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R E P O R T

OF PROPERTY OF

WEST VANCOUVER COMMERCIAL COMPANY,

QUATSINO SOUND, VANCOUVER ISLAND.

C O M P I L E D B Y

E D W A R D B. D U R H A M, M. E.

7 MAPS AND 7 PHOTOGRAPHS.

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REPORT ON PROPERTY OF
WEST VANCOUVER COMMERCIAL CO.
ON QUATSINO SOUND, VANCOUVER ISLAND.

COMPILED BY
EDWARD B. DURHAE, E. M.
FROM EXISTING REPORTS, MAPS, ETC.

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S I T U A T I O N

The property of this Company is known as Section 1 and Section 2 of Quatsino District of the Province of British Columbia, and is shown on "Sectional Map of the Northern Portion of Vancouver Island" of 1893, compiled for the Department of Land and Works of Victoria, as Lot 1 and 2. See Sheet No. 1, herewith.

Section 1 has an area of 5580 acres and lies along the North shore of the West Arm of Quatsino Sound and the northwest shore of Rupert Arm of the same Sound and includes the Peninsula between them.

This shore line which forms the southerly boundary of the property, is about 9½ miles in length not measuring minor irregularities of the coast. The east and west boundary lines run in a direction within a few minutes of due north from this shore line for a distance of 80 chains (1 mile). The northern ends of these east and west boundary lines are connected by a straight line 560 chains (7 miles) long which forms the northern boundary.

Section 2 has an area of 1980 acres and lies along the southern shore of Rupert Arm of Quatsino Sound. The Tract is rectangular, the short line and southern boundary being nearly parallel and both three miles long. The east and west end lines are each about one mile long.

To the west of the peninsula between Rupert and West Arms is a deep water cove, marked Coal Harbour on the maps, into the head of which empties the Matzinughtum Creek, which cuts Section 1 into two portions. Coal Harbour is in latitude north 50 degrees -35' and longitude west of Greenwich 127 degrees -35', or about the same latitude as the southern coast of England. The climate of Vancouver Island is quite mild, and is described in the " Official Handbook of the Dominion, 1895 " as being " much superior to that of Southern England or central France. Snow seldom falls and then lies but a few hours or days. Vegetation remains green and flowers are bright through the greater part of nearly every winter, while in spring and summer disagreeable east winds and excessive rains and fogs are unknown."

The guardian of the property on Quatsino Sound says that the most severe weather he has ever seen in winter in this part of the Island had not been accompanied by over 2 feet of snow and that remained on the ground but a short time. The rainfall is reasonable and not excessive.

The portion of Quatsino Sound on which the property is located, is about 25 miles from the open Pacific Ocean, up the sheltered waters of Quatsino Sound, over a course having from 16 to 100 fathoms of water and one that can be entered without difficulty in all weathers and in which vessels of largest draught are safe from all storms.

The description of the Sound by the Vancouver Pilot, 1864, is concise and clear:- " The breadth at the entrance is nearly six miles, narrowing to less than a mile at five miles within: The Sound then runs in a north easterly direction, (mag) nearly straight for thirteen miles, then branches off in two arms, one extending to the south east for twelve miles and terminating in low lands; the other arm lies to the northward of and is connected with the Sound by a straight, narrow pass (Quatsino Narrows) about two miles in length. Its length is twenty-two miles in an east and west direction and the eastern extreme, Rupert Arm, is only six miles distant from Hardy Bay on the north east coast of

Vancouver Island. The western part terminates within twelve miles of San Jose Bay on the outer coast. "

The Harrows above mentioned are entirely safe for steamers. The C. P. N. Co's. Steamer " Tees " came in with the tide running out at six knots per hour (January, 1898). Others not harbour as easy to enter as Vallejo or Benicia from Fort Point, San Francisco Harbour.

The course to open sea is direct, occupying but 2 or 3 hours, and when a vessel is once out she is entirely independent in her movements. The distance to San Francisco is about the same as from the Comox and Nanaimo coal fields on the eastern part of the Island and has the advantage of an easier passage to sea. The harbours on the east coast are obstructed by bars, the loading is done from long piers at which a vessel cannot remain during a storm and as the channel is intricate, sailing vessels are obliged by law, to be towed to open water, sometimes as far as Cape Flattery, a distance of 200 miles. See Reference Map, Sheet 1. Against this, a sailing vessel would be towed only 25 miles on Quatsino Sound, all vessels could load from short piers in safe harbors, notably Coal Harbor, in all weathers and there are no bars in the channel to annoy even the largest steamers. Coal Harbor is 2000 feet wide at its mouth, widening out to a diameter of 4000 feet with water 40 to 500 feet deep, the 5 fathom line being within 100 yards of shore. See Sheet No. 2 and Sheet No. 3.

Quatsino Sound offers the best harbor on the west side of the Island and with developments here, all steamers taking the outside course would stop here in preference to other points.

The property is only 10 miles overland from Hardy Bay on the East side of the Island. Here also is a splendid harbor and one well adapted for coaling vessels taking the inside course to the north from Puget Sound. By means of a railroad the output of the region could be cheaply transported to docks there. Hardy Bay is building up as a fishing and canning centre and will soon be an important station.

The Government is building a road between Coal Harbor

and Hardy Bay , which is intended to be a public highway between these two points.

This Company has received offers of sufficient land for docks, storage buildings, etc. on the best part of the harbor on the East side of the bay, on the sole condition that their piers will be free to general shipping. The water of Hardy Bay is deep and well sheltered as will be seen from the map accompanying this report. Sheet No. 2.

The mouth of Quatsino Sound is about 200 miles from Victoria and 850 miles from San Francisco, while from Victoria to San Francisco is 750 miles and Nanaimo about 100 miles further, making a distance from Quatsino and Nanaimo to San Francisco practically the same, with cheaper freight rates from Quatsino on account of reduced time for the trip and a safer route for the passage.

T O P O G R A P H Y .

The shores of Quatsino Sound are covered with hills, many of them reaching 2,000 feet in height, but on section one of this property the hills are lower. Near the shore around Coal Harbor is a broad bench 30 to 60 feet above tide, and among the hills are many fertile valleys well suited for farming , notably a district extending 2 1/2 miles up the Natzinughtum Creek from the Settlement at Coal Harbor. This is fine rich land with easy clearing and open patches of easily drained swamp here and there. There are other good patches along the north shore of West Arm and there is an abundance of good land between the head of Rupert Arm and Fort Rupert.

The drainage of the country north of Coal Harbor is by way of a number of creeks flowing easterly and which are called 1st. 2nd. and 3rd. Creek from their positions relative to the settlement. They all flow into a swamp half a mile or so up the Natzinughtum and from this swamp flows the latter stream.

The above mentioned creeks run in valleys which are divided by ridges having the same general direction as the creeks and terminating in the bench, about 30 to 60 feet high, which surrounds the shore of Coal Harbor. The western part of Section 1 drains through streams running in a southerly direction directly into West Arm.

Section 2 is more rugged than No. 1 and does not appear to have the good harbors that characterize the latter but as it is as yet almost unexplored it is impossible to tell what its natural advantages are.

Both sections abound in timber. Large quantities of fir and hemlock have been noted and in parts of the property cedar, pine and other woods are found. One estimate by Mr. A. S. Hallidie places the total number of trees between 8 and 48 inches in diameter at 125 to the acre of which "probably 25% were larger than 24 inches".

G E O L O G Y .

The geology of the northern part of Vancouver Island has been worked up in detail all around the coast and up to the numerous sounds by the Canadian Geological Survey, but the interior is so heavily wooded and the undergrowth so dense that exploration there would be very laborious and unsatisfactory. Since the property of the West Vancouver Commercial Company is located within the region examined, the uncertain nature of the interior is immaterial to them, but from present indications is worthy of the consideration of capital.

In general, the northern part of the Island consists of Triassic rocks in which there are many basins which are filled with Cretaceous rocks. Whether the latter once completely covered the Triassic rocks and erosion has removed all the higher portions, or whether the original deposits merely filled the hollows, cannot be determined without further exploration and study, but the result is

that the Triassic rocks are now specked with Cretaceous areas.

The Map, Sheet No. 4, is reproduced from the Annual Report of the Geological and Natural History Survey of Canada for 1886, by G. M. Dawson and shows the distribution of the Cretaceous areas. These are important as they are the coal-bearing rocks. From this Map it will at once be seen that Section 1 of the property of this Company is in one of these areas which is probably a continuation of the one on the east shore from which the Hudson Bay Company obtained 9000 to 11000 tons of coal at Suquash.

With regard to the nature of these deposits, Dawson says, "As the areas of these beds that have escaped subsequent denudation, are probably to a great extent those which have filled the deeper portions of the hollows, it follows that the actually outcropping edges of the beds rarely give a complete section of the entire thickness of the formation." The central portion of a basin may therefore be different from the outcrop and in them "there is a greater probability of finding thick and workable deposits of coal. It is thus of importance to keep this condition in view in any explorations which may be carried out in searching.

The Cretaceous Area on Rupert and West Arm has been carefully examined by Dawson and he reports finding the northern limit at four points, viz., on the shore on both West and Rupert Arms and on Hockneemish and Matzinughtum Creeks, so that by joining these points a fair line is established. The Cretaceous rocks here lie unconformably on the Vancouver series of the Triassic and dip southward.

To the east the Cretaceous may continue under Rupert Arm and be found continuously to the Port McNeill Area but the intervening country is low and the nature of the rocks is not apparent.

The total area of the Cretaceous is thus about 7 miles east and west and 2 miles north and south, or about 5630 acres, not including under water extensions. The rocks consist of sandstones, shales and conglomerates. The dip is southward 10 deg. to 30 deg. except for a slight synclinal flexure running across Coal Harbour.

Landale in describing the geology of the formation in 1863, notes that the coal measures lie on a bed of calciferous sandstone many hundred feet thick (belonging to what Dawson calls the Vancouver series). He also describes two characteristic strata of the coal-bearing rocks, viz. a bed of dull red colored conglomerate about 70 feet thick containing fine stones and pebbles which lies on this calciferous sandstone and a second conglomerate, coarser in its material and not so finely cohesive and at least 100 feet thick and entirely above the coal. He calls them the upper and lower conglomerate.

These were also found by Moore (The Company's Supt.) in 1884, first the lower red conglomerate on West Arm at the extreme west end of the property and the second, the upper very coarse conglomerate overlying the coal in several thin patches in various places and in bluffs on Rupert Arm some 12 miles distant from where the lower conglomerate appears. But while Landale calls these " characteristic strata " they are not enough different from the other rocks to make them of much service as a guide in drilling or prospecting.

Other details of the formation have been developed by the work done on the property by the West Vancouver Commercial Company and will be brought out after that work has been discussed.

H I S T O R Y .

In the autumn of 1862 W. H. R. Adamson and partner went to Quatsino Sound to locate and hold 5000 acres of coal and 2500 acres of copper lands to be taken up by John Robertson Stewart for himself, a Mr. McKean of London and others. They built a hut on West Arm near coal croppings and endeavoured to test the quantity by a shaft near shore, but the tide which rises 8 to 12 feet here, drove them out without determining anything, and not having the proper tools for the work, they abandoned their efforts.

In February, 1863, a schooner came into the harbour with a Mr. Munro as Agent for Mr. McKean and a Mr. Arthur. Arthur accidentally shot Munro and killed him within a day or two after arriving and the whole party returned to Victoria to testify with regard to the shooting. The Captain of the schooner pointed out where the coal showed 3' 6" in the side of the creek at Coal Harbour. This they used in a new cabin built near it. It was here that H.M.S.S. Hecate coaled.

Adamson says " My individual opinion was that there must be a very valuable coal field existing and underlying the 5000 acres of land taken up, judging from the visible seams and croppings. " Indications of copper had already been noticed and he says " the copper croppings were apparent and the Indians had found pieces of pure copper. "

Timber was found in abundance. The Sound abounded with herring and salmon in their season, forming the main support of 150 to 200 Indians.

Shortly after Adamson's departure in 1863, John J. Landale, an engineer of note, made a careful examination of the property and reported on same to John Robertson Stewart, who purchased the property from the Government of British Columbia and received Crown Grants thereto dated January 20, 1872 for Section 1, and April 18, 1872 for Section 2. The grants

cover the land and all the minerals except gold and silver,
which are reserved by the Crown. The date of these grants
is such that they are exempt from royalty on mineral produced.

T I T L E .

The property has passed through several hands and in 1882 was bought by the West Vancouver Commercial Company who obtained a " Certificate of Indefeasible Title " from the Land Registry Office of British Columbia on April 3rd. 1894, thus removing any possibility of doubt with regard to the clearness of the title.

Nothing appears to have been done with the property until the West Vancouver Commercial Company took hold of it in 1882. This Company was incorporated under the laws of California on October 20, 1882 " to deal in and work coal fields, copper mines, slate, fire clay, and other deposits; to build, own and work saw mills and to deal in lumber and timber products. To build, own and run steam and sail ships. To put up wharves, construct rail and tramways. To own and deal in land for town sites and other uses and to do all things necessary and pertinent to carry out the above and to do a general commercial business. "

They sent an examining expedition consisting of M. Henderson, a doctor and workmen, to the property in 1882. They built a cabin on Coal Harbour and sunk a shaft near the shore. They used the coal from the outcrop of the Hecate Seam near tide water in their cabin fires. The shaft went through 14 feet of sandstone, 10 feet of slate, and 19 or 20 inches of coal with fire clay beneath. When this was struck an inrush of water drove them out. A pump was erected and shaft continued to a depth of 68 feet when they struck a feeder of water that drowned out their pump and the shaft had to be abandoned and the expedition returned. A drill hole 9 1/2 feet deep in the bottom of the shaft was in sandstone.

In July, 1883, active prospecting work was begun on Section 1, under M. B. Silver, a mining engineer. After some surface prospecting, a diamond drill was put into oper-

ation to facilitate the work. On July 1st, 1884, Silver was superseded by J. Preston Moore as Supt. A number of drill holes 5/8" core were put in and a number of outcrops explored by drifts. Owing to mismanagement the drill being only 5/8" was not suitable for these coal measures, which are of a bituminous nature. The parties in charge were unable to secure a core. At that time communication with the property could only be had by chartering a vessel and the drill procured proving unsatisfactory, the directors decided to stop operations, which was done. On June 1, 1895, the works were closed down until the fall of 1898; during which time the property remained in the hands of a keeper.

In 1895, the President of the Company, Mr. A. S. Hallidie visited the property.

In 1896, the openings were pumped out and put in shape for inspection. At this time Mr. G. F. Allardt, a civil engineer of this City visited the property and made a careful survey of Coal Harbor.

The works remained idle again and in care of a keeper until the winter of 1898, when Phillip Rowe was placed in charge of the property with instructions to prospect and explore. In April, 1898, a very complete outfit consisting of a 50 H.P. portable boiler, double cylinder hoisting engine, duplex steam pump, track, pipe, cars, tools and supplies, was sent up for the purpose of sinking on the various coal seams and so open up the beds as to determine their exact quality and position and to obtain information as to the best method of mining and the plant necessary for the purpose.

The result of all these expeditions can be most clearly understood by taking each opening or outcrop of coal by itself and describing all the work ^{done} there, together with the record of their discoveries.

EXPLORATION OF COAL SEAMS.

Landale in his reports of examinations made in 1863, describes three important outcrops. A, on the shore of West Arm about four miles from Coal Harbour; B, on the shore at Coal Harbour, both being below high tide. C, on one of the feeders of the Natzinughtum River, which is now called 3rd. Creek, To these have been added by the discoveries of Moore in 1884, a fourth vein, D, on the bank of the Natzinughtum River about 500 feet above its entrance into Coal Harbour. All of these are on Section 1. See Sheet No. 5 also Sheet No. 3.

Taking these in the order given above:-

A- WEST ARM SEAM:- This was the first noted by Mr. Adamson in 1862, who located his first hut near it. Sheet No. 5. He tried to mine the coal but opened it too close to the water and was obliged to abandon the work without any result. The next year Landale examined the outcrop and gave it little consideration but went back one hundred feet or more from shore and sank a shaft in which he laid bare the following section which appears to be two seams:-

Gravel	0' 6"	
Coal poor	0' 3"	}
Bituminous shale	1' 3"	
Free Coal	0' 3"	} Upper seam Aa 3' 1"
Bituminous Shale	1' 2"	
Bituminous Sandy Parting	0' 1"	
Coal speckled with shale not banded	3' 10"	}
Shale	0' 1"	
Coal	0' 3"	} Lower seam Ab 4' 7"
Shale	0' 2"	
Coal	0' 3"	
Sandstone very coarse	base	
Dip S. 30 deg. E. about 1 in 3 1/2 or 4		

With regard to the upper seam Aa, Landale notes that the two bands of 1' 3" and 1' 2" of bituminous shale are heavily charged

with gas, burn almost as well as the coal itself and closely resemble Boghead cannel coal. Drops of viscous matter fall from it in burning and he used splinters of it as a torch in going short distances from the house at night. He thinks it will yield parafine and says:- " I tried it as far as gas is concerned but only imperfectly as I had neither proper retort nor luting. The bowl of a common tobacco pipe, however, though only partially tight, yielded a jet of gas for nearly two minutes. It loses in weight in burning but not in bulk."

Analysis:-Upper West Arm Seam, Aa Cannel coal.

Burns clearly, parts with gas freely, dullish black, very little lustre.

Carbon	60.436
Hydrogen	8.320
Nitrogen	1.235
Sulphur	0.300
Oxygen	4.551
Ash	25.168 100.00 (Landale).

Below this seam, Ab 4' 7" thick including 3" of shale in two streaks. The main portion is very similar to the Nanaimo No. 3 seam and will be an excellent steam coal as it does not contain the sulphur in the form of pyrites in the fissures that is so detrimental to many coals.

For steaming purposes the coal of this seam surpasses any yet discovered on the Pacific Coast. It makes less klinker than any now in use on this Coast; it is above all well nigh free from sulphur or other impurities. "

Analysis:- Lower West Arm Seam, Ab Steam Coal.

Specific Gravity	1.320
Carbon	61.16 68.15
Hydrogen	4.70 4.50
Nitrogen	1.25 1.10
Sulphur	0.60 0.70
Oxygen	13.50 11.50
Ash	<u>13.60</u> <u>14.05</u>
	100.00 100.00 (Landale)

The mining of these seams, Aa and Ab, Landale thinks should be done together giving plenty of head room. The coal could be taken out by "stopp and room" - small pillars and wide rooms, and will not be costly to work.

Silver in November, 1883, again exposed these seams by an incline 18 feet deep sunk near the water's edge. The shaft shows 8 foot thickness of vein matter but was badly located to give much information, as the coal had been altered by the near presence of a trap dyke running north and south and the shaft was liable to be flooded by the tide at any time.

Moore sunk a shaft in October 1884, to prove this vein, about 200 yards from Silver's shaft, and found the finest coal he had seen on the property though without any covering on it except the sand and washed gravel brought down by the near-by stream and which the sea had thrown upon the shore. Here the outcrop coincides closely with the shore line and is buried deeper and deeper under this mass of sand and gravel until the above stream is crossed coming east and the solid rock takes the place of the sand and gravel.

The vein in the shaft is 7 feet with over three feet of solid coal.

In order to test the vein where not disturbed, he started the hole on the Hookneemish about a mile east of the outcrop but the rains and floods came upon him before he reached sufficient depth to strike it and he was obliged to abandon it on account of lack of shelter.

Moore said "I also satisfied myself from a geological examination of the rock strata in the neighborhood that it was the lowest of the 4 well-defined seams of coal on your property, and that as at Nanaimo it had been proven, this would also prove to be the largest vein and yield the best quality of coal. It evidently underlies the whole property for these croppings show near your west boundary line and the dip of all the strata is to the south east.

In 1895, Mr. A. S. Hallidie, President of the Company, visited the property, and noted this seam as showing a 12 foot

outcrop with dip of 22 deg.

B. - HECATES SEAM. :- This outcrop occurs below high tide on the west shore of Coal Harbour. Sheet No. 5 and Sheet No. 3. Coal from it was used by H.M.S.S. "Hecate" to replenish her coal bunkers in the early days. It was probably the presence of this seam that gave the name "Coal Harbour" to the cove on which it outcrops.

Lendale deepened the hole sunk by the steamer's crew and reported the following section:-

1' 8" White Clay
0' 8" S.S.
0' 9" Good Coal.
0' 1" to 4" Shale, variable.
0' 10 1/2" Good coal.

Sandstone.

This seam is of fair quality as far as the section exposed showed and could be worked to advantage by the long wall system. The coal is well suited for smithing and for Coke making as it swells considerably while burning in an open fire, and leaves a good deal of cinder. It contains very little sulphur or other impurities. The presence of copper ore, as will be noted hereafter, near the property and in the adjoining arms of the sound will make this of great value in this vicinity, for smelting purposes.

The seam is covered by 2 to 4 feet of fine freestone well suited for building or for grindstones as it lies in bands and dresses easily with chisels.

Lendale gives the following analysis of this coal:-

Hecate Seam:- Coal Harbour - Coking Coal. Cubic fracture, laminae filled with lignite matter, lustre small.

In 100 parts.

Moisture	2.50	2.58
xxx Coke	64.20	61.18
Ash	14.00	14.26

	In 100 parts not dried.	
Carbon	67.50	67.00
Hydrogen	5.15	5.10
Nitrogen	1.75	1.50
Oxygen	12.00	13.17
Sulphur	0.90	0.84
Ash	12.70	12.39
	<hr/>	<hr/>
	100.00	100.00

The first prospecting Company sent up by the West Vancouver Commercial Company under Henderson, sank a shaft, which was named for him, about 50 feet back on the shore. They went down 68 feet when they struck a feeder that flowed 18 gallons per minute and which they could not handle with the appliances at hand and abandoned the attempt. They developed a section as follows:-

Sandstone	1	14 ft.
Shale		10 ft.
Coal 1" good, rest bony		19 to 20 inches
Fire clay		
sandstone		

Bore Hole in the sandstone 9 1/2 ft.

C - 3rd. Creek Seam.- This was discovered in a stream emptying into the Matzinughtum Creek. Sheet No. 5 and Sheet No. 3.

Landale mentions the stream on which this coal occurs as the Matzinughtum, apparently mistaking it for the main creek. Other reports mention the stream as the Klensaugh Creek. It is now called the 3rd. Creek and the seam is known by the same name. The creek ~~earned~~^{earned} its name from its position, being the 3rd. creek above the settlement.

The exposure is in the margin and bed of the creek about 1 mile north, or a little east of north of the settlement and about the same distance from the mouth of the Matzinughtum following up the Creeks.

Landale gives the following section for this outcrop:-

with a dip south east at angle of 1 in 3:-

Sandy Clay	3' 0"
Coarse Sandstone	0' 7 1/2"
Fire Clay	3"
Free Coal	3"
Clean Cherry Coal	1' 4"
Softer do	4 1/2"
Culm	4 1/2"
Softer do	4 1/2"
Fire Clay.	

This gives a seam of 3 feet of which the centre 16 inches is " Beautiful clear cherry coal, superior to anything on the island, being almost pure carbon, having little or no ash after burning. The next 4 1/2" is of similar stuff but softer ".(Landale)

The working would include the top and bottom clays and be about 3' 6" high. " The holder can be either in the bottom culm or in the clay. It will work best with long pillars 20ft x 8 ft and rooms 10 to 12 feet wide or it would work long wall.(Landale)

Landale has a high opinion of this seam and said, " This is the best household coal I have seen of these coasts. It is almost pure carbon, burns clearly, evolving a strong, continuous heat and leaving a small bulk of pure white ash. It is a singularly clean coal, causing little or no dirt or unpleasant odors. "

Analysis, 3rd. Creek Seam, C, Household Coal.

Fracture Cubic, horizontal laminae and vertical cleavage planes, thin films of carbonate of lime.

Specific Gravity.	1.360	1.320
	in 100 parts.	
Moisture	2.70	2.28
Coke	60.00	57.70
Ash left on burning	11.08	11.00

In 100 parts not dried.

Carbon	70.00	71.00
Hydrogen	5.30	5.35
Nitrogen	1.28	1.10
Oxygen	10.01	11.55
Sulphur	0.41	0.60
Ash	13.00	10.40

Coke from this does not swell much. The ash left from burning is gray and easily fusible. (Landale).

In 1883 Silver opened up this seam by an incline and found it to increase to 3 1/2 or 4 feet in thickness and impurities to decrease with depth. At one place it became 5 feet thick. Moore visited the opening and at 36 feet down notes 3 feet 2 inches of nearly all good coal. The dip averages 25 deg. toward S.S.E. The opening is 25 feet above high tide in the harbor. The incline was driven down 104 feet when the lower end was in fault. Instead of driving across it and recovering the seam, the drift was turned off to one side.

Moore says it is a good blacksmith coal. Some of this coal was used in the furnace of the boiler of the steam schooner "Mischief" in 1896 and the steam gauge at once showed an increase of five pounds and in a few minutes 10 pounds pressure. The boat was using Comox coal at the time of the experiment. This coal has been pronounced better than Comox coal even after the latter has been screened and washed (Dodd).

Analysis of this coal by G.C.Hoffman, (Geological and Natural History Survey, Canada, Part B, 1886, Annual Report) gives

Hydroscopic Water	1.05	
Volatile Combust matter	34.38	produce a fine compact
Fixed Carbon	54.01	coke and is scarcely
Ash	<u>10.56</u>	acted on by Caustic potash.
	100.00	

D- Hatzinughtum Seam :- This seam outcrops on the east bank of the Hatzinughtum Creek, a short distance above its mouth. Sheet

No. 5.

No. 5 and Sheet No. 3. Landale indicates coal here on this map but does not give any description of it and apparently did not think the outcrop of any importance and did not uncover it. It remained for Moore, while on a visit to the property in 1884 to notice the importance of the outcrop and commence the exploration of it. It turned out to be a thick seam, at only 25 feet from the mouth of the drift he found it 5' 2" thick streaked with sandy shale with a dip of 1 in 4 to the south east. It was underlain by 2 feet of fire clay, which rests on coarse-grained sandstone. The roof is a dark coloured slate about 12" thick overlain by close grained hard sand rock. The seam was naturally considerably broken up as the cover was very thin, but it maintained its regular width as they descended and improved in quality with the depth. The drift when in about 30 feet became an incline and pitched about 12 deg. and was carried in for 105 feet all told. The incline crossed one break in the formation which let in the surface water. To prospect this seam further a diamond drill hole was put down on the Wagstee creek about 1000 feet south east of the incline and a few hundred feet up the creek from coal harbour. Here this same seam was struck at a depth of 27 feet 10 inches. It showed a vein of 5 feet 4 inches thick including one 6 inch band and one 1 inch streak of shale. It was underlain by 4 feet of fire clay at this point. From the settlings from the drillwater Moore judged the coal to be of better quality than in the drift and was "fully of the opinion that this is of a valuable vein of coal, and that it underlies the whole eastern portion of your property." He was aided in forming this opinion by the outcrops of the seam found in a couple of the streams on this peninsular. On one it caused a waterfall and in the other it is the bed of the stream. The coal appears good and is nowhere less than 5 or 6 feet.

As yet this seam has not been opened at any point where it is covered by enough rock to give it protection from weathering but its existence being well determined there is little doubt but what it can be so found on the peninsular between Coal Har-

bour and Rupert Arm to the south of Wagstee.

CONCLUSIONS DERIVED FROM THE EXPLORATIONS.

In criticizing all these coal seams it must be borne in mind that they have not been developed below the water line as yet and consequently appear dirty and high in ash, which objections will largely disappear as they become more solid.

After the prospecting ceased, George M. Dawson visited the property, weighed all the evidence at hand, from the openings and his own observations.

He says, the top of the series here is the massive conglomerate exposed on the axis of the synclinal on both shores of coal Harbour. Under this at a depth of 200 to 300 feet is a coal bearing zone, whose outcrop on the south side of the synclinal is the Hecate Seam, dipping north-westerly 25 deg.

He thinks the second coal bearing zone is probably 400 to 500 feet lower in the series. Its outcrop shows on the West Arm about 1 1/4 miles west of the Nookneemish near the beach where a small shaft had been sunk.

In brief, the outcrops and prospecting show valuable seams of coal of varieties suitable for household use, gas manufacture and steam generation. What their relation to each other is, or what their size or character below the surface is, has not been proved.

OTHER MINERAL RESOURCES .

COPPER. Indications of the presence of ores of this valuable and important metal are numerous. Adamson notes that the Indians had pieces of native copper that they had found in the vicinity. Landale found a number of outcrops and has recognized several varieties of minerals, viz. native copper, black oxide of copper, carbonates, both blue and green and copper pyrites. He says:-

" I would not advise any provings on any of the different veins till the one on the South side of the inner (Rupert) Arm be proved. This consists of a rich black oxide of copper in a matrix of spar. It is interspersed with Virgin Copper in specks and will possibly assay 29% to 30%. He traced it for over 100 yards finding it near the shore to be 2 1/2 feet thick, further up the stream, it was 2 feet thick and it appeared a third time, in the bank of the stream. Here it bore towards the rapids and he thinks it is not improbable that it will change to virgin copper on account of a trap dyke in that vicinity, which change would make the lode considerably thinner. The foot wall at the shore is hard rock and the hanging a green stone, which is close in grain but will soften in water. This vein is probably near Aklar on section 2 of this the Company's property. See Sheet No. 5. Landale also notes other prospects on other parts of the Sound, which, if developed, would make a demand for coal.

There are known copper deposits on Vancouver Island and on Queen Charlotte Island which would use such a smelter and since his report was made other copper deposits on Quatsino Sound have been taken up and are merely waiting facilities for treatment to encourage their development.

BUILDING MATERIAL.:- Lime stone of very pure quality suitable for the manufacture of lime and for building purposes occurs in many places on these sounds in the beds of calciferous sandstone and can probably be obtained in any desirable quantity.

Sandstone on the fine free stone grade so desirable for building, also occurs in many places, having good bedding planes.

and few vertical seams. Such a deposit occurs just over the Hecate seam about 4 feet thick, and another on Powish River near Queenstown.

Quarries of sandstone are operated on other parts of the Island and why not on this Sound? The new Parliament House at Victoria is built on sandstone from Haddington Island, just east of Vancouver Island.

Slates of a great variety of colors and of excellent quality occur at the extremity of West Arm over a large area. Landale says it is suitable for school slates, billiard tables and roofing.

While these stones have not yet been uncovered on this Company's property to any extent, their presence is indicated by their occurrence in the neighborhood. Further, their presence elsewhere will also aid in the development of the Sound and all industries near there will increase the demand for the West Vancouver Commercial Company's coal for their manufacturing or shipping.

Landale notes the occurrence of Graphite on the Satzad Creek but does not think it occurs in paying quantities.

TIMBER WEALTH.

The timber on the property of this Company is of great value and will be a source of considerable revenue to the Company and one which contains none of the uncertainties of mineral wealth, for even a novice can see, count and measure the trees. Everyone who has seen the property is at once struck with the magnificent forests.

Landale reports that Douglas pine, spruce, hemlock and cedar are found in plenty on all the arms of the sound and in positions to be easily placed in water, especially on the Rupert West and Southeast Arms. The photographs taken in 1895 show the vast size of the timber growing on the property.

Landale also notes the plentiful occurrence of maple, arbutus, alder and dogwood, but does not indicate their dis-

tribution. He says yellow pine, cypress, yew and oak are scarce.

Pines suitable for spars are quite numerous. It is probable that 4 or 5 of the largest size could be obtained from every 100 trees. Hemlock piles can be furnished in any quantity and readily delivered alongside ship.

Mr. A. S. Hallidie on his visit to the property in 1895, estimates, " there are probably twenty to thirty trees to the acre over 24" in diameter and 120 feet high, and one hundred to the acre smaller than 24" in diameter. "

GAME .

" The woods are inhabited by elk, deer, bear and small game, while ducks and geese make their periodical visits in great numbers. " (Hallidie.)

A considerable trade with the Indians in furs, fish and oil, which now goes through Fort Rupert, could easily be turned through a Company's store by a little pains.

While mentioning game, the great quantities ~~for~~ ^{of} fish in this Sound must not be overlooked, and while more in the province of the sportsman than the engineer to write on fishing, still, in this case, the subject is of importance from a commercial point of view. Delicious halibut and salmon can be salted down cheaply and it would pay (Landale.)

The good quality of salmon, the abundance of herring and a teeming halibut bank a short distance off the entrance rock would make a cannery profitable here, as they have been elsewhere on the Coast. At Alert Bay the Winkish River Salmon Cannery put up 7000 cases of salmon in the season of 1895; each case contains 24 one pound cans and sells at \$5.00 per case in Victoria.

The game in the Sounds and in the woods surrounding them at one time supported 150 to 200 Indians.

SUMMARY.

Briefly, the West Vancouver Commercial Company owns 5580 acres of land underlain by coal which shows in four well defined outcrops of quality suitable for steam generation, for gas manufacture and for smelting purposes. They also own 1980 acres of land having indications of copper. Both tracts, containing 7560 acres, are densely wooded with many valuable varieties of timber suitable for general building purposes, for spars and for piles. Game abundant in the woods and fish in the adjacent Sounds. Building stones are found in the vicinity.

All these commercial products are located on Quatsino Sound, a deep waterway direct from the Pacific Ocean and within convenient and profitable distances of all the large markets of the Pacific Coast and in a country where the climate is as mild as that of England.

The Company owns an indefeasible title to these lands and to their minerals. All the taxes are paid and the property is unencumbered. These lands are of undoubted value from a commercial standpoint. The shipment of lumber could commence at any time and the installation of a sawmill would be a good forerunner to the work actively operating the coal seams. The present exploration work on the latter will soon develop their character, position and best methods of working. See Report of Rowe and Pearson.

As mentioned before, the writer has not seen the property and has compiled this report from the statements of others, drawing natural conclusions from the evidence at hand. The reports of Landale and Moore are of the greatest value and give a detailed description of the land and its resources, but, being almost devoid of maps, require much study to determine their meaning. These reports have been used freely here and are ambiguities removed. The reports of Silver, Allhardt and Hallidie, notes by Adamson, the Canadian Geological Survey Report by Dawson and the correspondence with superintendents and miscellaneous papers of the Company have all been utilized and greatly assisted in furnishing data for this compilation.

Edward B. Durham, E.M.,

San Francisco, Aug 2, 1898 .

Mining Engineer