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REPORT ON ISLAND OF KAUAI

TERRITORY OF HAWAII

February 4-9, 1918

By

2nd Lieut. E. H. Wisser

Engr. R. C.

REPORT ON ISLAND OF KAUAI.

February 4-9, 1918.

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HEADQUARTERS HAWAIIAN DEPARTMENT,
HONOLULU, H. T.

March 10, 1918.

From:
2nd Lt. E. H. Wisser, Engineers R. C., A. D. C.

To:
The Department Commander.

Subject:
Report on Island of Kauai.

1. The following report is based on a trip taken to Kauai February 4-9, 1918; in compliance with an order from the Department Commander dated February 4, 1918.

2. An effort has been made to furnish a brief general description of the island, together with some data on its harbors and possible landing places, its roads, railroads, water-supply, and any other particulars of a conceivable military value. The monthly rates of flow of the principal streams, taken from the Water-Supply Papers of the U. S. Geological Survey, have been averaged over a period varying from two to seven years, in an effort to furnish some idea of the water to be expected in any month. A few notes on each of the island harbors are included; also some data on the plantation railroads, and the road system of the island.-

GENERAL FEATURES OF THE ISLAND.

Kauai lies at the N W end of the chain of main islands of the Hawaiian group consisting of Kauai, Oahu, Maui and Hawaii, in order from N to S. Its nearest port, Nawiliwili, is 98 sea-miles from Honolulu. The channel between Oahu and Kauai is 63 sea-miles in width.

Area- The area of the island is 547 square miles, somewhat less than that of Oahu; in shape it is roughly circular, but the N-S dimension is 23 miles, while the E-W is 32. Marked indentations or promontories are absent. Reefs are comparatively rare, and deep water is commonly found near the shore, but good harbors of any size are absent. The island is almost one homogeneous mountain mass, the ground rising from the shore on all sides to the center and summit of the island, the mountain of Waialeale, 5100'. A coastal or foot-hill belt, of varying width, extends around the island from Hanalei Bay, on the N Coast, to the "Barking Sands" on the N W coast, or for about 3/4 of the circumference of the island. On the remaining section, the mountains come directly to the sea, forming an inaccessible region of high cliffs, called Na Pali. The coastal belt is gently rolling, open country, and varies from 1-6 miles in width; it is the only populated portion of the island, and the scene of the sugar, rice and taro cultivation.

The topography of the coastal regions on the E side varies considerably from that on the S and W sides, doubtless partly due to the difference in rainfall between the two regions. Dissection has progressed further on the E side. The country is open and rolling, a typical foothill country, and the stream valleys

are wide and the streams of low grade. Kilohana Crater is evidently a late disturbance of the foot hill region; it has disturbed the normal drainage of the main slope, and formed a swamp behind it. Likewise certain other formations appear to be of comparatively recent origin, but the general appearance of the coastal belt on the E side is that of normal foothills contemporaneous with the main mountain mass.

On the leeward side of the island the difference is marked. Here a great plateau slopes gently from the main divide S W to the sea; the rivers flow also S W in parallel courses, except the Wáimea River, which flows S in a great canyon 2000', 3000' feet deep, and 10 miles long. This plateau ends rather abruptly a mile or so from the sea, in a wall 300' high or more. From the foot of this wall the ground extends as a perfectly flat plain to the sea. (Mana Flats) This appearance prevails over practically the S W half of the island, the latter being divided into a NE and SW half by the main divide, which starts from Carter Point, the S boundary of Nawiliwili Bay, runs NW to the summit of the island, Waialeale, thence continues NW to the NW coast of the island, the Na Pali region. It is broken six miles from Carter Point by the Koloa Lihue Gap, thru which the belt road from Kekaha to Wainiha runs. From Waialeale to Kilohana Peaks the divide passes along the E boundary of the Alakai Swamp, a mountain marsh ten miles long and 1/3 miles wide, lying at an altitude of 4000', at the summit of the W plateau mentioned above. The rainfall is so excessive in this region, that the upper part of the plateau has not sufficient slope to drain the run-off, and this swamp results.

The mountanous portions of the island, both on the windward and on the leeward sides of the divide, are very difficult of access in their higher portions. On the windward side the excessive rain and the deep vegetation make the going hard, while on the leeward side the deep canyons and knife-edge ridges, together with the treacherous soil, have the same effect. The summit of Waialele and the Alakai Swamp are almost always covered by clouds.

POPULATION ETC

The population is chiefly grouped around the centers of the different sugar plantations, and consists to a large extent of the laborers. It numbered 23,952 by the census of 1910. About 1/2 of these were Japanese, Chinese, and Portuguese. Cane is grown to an elevation of 1200', and takes up most of the agricultural land. Nearly every river on the island is drawn on to irrigate it and the rice which is cultivated by the Chinese on the floors of the valleys and along the shore. Pineapples are also grown near Koloa. The principal towns, from W to E are:

Kekaha (Hdqrs. Kekaha Plantation)
Makaweli
Eleele (Hdqrs. McBryde Sugar Co., Hawaiian Sugar Co.)
Koloa (" Koloa Sugar Co.)
Lihue (" Lihue Sugar Co.)
Kapaa
Kealia (Hdqrs. Makee Sugar Co.)
Kilauea (" Kilauea Sugar Plant)

Lihue is the county seat and the largest town. It has a commercial wireless station.

HARBORS AND LANDING PLACES.

All landing places of any importance will be briefly described, beginning at the N.

Hanalei Bay - Diameter 1/2 mile, Coral reef on NE side, smooth except with

N winds. Two rivers empty into it, the Hanalei and the Waioli, which keep filling the harbor with silt. The valley of the Hanalei is broad and flat for 2/3 miles from its mouth, and navigable for small boats for this distance. The main road from Waimea crosses the river near its mouth. This bay would make an excellent base for a landing party, as there is plenty of level ground, abundant water-supply in the many tributaries of the Hanalei, and fuel in large quantity, as this is the thickly grown part of the island. The bay has a dock with a derrick, but no direct docking facilities for ocean craft.

Kilauea Bay - Opens directly into the trades. A cable-way on a high bluff on the E side serves as a loading place for Kilauea Plantation. On plantation RR.

Anahola Bay - A well-defined bay with a shifting bar at its mouth, traversed by a channel 4 fathoms deep, and an anchorage 200 yards in diameter and 5/8 fathoms deep. Wharf on the S side connected by rail with Kealia. 15' of depth at wharf. Open to trades, and used only during a Kona. Makee Sugar Company. Irrigation has decreased the silt brought down by the Anahola River.

Kealia Bay - Slightly protected from trades. 3/4 miles long (point to point) 1000' from head of bay to line between points. A breakwater is being build from the NE point Lae Niau, by the Lihue Company. Harbor very small, and tends to fill with silt.

Kapaa Bay - A coral reef extends across a bight, leaving a narrow channel. Dangerous, and now abandoned.

Hanamaulu Bay - This is a considerable indentation at the mouth of Hanamaulu River. The main landing is on the S side of the bay, called Ahukini Landing, and is used by the Lihe Plantation as a loading place for sugar. A mechanical conveyor takes the sugar from a warehouse on top of the bluff to a boom on the end of the wharf, from which it is dumped directly into the hold of the vessel. This landing is connected by railroad to the Lihue system, and also by improved road to the main road system of the island. It opens directly on the NE trades and has a sand bar across its mouth. The channel extends up the bay several hundred yards above the wharf, and is 200 yards wide and 5 fathoms deep.

Nawiliwili Bay - This harbor, into which four streams empty, may be divided into an outer and an inner harbor by a reef extending to Carter Point, the promontory on the S side of the Harbor.

Outer Harbor - 7/10 fathoms, good holding bottom. Protected on N by the high shore line to Ninini Point, on the SW by the Haupu Ridge, the S end of the island divide.

Inner Harbor - Consists of several deep water channels separated by shoals. The present anchorage is in the N part of the inner harbor, near Kukii Point. While a breakwater built out from the Carter Point promontory combined with the dredging of an approach to the outer harbor would make an excellent port here, at present it is almost impossible to land freight at this harbor, due to the prevailing roughness and to the distance (500-600 yards) at which vessels are forced to anchor from the shore. Nawiliwili is connected to the island road system by good macadam roads, but no RR. It is the best prospective harbor on the island, because of its natural advantages of shape and location, its central location with respect to population and its size.

Koloa Landing - A mere open roadstead on the Koloa RR system, used during NE trades only. Deep water is found close to shore.

Makaweli Landing - In a bight at the mouth of two streams, which bring down much silt; dock; storage facilities.

Hanapepe Bay - (Eleele Landing) A bight at the mouth of the Hanapepe river. Two docks; one, inside, for landing coal and lumber, one next the short breakwater, for general freight, and passengers; both are provided with dorricks. There is a large sugar warehouse between the two, fitted with electric convey-

ors, dropping the sugar into small boats, hauled to and from the steamer by endless cables. Loading place for McBride Plantation. The anchorage is very small, although ships can come in within 200 yards of the docks. At the present time, this is the best landing on the island, and is the only one used by the American Hawaiian SS Company. It has been surveyed by the District Engineer, and an improvement plan drawn up, which is on file in the District Engineers Office, Honolulu, H. T. A kona storm absolutely stops loading at the port, and but one vessel of any size can lie at anchor in the inner harbor. Even the trades raise a considerable swell.

Waimea - A slight indentation at the mouth of the Waimea River. Long lighterage. Silt brought down by the stream makes it necessary to extend the dock from time to time so that even the small boats may dock. Best protection on the island from trades. Loading place for Kekaha Plantation, and connected with their RR system. At this spot the Russians landed, according to tradition; it was also used by whalers.

There are no landings further W of here.

SUMMARY

The harbors of Kauai are without exception small, dangerous, and in nearly every case exposed either to the NE trades, which blow almost continuously during the winter, or to the Kona storms. They are generally formed at the mouth of streams, and for this reason tend to fill up with sediment.

WATER RESOURCES.

RAINFALL.

The rainfall varies greatly with altitude and location with respect to trade winds and mountain masses, but the variation is not so great as on most of the other islands. At Mana Flat, on the W, it is 15/20"; it is about 63" at Koloa (both these places on the leeward side) On the windward side, at Lihue, it is 45", and at Hanalei, 100". (All these points at sea level). At elevations of 1000'-2000', on the windward side, it is 100"-200", and at Waialeale, the summit of the island, it is probably 600", perhaps the heaviest in the world. The period of greatest rain is from November to March, when the NE trades are the prevailing wind, bringing the rain to the E slopes of the island. S winds, or Konas, occur at intervals, generally bringing rain to the S and W portions.

STREAMS.

Perennial streams flow in all directions from the main divide, except on the West, where the deep Waimea Canyon, flowing S across the general direction of the slope (West), intercepts the water of the Western streams. The streams of the island are in general of good size, and have a more uniform flow and are flatter in grade than any other streams in the territory. The valleys are longer, deeper, and broader. Hanalei River, on the North coast, is actually navigable for small boats for a considerable distance from its mouth, a thing unique in the islands. Practically all of the streams are fordable during normal stages, except the lower portions of the Hanalei River, although some of them are deep and swift for considerable stretches.

WATER-SUPPLY.

The water-supply of the island, both for irrigation and human consumption, is derived almost entirely from surface sources, namely, the main perennial streams of the island. Water is drawn from all the larger streams by ditches, the latter in many cases taking all the low water flow. Most of it is used

to irrigate cane, one ton of sugar requiring about 1 MG. The cane belt is identical with the coastal plain of the island, and extends from Mana on the West to Kilauea, on the North, and draws water from all the streams within its limits. In addition, rice is grown on the lowlands and in all the valleys, where water is plentiful, also some taro. Both these require an excessive amount of water, and are therefore confined to the lowlands and mouths of rivers.

There are several small pumping plants used in dry seasons only, but the only one regularly used is the McBryde Sugar Companies' system, consisting of five electric plants with seven pumps and two steam plants with two pumps, pumping under ground water from Hanapepe and Lawai valleys. 25,600000 gallons pumped daily, in 1912, much of it against a 400' head.

MEAN MONTHLY FLOW OF PRINCIPAL STREAMS AND DITCHES. (MIL. GALS.)

The 1st set of figures is the mean of the average monthly flows of the different years. The 2nd set is the minimum mean monthly flow observed in the period, while the 3rd is the maximum mean monthly flow occuring in the period.

STREAM	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Waimea R.	240	90	71	87	69	23	65	18	70	60	94	130	1911-16
	7	31	1	68	11	.6	5	0	30	3	12	31	
	1060	235	207	116	140	52	140	40	190	164	1080	247	
Kekaha D.	30	35	37	40	39	40	35	29	32	31	35	38	
Makaweli R.	35	18	41	43	28	30	26	18	76	46	130	130	1912-16
	15	10	7	28	14	12	12	8	8	9	13	13	
	75	35	113	65	40	62	38	25	252	70	330	256	
Olokeli D.	----------45 Million Gallons------												
Hanapepe R.	47	35	25	42	35	45	38	41	78	47	84	53	
	11	9	10	20	14	17	29	17	12	23	22	17	
	142	109	57	71	60	66	57	79	205	82	175	133	
Hanapepe D.	----------27 Million Gallons------												
Huleia R.	8	8	8	9	13	14	7	8	19	30	37	30	
	5	4	3	7	7	5	5	5	5	19	21	19	
	12	14	14	11	19	22	11	13	28	45	59	43	
Hanamaulu R.	7	9	9	9	10	10	5	3	3	7	7	13	
S Fork Wailua, below Lihue and Hanamaulu Ditches.													
	80	42	67	89	62	98	83	85	168	126	165	149	
	56	20	14	51	55	41	17	49	44	118	59	78	
	123	75	115	124	129	156	126	157	420	134	290	230	
Lihue Ditch--------About 6 Million Gallons--------													
Hanamaulu Ditch---- " 20 " " --------													
N Fork Wailua River below Kenaha Ditch.													
	113	59	54	47	73	70	56	48	88	37	38	44	
	39	20	22	33	30	26	45	29	21	34	32	62	
	286	160	83	61	124	110	73	84	158	59	60	107	
Kenaha Ditch-----About 15 Million Gallons-----													
Konohiki Stream-- " 1 " " -----													
Kaehulua Stream-- " 1 " " -----													
Kapaa River above Kapahi Ditch													
	22	15	16	18	21	19	20	16	27	14	24	16	
	12	7	10	13	14	10	14	13	13	13	12	14	
	41	28	24	29	30	24	26	21	48	17	45	23	
Kapahi Ditch-----About 15 Million Gallons-----													
Kaneha Ditch----- " 6 " " -----													
Anahola R.	18	19	11	17	16	12	13	8	21	10	21	27	
	4	4	4	13	10	9	6	6	8	7	10	11	
	36	48	29	24	21	15	23	13	39	12	29	45	

STREAM	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
Anahola Ditch--------About 5 Million Gallons-----													
Kalihwai Stream	34	26	28	21	38	34	37	30	58	26	97	39	12-16
	12	16	10	12	30	24	22	18	32	19	33	40	
	34	45	46	31	47	53	52	46	101	35	200	87	
Hanalei River below China Ditch													
	140	73	100	120	140	92	97	120	117	121	180	130	12-15
	45	34	32	53	79	60	72	88	75	72	63	79	
	338	130	192	330	266	123	124	161	166	232	436	251	
China Ditch----------About 18 Million Gallons-------													
Kuna Ditch---------- " 15 " " ----													
Wainiha R.			67	150	75	93		167	320	140	130	113	
Lumahei R.	28	62	50	66	78	73	79	60	106	69	164	126	14-15
Waioli Stream	11	19	17	25	49	49	25	27		16	37	33	

NOTES ON PRINCIPAL STREAMS AND DITCHES.

Waimea River Basin. Area about 58 square miles. Largest on Kauai. Slope SW. Streams have their origin in Alakai Swamp, on the main divide. Streams flow SW in parallel courses to the main stream, which flows S in the famous Waimea canyon, 10 miles long, 1 mile wide, and 2000-3000' deep. Rainfall on basin 200" in E and N parts, 90" in S and W parts. The Kekaha Plantation maintains a 1000 KW hydro-electric plant about 8 miles from the mouth of the river, elevation about 550', operating under a 400' head, used for pumping the Kekaha Ditch water to the levels of cane land, above the elevation of Kekaha Ditch. The figures of the Waimea River flow given in the table refer to the stream above its confluence with the Makaweli River.

Kekaha Ditch. Diverts water from Waimea River (E side) 8 miles from the sea at an elevation of 550' above sea-level. It crosses the river 3½ miles from the sea in an inverted siphon. The water is used for irrigating cane by the Kekaha Sugar Company, and for the Waimea City water supply.

Makaweli River. This river joins the Waimea at about 1½ miles from the sea. Basin has an area of 30 square miles.

Olokele Ditch. Diverts water from S side of Olokele Stream (a branch of Makaweli River) at an elevation of 1477'. It is practically a continuous tunnel of 5/6 miles in length. Irrigates upper cane fields of Hawaiian Sugar Company, Makaweli.

Hanapepe River. Basin extends from Hanapepe Bay to Kawaikini Peak of Waialeale, the summit of the island. Rainfall in upper valley about 200". Deep canyon for several miles of valley in upper regions, broadening out towards the sea.

Hanapepe Ditch. Diverts water from W side of Hanapepe River at elevation of 520'. Takes all the low water flow of the river.

Huleia Stream. About nine miles in length, flowing into Nawiliwili Bay.

Hanamaulu River. Rises N of Kilohana Crater and flows E thru open country to Hanamaulu Bay for a length of 8/10 miles. Rainfall varies from 50" at the sea to 100" at the source.

S fork of the Wailua River. Wailua River basin is the largest on windward Kauai: 50 Square miles. Mostly open rolling country. Wailua River has two main branches, uniting about 1½ miles from the sea. Rainfall varies from 120" in the lower valley to 600" at Waialele. Upper part of the basin is very steep. Flow is very irregular. Much rice is grown in the valley near the mouth of the river.

Lihue Ditch. Diverts water from S side of a tributary of the S Fork, at an elevation of 600'. Unites with Kanaha Ditch 1½ miles below the intake, and

continues as a high-level ditch for the upper cane lands of the Lihue Plantation Company.

Hanamaulu Ditch. Takes water from the S side of the S Fork of the Wailua River at 500' elevation. Lihue Plantation Company.

Kanaha Ditch. Diverts water from the S side of the N Fork of the Wailua River ten miles NW of Lihue. Crosses the S Fork in an inverted Siphon and unites with Lihue Ditch.

Konohiki and Kaehulua Basins. Small, open basins reaching back 5/6 miles from the sea.

Kapaa River Basin. On the E slope of Kauai. Area 18 square miles. Open rolling country. Rainfall: 40" at sea-level to 300" or more at head of stream. Kealia and Kapaa Streams unite about two miles from the sea to form Kapaa River.

Kapahi Ditch. Takes water from the S side of Kapaa Stream at an elevation of 400'. Takes all normal flow of stream.

Kaneha Ditch. Takes water from the N side of Kealia Stream at an elevation of 870'.

Anahola River Basin. On E slope of the Island, S of the Anahola Mountains. Area 8/10 square miles. Rainfall from 60" at sea-level to 300" at head.

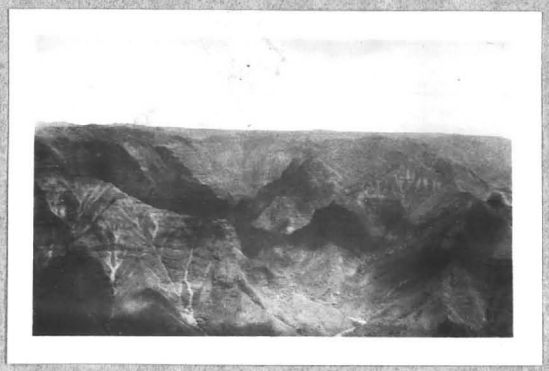
Anahola Ditch. Takes water from the S side of Anahola River at an elevation of about 400'.

Kilihiwai River. Flows in valley about 200' deep, 1/4 to 1/2 mile wide, thru open country to Kilihiwai Bay, on the N coast.

Hanalei River Basin. Area about 25 square miles. Opens out into a broad valley 1½ to two miles in width, about two miles above Hanalei Bay. Navigable for small craft. Rainfall: 100" at Hanalei, 600" at Waialeale.

China Ditch. Diverts water from W side of Hanalei River, five miles from its mouth at an elevation of about 150'.

Wainiha River Basin. Long and narrow. Area about twenty square miles. The Wainiha River rises, like most of the island streams, on the slopes of Waialeale and flows N. Rainfall: 100" at mouth, 170" at 700' elevation, and 600" at the source. Water is diverted from the W side of the stream thru Wainiha Canal, and is used for power development by the Kauai Electric Company.



Views of Waimea Canyon from Puu ka Pele,
a peak on the West Side.

Intake of Kekaha Ditch, Waimea Canyon.

Waimea Power House,
Waimea Canyon.

ROADS.

An oil macadam belt road runs from Kekaha to Wainiha, or 3/4 around the island. The road is about 16' wide; the coat of macadam is thin, and would not stand up under continuous heavy traffic; it is subjected to little but passenger, as most of the cane is transported on plantation RRs to the company landing places. The oil macadam is topped with sand or fine coral. The road is fairly well maintained, but the side ditches are shallow and tend to fill with weeds, especially on the windward side. The fences, of wire generally, are usually close to the road, and troops would be unable to march beside the road. The road will accomodate two streams of traffic only. Comparatively little of the road is in cut or fill. Grades are not excessive. Bridges on this road are exceptionally strong, being mostly of concrete (reinforced). Nearly all the landing places are connected to this road by similar types of road, but all roads leading to the mountains are without exception bad, and impassible after a rain. The red mud characteristic of the Oahu dirt roads is here in abundance.

VEGETATION.

On the leeward side, vegetation is confined to sparse grass and brush on uplands below the timber line, which is at an elevation of about 1500'. Above this line is a considerable growth of Koa, Mesquite, Kukui and other trees, making a fairly dense forest. Along the coastal plain the timber is limited to Mesquite and some imported Ironwood. In the stream valleys the vegetation is thicker, but not dense. On the windward side the timber extends in many places down to the coast, and Banana trees and Cocoanut trees are added to the above, as well as many others. The coastal plain has been almost entirely cleared of all other growths than cane or pineapple, while the lower parts of the valleys are entirely given over to the cultivation of rice, and are in a flooded condition.

RAILROADS.

Public Railroads.

Kauai Railroad. This connects Port Allen (Eleele) with the Plantations lying between Waimea River and Nawiliwili, namely Hawaiian Sugar Company, Mc Bryde Company, and Koloa Plantation. It has twelve miles of track, of 30" guage and three weights, 25#, 30# and 35#. Its rolling stock consists of

twenty-five small 4-wheel flat cars of five ton capacity and twenty ordinary box cars of fifteen ton capacity. The loading and storage facilities at Port Allen are described under "Harbors and Landing Places".

Plantation Railroads.

There are five unconnected systems, all of 30" guage except one on the extreme N of the cane belt, namely Kilauea Plantation system, which is 24".

Miles of Permanent Track of the Different Systems, and Gaps between the Systems, beginning at the S W end of the Cane Belt.

Plantation	Total Miles	Length of gap over which a connection could be laid	
Kekaha Sugar Company	15		Connects with Waimea Landing.
Waimea Plant	7		
		1	
McBryde Sugar Company	16		Connected by Kauai RR to Port Allen-Koloa Landing-Makaweli.
Hawaiian Sugar Company	30		
Koloa Sugar Company	20		
		5	
Grove Farm Plant	1		
Lihue Plantation (Hanamaulu)	32		Connects with Hanamaulu Bay.
		1.5	
Makee Sugar Company (Kealia)	25		Connects with Anohola Landing.
		7	
Kilauea Sugar Plantation	10 (24")		Connects with Kilauea Bay.
Total Mileage------	146		
Total Gap----------		14.5	

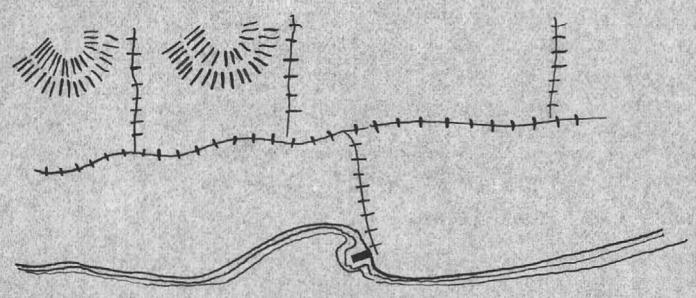
Thus by completing only 14.5 miles of gaps between the different systems, and increasing the gague of Kilauea RR 6", 146 miles of permanent railway could be formed, making a belt line extending for 78 miles around the island, or nearly 3/4 of its circumference, connected with all the principal landing places by permanent spurs, but as all the plantations have their own loading places, due to the fact that no pre-eminently good harbor has yet been developed on the island, making the expense of lightering incident to all, there is little incentive toward co-operation among the plantations, and each uses its own landing place; the Kauai RR and the Port Allen are the only features on the island of this kind.

Weight of Rails etc. The weight of the permanent rails on the island is in general 25#-30#. Ordinary wooden ties and coral, sand or lava rock ballast are used. Trestles, bridges etc are little used, and fills are reduced to the minimum, as the short, light cane cars permit of sharp curves and heavy grades.

Plantation	Weight of Permanent Track
Kekaha	About 20#
Waimea	15#
McBryde	30# $3\frac{1}{4}$" base on rail-section
Koloa	30#
Lihue (including Hanamaulu)	20-25#
Kilauea	20#

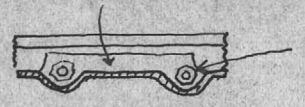
Standard Rail

General System. The RR system of each plantation generally consists of a spur connecting the landing place with the main lateral artery running the length of the plantation (generally parallel to the shore-line) from which spurs extend "mauka" to connect with the temporary track laid as the cane cutting progresses.



Temporary Track. This is used as an extension to the permanent track, being carried along in the cane fields, as the cutting progresses; the weight of the rail is from 14#-16#. Steel ties are exclusively used with the portable track, the track being fastened to the ties by clips and hook-bolts, in sections 15' long. These sections are carried on 4-wheel flat cars in lots of ten or fifteen and are laid down as needed, without ballast or any other preparation. Connections are of course abreast of each other, and not staggered, as with the permanent track, and are made with a tie twice the width of the normal ties, one set of rails reaching over half the width, and being bolted in the usual manner to the tie, while the other set is slightly spread, and thus exerts pressure against the clips on the tie.

Side elevation.



End elevation

Mules and horses are the motive power on the temporary track, the American locomotives being too heavy for it, although Kilauea uses some light German locomotives on their 24" temporary track.

Mileage of Temporary Track of the Different Plantations.

Plantation	Miles of Track	Weight of Track	
Kekaha	3	14-16#	15' lengths
Waimea	2 ?	14# ?	

Plantation	Miles of Track	Weight of Track	(Continued)
Hawaiian Sugar Co.	7	14-16#	
McBryde Sugar Co.	8	14#	15' Lengths
Koloa Sugar Co.	2		12' "
Grove Farm	3 ?	16#	
Lihue Plantation	8	14#	
Makee Sugar Co.	5		
Kilauea Plantation	3 ? (24" guage)		15' Lengths

Rolling Stock of the Different Systems.

Kauai Railroad - (See page 8-9)
Kekaha Plantation - 401 3-ton side-door cars without ends. (4-wheel)
Waimea Plantation - 49 3-ton " " " " " "
Hawaiian Sugar Company - About 500 cars, mostly of the side stake type, with ends (see illustration) 5-tons.
McBryde Sugar Company - 400 of the above type of cars.
Koloa Sugar Company - 250 cars. Low, wide-flaring box type. 4 tons.
Grove Farm - 6 double truck flat cars, 10-tons. Also a few cane cars.
Lihue Plantation - 500 Box type cars, 3-ton. (This includes Hanamaulu Plant)
Makee Plantation - 400 " " " "
Kilauea Plantation - 250 " " " "

In addition to the above, each plant has a few box and flat cars of the ordinary type for the transportation of bagged sugar, the total on the island not exceeding fifty. They are of 10-15 ton capacity.

LIVESTOCK ON THE ISLAND.

CATTLE.

Cattle raising on Kauai is limited to some extent by the requirements of local consumption. The island is entirely self-sustaining as regards its beef supply, and in addition could if necessary export a certain amount to the other islands; this has been done at times.

The total number of head on Kauai is at present 5-6000, of which the Hanalei Ranch, Hanalei, has about 2500 head, on 12,000 acres, half low and half upland, while Eric Knudson runs about 2000 head on the lands which he leases on Western Kauai from the Territory, the lease expiring June 1st, 1920. Messrs Gay & Robinson have about 3000 head on their island of Niihau; they export to Oahu. Mr. Arthur Rice of Lihue owns several hundred head, and each plantation own some cattle, running them on land not taken up by sugar or in the uplands above the sugar belt.

An epidemic of anthrax, breaking out in the first part of 1917, cost the Hanalei Ranch 350 head of cattle. There have been no cases since August 24th, 1917, but the ranch is still quarantined against the bringing in or out of any animals whatever. During the quarantine Gay & Robinson have been furnishing beef to the Island, but normally the Hanalei Ranch suffices for this. Only the two main towns, Lihue and Waimea, find it necessary to get their beef from the Hanalei Ranch or other outside sources, as all the plantations keep enough cattle for their own use, and these two towns, with Hanalei, are the only places containing any considerable number of inhabitants not directly connected

with plantations.

Mr. Knudsen's lease on his grazing land expires June 1st, ~~1917~~ 1920, as stated above, and a certain amount of this land will undoubtedly be turned over to homesteaders, so that the future of this herd is uncertain.

Great numbers of cattle on Kauai have been slaughtered during the last year thru fear of anthrax, but this scare is about over, and the quarantine will probably shortly be lifted.

SHEEP.

There are a few sheep on the island, grazing on fallow ground near Koalia, but their number is insignificant.

MULES AND HORSES.

These are kept by the different plantations in considerable quantity, as they are means of hauling the cane cars on the portable track in the cane fields, the rails being too light for the locomotives. No figures are at present available as to their exact number.

One U. S. Geological Survey map of Kauai is included in this report.

E H Wisser

2nd Lt. Engineer R. C., A. D. C.

-ehj

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