37.60	40.50	29.07	31.01	29.46	48.84
2000	71.06	31.91	35.40	51.10	30.36	32.04	40.25	52.46	58.14	54.01	52.65	33.98
2001	29.72	38.50	33.14	41.34	38.57	37.60	33.79	51.49	34.56	49.03	57.24	44.51
2002	52.86	53.81	62.40	40.96	65.25	41.93	55.17	46.84	35.72	--	--	--
<b>Median Monthly Mean Flow</b>	<b>941.03</b>	<b>329.40</b>	<b>1,074.04</b>	<b>1,096.26</b>	<b>950.33</b>	<b>875.14</b>	<b>1,047.49</b>	<b>933.99</b>	<b>861.63</b>	<b>799.81</b>	<b>958.34</b>	<b>842.00</b>

<sup>5</sup> Surface Water Data for USA: Monthly Streamflow Statistics available at [http://nwis.waterdata.usgs.gov/nwis/monthly/?site\\_no=16614000&agency\\_cd=USGS](http://nwis.waterdata.usgs.gov/nwis/monthly/?site_no=16614000&agency_cd=USGS).

Data originally collected by USGS station called "Waihe'e River at Dam near Waihe'e" and identified as Station No. 16614000. The station is located 605 feet above sea level and is used to measure the surface water in the Waihe'e River. Information available at [http://nwis.waterdata.usgs.gov/nwis/monthly/?site\\_no=16614000&agency\\_cd=USGS](http://nwis.waterdata.usgs.gov/nwis/monthly/?site_no=16614000&agency_cd=USGS).

**Waihe`e Stream Flow  
(1983-2002)  
USGS Station # 16614000**

Approximate baseflow  
of Waihe`e Stream for 1983-2002

in millions of gallons per day	<u>Q90</u>	<u>Q75</u>	<u>Q70</u>	<u>Q50</u>
1983 (61 days)	20.03	24.55	25.84	31.01
1984	17.44	20.03	21.96	27.13
1985	18.09	25.84	25.84	29.72
1986	27.78	34.24	36.18	45.87
1987	29.72	34.24	34.88	45.87
1988	30.36	36.18	38.11	43.93
1989	27.13	30.36	32.30	41.34
1990	29.72	32.95	33.59	36.82
1991	27.78	30.36	31.01	33.59
1992	21.96	24.55	25.19	31.01
1993	25.84	29.07	30.36	35.53
1994	32.30	38.76	40.05	45.22
1995	25.19	26.49	27.13	29.07
1996	21.96	23.26	23.90	27.13
1997	24.55	27.78	29.07	34.88
1998	28.42	32.30	32.95	38.76
1999	23.26	27.13	27.78	31.65
2000	27.13	29.07	29.72	32.95
2001	23.90	25.84	26.49	29.72
2002 (275 days)	30.36	32.95	34.24	37.47
<b>Overall 1983-2002 (6909 days)</b>	24.55	28.42	29.72	34.88

Data represents the durational flow curve of the Waihe`e Stream based on the daily mean streamflow measured at the "Waihe`e River at Dam Near Waihe`e" gage, Station No. 16614000.  
Data from Surface Water Data for USA; see note 3.

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