

THE HISTORY OF SUBMARINE MINING

AND

BOOM DEFENCES

IN

ESQUIMALT HARBOUR 1893-1938.

by

RONALD LOVATT

Submarine mining was always conducted in great secrecy. All plans, documents and correspondence connected with it were classified and, in accordance with the rules for such material, were subsequently almost entirely destroyed.

Those few items which have survived which are related directly to submarine mining at Esquimalt, plus evidence from secondary sources and the general military manuals of the period, indicate the general nature of the submarine minefield as well as the methods for a short period between 1893 and 1938. It was possible to estimate the pattern and location of the minefield.

A RESEARCH PAPER IN PARTIAL
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Archives of Fort Rodd Hill National Historic Park, the
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 Engineer Museum, Chatham, England. PREFACE I am most grateful for
 the help I received from the staff of these institutions.

This history of the submarine mining and boom
 defences of Esquimalt harbour from 1893 to 1938 has been
 prepared for the Superintendent of Fort Rodd Hill National
 Historic Park. It is intended to serve as a reference for
 the briefing of park guides and staff, and as a source for
 the eventual whole history of Fort Rodd Hill.

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September 1974

Brentwood Bay

R.L.

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consequently raised by General Sir John F. Burgoyne, Bart., G.C.B., Inspector General of Engineers. A joint Military and Naval Committee was appointed to examine the feasibility of submarine minefield defence of harbours. After five years of technical reports and practical experiment, the general conclusion was drawn that effective submarine mine defence of ports and bases was not only feasible but desirable. Funds were allotted for expenditure on submarine mine defences in 1870. In that year, the Torpedo Committee of the Works and Fortifications Branch of the War Office in London, under the direction of Lieutenant-Colonel C.H. Nugent R.E., began work on the detailed specifications of submarine mines and mining equipment for service use. The Committee's first report, dated 3 October 1870, contained recommendations for the type of mine case, explosive content, arrangements for mooring on the sea bed, and electrical cable and batteries. Other reports followed as technical trials of various pieces of equipment were completed. The Torpedo Committee's technical reports were considered by a War Office committee presided over by Sir Frederick Chapman, K.C.B., Inspector General of Fortifications, which studied the tactical deployment of mines and the provision of personnel necessary to maintain and operate the

1. Lt. Col. W. Baker-Brown R.E., History of Submarine Mining in the British Army (Chatham: Royal Engineers Institute, 1910), pp. 7-15.

2. Ibid., pp. 17, 18. Prior to 1870 all forms of explosives devices for use in water were known as torpedoes.

new weapons. Minefields were to be placed under the protection of the guns of coastal forts, never more than 1000 yards in advance of the forts. At that time 1000 yards was considered to be the range at which shell penetration of the new ironclad ships, and therefore artillery defence superiority, could be guaranteed. The minefield would be patrolled by armed vessels by day and be illuminated by night to prevent enemy small boats from minesweeping. If, in spite of these precautions, an enemy was able to start minesweeping, this would be made difficult by the use of dummy mines and chains laid on the sea bed parallel to all electric cables. The Committee considered a Royal Engineer staff of two officers, six non-commissioned officers and 44 sappers was necessary for each principal port having a minefield. Some of these men were to be trained divers, able to inspect mines which were permanently laid, thus reducing the expense which would otherwise be incurred in the periodic lifting of minefields for maintenance. After considering the general principles of minefield defence and the deployment of personnel, the Committee began an examination of specific requirements for the many ports and bases throughout the Empire. A cloak of secrecy was drawn tightly over all details of plans and equipment.

All minefields in the British service had certain general characteristics in common. Electrically fired mines

of two types were used, fired either by an observer or by contact. The observer fired mines were usually of large explosive capacity, up to 500 lb, to allow for errors in observation. They were laid at a depth of 30-60 feet. Position finders, or marks, on shore allowed an observer to assess the position of a ship entering the minefield so that a mine could be detonated to maximum effect. Such mines could be laid in peacetime and maintained by divers, thus reducing the time needed to fully prepare a minefield in any war emergency. The second type of mine, the contact mine, was connected to a circuit closer system. The mine was made active when the circuit was switched on at the shore control post. Once activated, a mine could be detonated on contact by any ship. These mines were laid closer to the surface than the observation mines. Neither type of mine offered any restriction to shipping unless activated by the shore control station, except that ships were not allowed to anchor in a minefield for fear of damage to the electrical cables on the sea bed. By 1871, the development, maintenance and operation of submarine mines in the British service had become a Royal Engineer prerogative. In that year the first submarine mining company, 4 Company, was formed. Two years later an old line of battle ship, H.M.S. Hood, was converted into the first submarine mining school. In the years that followed, the

4. Ibid., pp. 2, 235.

first submarine mining militia were formed in England. Trials of the new weapon regularly occurred during the course of the development of equipment and techniques. In 1885, a Royal Engineer submarine mining officer, Captain E.F. Rhodes, was posted to Melbourne, Australia, the first to be sent to the self-governing colonies. Five years earlier, the first Manual of Submarine Mining had been published. In 1888 this was rewritten to include all the latest developments in techniques and equipment.⁵

In spite of the Royal Engineer prerogative in submarine mining in the British service, the first submarine miners to serve in the British garrison at Esquimalt were Royal Marines. A strong parliamentary lobby and the influence of Sir J.C. Coulomb M.P., a respected military strategist and ex Royal Marine officer, resulted in the experimental garrisoning of small stations throughout the Empire with Royal Marines. Esquimalt was one such station. It received a Royal Marine Artillery garrison in 1893. Two of the officers and thirty-one marines of the garrison were specially trained in submarine mining. The marines had all completed the Royal Engineer's submarine mining recruit course. Some had completed further specialist training, two having qualified as Military Mechanist Electricians after completing the Royal Engineers long course of twenty-two months. The two officers had both completed the Royal Engineers officer's

5. Ibid., pp. 25,35,52.

6
course in submarine mining.

Whilst the British authorities had shown remarkable foresight in sending trained submarine miners to Esquimalt at this early stage in the developement of the defences, it was of no avail. Only the positioning of 6-inch disappearing guns had been decided when the Royal Marine Artillery began their garrison duties in 1893. The first of these guns did not arrive until 1896. In that same year, electric lights and 6-pounder guns were considered for the defence of the minefield at the entrance to Esquimalt harbour. It is clear that in 1896 the minefield was still being planned and that no actual mine laying had taken place. A plan for the minefield was approved by the Admiralty in London on April 2, 1898. The five year agreement between Canada and Britain, which had brought the Royal Marine Artillery detachment to Esquimalt in 1893, expired in 1898. A new agreement was negotiated in 1898-1899 and the Royal Marine Artillery Detachment's tour of duty was extended to cover this interim period. It is hardly likely that Britain would have supplied

6. R. Lovatt, "A History of the Royal Marine Artillery Detachment at Esquimalt 1893-1899," (Unpublished Research paper, Fort Rodd Archives, 1974), pp. 5-8.

7. Public Record Office, London, England, (Hereafter referred to as P.R.O.) CAB 11/27, 7968. Report on Electric Lights and Quick-firing Guns. By Major Muirhead, R.E.m and Lieutenant Boothby, R.N., 30 March 1896.

8. P.R.O. CAB 11/27, 7968. Colonial Defence Committee proposals as a result of War Office and Admiralty consideration of Muirhead/Boothby report, 15 March 1898. Annotated; Approved Admiralty 2.4.98.

Esquimalt with the classified equipment necessary to establish a minefield during this period of negotiation. There is no evidence to suggest that the Royal Marine Artillery Detachment which garrisoned Esquimalt between 1893 and 1899 was ever actively engaged in the laying and maintenance of a submarine minefield, or in training the militia gunners of Victoria for duties with such a minefield.

The plan approved in 1898 allowed for a minefield which was to contain 32 one-hundred-pound electro-contact mines, 4 fifty-pound electro-contact mines in the shallows under Rodd Hill and 22 five-hundred-pound observation mines in a 200 yard wide friendly channel. Outside the minefield, an examination anchorage was to be established beyond a line from BlackRock to the west end of the salt lagoon on the west shore of the harbour entrance. For the close protection of this minefield, two batteries, each of two 12-pounder Q.F. guns, were to be erected at Belmont and Black Rock to supplement the two 6-pounder Q.F. guns at Duntze Head. One searchlight was to be mounted at Rodd Hill and two at Duntze Head to illuminate the minefield area by night.

The terms of the new agreement between Canada and Britain for the defence of Esquimalt were accepted by Canada in May 1899, to take effect from September 30, 1899. The new agreement provided for the replacement of the Royal Marine

9. C.S. MacKinnon, "The Imperial Fortresses in Canada: Halifax and Esquimalt, 1871-1906," (Unpublished M.A. Thesis, University of Toronto, 1965), p. 335.

Artillery at Esquimalt by a larger garrison of Royal Artillery to man the gun batteries of the defences, and Royal Engineers to lay and maintain the minefield, to man the searchlights and to maintain all buildings in the fortress. 48 Company (Submarine Miners) and half of 44 Company (Fortress) of the Royal Engineers arrived at Esquimalt in the spring of 1900, from Chatham, England.

Consequent upon the new agreement, 5th British Columbia Regiment Canadian Artillery, the militia regiment of Victoria allotted to the Esquimalt defences, was reorganised with one of its six companies, 5 Company (Major Hibben), converted to a company of submarine miners. This arrangement was in accordance with the common practice in England where the small regular garrison of submarine miners of each defended port was backed by a unit of militia submarine miners who, when mobilized, would provide the necessary extra manpower needed to lay and operate the minefield in time of war. The experiment with the Victoria militia gunners was short lived. A compulsory three week annual camp and stiff technical skill requirements for admission to its ranks kept the strength of 5 Company at a very low level. After failing

10. Ibid., pp. 263, 305-307.

11. The Daily Colonist [Victoria], 26 May 1900. F.V. Longstaff, Esquimalt Naval Base (Victoria, B.C.: Victoria Book and Stationery Company, 1941), p. 52.

12. 5th British Columbia Regiment Canadian Artillery Regimental Order (Hereafter referred to as R.O.) 22 November 1899.

to fulfill its role during the first annual practice mobilisation of the defences in September 1900, the Company¹³ reverted to artillery duties in the following October.

Ottawa agreed to pay for a small increase to the strength of 48 Company (Submarine Miners) Royal Engineers of one officer and fourteen sappers to compensate for the loss of the militia company.¹⁴

By 1902, the Esquimalt fortress defence scheme had become a sophisticated plan which clearly stipulated procedures to be used in any emergency and coordinated the gun, searchlight and mine defences of the harbour. The plan for the minefield, approved in 1898, had been largely implemented. A mine test room and minefield observing station had been built at Duntze Head. Lead covered cables had been laid on shore between the observing station and connection points for the southern half of the minefield. Similar cables were awaited for the northern half of the minefield, meantime armoured cables of the correct length were ready in reserve for any emergency. The remainder of the submarine mining stores were practically complete and were held ready for immediate use at Duntze Head. The fortress mobilisation plan allowed two days for laying the mines and bringing the minefield to a state of operational readiness. To meet this time limit much would depend on the availability

13. R.O. 5 October 1900.

14. Mackinnon, "The Imperial Fortresses in Canada" p. 308.

of suitable steamers at Esquimalt or Victoria. The steamships Maude and Selkirk were considered the most suitable vessels, having clear deck areas and lifting gear of the necessary capacity. As these vessels were regularly employed along the British Coast their availability in any emergency was by no means certain. This uncertainty, and the consequent weakness in the defences which might result, could be remedied only by the construction of vessels specifically for minelaying and having these vessels always under military control.

The steamships Beryl and Topaz were built locally for minelaying and minefield maintenance between 1902 and 1905. Both conformed to the standard construction plans for such vessels formulated in England and published in the technical handbooks of the time. They became a familiar sight on the harbour waters, no doubt carrying out a wide variety of routine tasks for the garrison and regularly visiting both Fort Rodd Hill jetty and the minelaying jetty at Duntze Head.

By 1903, the development of the submarine had reached the stage at which the Admiralty could offer it as a viable alternative to minefields for the defence of harbours.

15. P.R.O. CAB 11/27. 7968. Secret. Esquimalt, British Columbia, Defence Scheme. Revised to January, 1902. An extract indicating the preparation and laying procedures is at Appendix A attached.

16. The author has compared a photograph of Beryl and Topaz on a garrison christmas card with photographs of vessels in Manual of Submarine Mining (London: War Office, 1901), I, List of Plates, at the Royal Engineers Museum. Reproduction of plates was not possible for this paper.

Minefields, controlled by army personnel and confining ships to narrow channels in time of war, had never been popular with the Royal Navy. The submarine, controlled by the Royal Navy, offered an alternative, but the army could not agree that it offered as complete a defence, and could not agree either to complete freedom of entry and exit for submarines. It was also argued that minefield defence cost less. The Russo-Japanese war clearly showed the value of electrically fired, controlled minefields for the defence of harbours, ensuring the retention of such minefields in the British service for some years, but the Admiralty won control of such minefields from the Army. The handover of minefields, and of all minelaying responsibilities, from the Royal Engineers to the Royal Navy began in 1904.

Some details of the change in British service responsibility, and of its effects on the Esquimalt defences, were given in a report in the Daily Colonist [Victoria], March 8, 1905, at a time when the Royal Navy had started to evacuate the base at Esquimalt:-

The mines laid at Esquimalt by the submarine mining branch of the Royal Engineers are being raised and will be shipped to England by the British ship Penthlisea, now loading stores, ordnance and naval supplies being returned to England as a result of the dismantling of the station. Moreover, the submarine mining corps now affiliated with the Royal Engineers of the Work Point Garrison are to be disbanded; This decision has been reached by the War Office. . . . The reduction of the submarine mining branch of the corps of Royal Engineers

17. Ibid., p. 553. Baker-Brown, History of Submarine Mining, p. 114.

will involve thirteen regular and ten militia companies. The foreign service units are stationed at Bermuda, Malta, Halifax, N.S., Hong Kong and Esquimalt. . . . How the changes will affect the two steamers Beryl and Topaz, built here for the submarine mining corps of the Royal Engineers is not known. Both vessels are at Esquimalt.

A further report the following day in the same newspaper gave the British garrison commander's opinion on the loss of the minefield at Esquimalt:

The Mines at Esquimalt----. . . . it is stated by Colonel English that he does not anticipate the abandonment at the present juncture, if ever, of this important feature of the defences of Esquimalt. . . . The Colonel is inclined to believe that one or both [Beryl and Topaz] will be taken over by the Canadian government

These two reports confirm the presence of minefield equipment at Esquimalt in 1905 and the existence of the two minelaying and maintenance vessels Beryl and Topaz. The report of March 8 indicates that mines were actually laid at the entrance to Esquimalt. This report appears to clash with the clear indication in the 1902 Defence Scheme that the mines were held in store at Duntze Head in a state of immediate readiness. It seems probable that a change of policy with regard to the laying of the minefield occurred between 1902 and 1905. This change may have occurred with the construction of Beryl and Topaz. With these vessels it would have been easy for 48 Company to lay the minefield and to regularly maintain it using the trained divers within the Company's ranks. In doing so, 48 Company would have been

18. The Daily Colonist [Victoria], 9 March 1905.

operating in accordance with the general submarine mining procedures of the time.

The reported statement by Colonel English appears to clash with the first report with regard to the continued inclusion of a minefield in the Esquimalt defences. However, Colonel English does not deny the removal of mines and equipment which were British owned and operated. It appears that he was probably being no more than diplomatic for there were many people locally who viewed the removal of British responsibility for the defences of Esquimalt as a retrograde step.

It seems certain that mines which had been laid at Esquimalt were raised in the spring of 1905 and removed with all other naval stores during the evacuation of the naval station by the Royal Navy. There are three major considerations which seem to support this. Firstly, there is no mention of a minefield, or mining equipment, at Esquimalt in newspaper reports of the handover of the Esquimalt defences from the British garrison to the Canadian forces a year later, in 1906, even though the handover is treated in considerable detail. Secondly, the Canadian replacement for the Royal Engineer Companies was 3 Fortress Company Royal Canadian Engineers and there seems to be no record of this company having any duties with regard to a minefield at Esquimalt, even though some members of 48 Company were among the 31 sappers of the Royal

Kerry and Major W.A. McGill, *The History of The Corps of Royal Canadian Engineers* (Ottawa: Military Engineers Association of Canada, 1962), I, p. 54.

Engineers who transferred to Canadian service. Lastly, There is no mention of the transfer of a minefield or mining equipment between British and Canadian naval authorities in accounts of the transfer of the Esquimalt naval base from Britain to Canada.

The subsequent fate of the two steamships Beryl and Topaz is unknown, although there are indications that they may have continued in harbour service for some time after 1906. 48 Company returned to England with other troops of the British garrison in 1906. It was disbanded shortly after its arrival.

It appears certain that a minefield did not exist at the entrance to Esquimalt harbour during the First World War, 1914-1918. There are many accounts of the near disastrous entry of the two former American submarines, purchased by Premier McBride, into Esquimalt harbour on 5 August 1914. Whilst these accounts differ in detail they agree in their omission of any mention of any hazard to the two vessels from mines, emphasising only a hazard from the shells of the coast defence guns. There is no mention of a minefield in any account of the naval history of Esquimalt during the war. The responsibility for the coast defence of the harbour was vested in 5th British Columbia Regiment Canadian Artillery. The Regimental Archives for the period are extensive. A search of

19. Victoria Daily Times 12 May 1906. Colonel A.J. Kerry and Major W.A. McDill, The History of The Corps of Royal Canadian Engineers (Ottawa: Military Engineers Association of Canada, 1962), I, p. 54.

them did not reveal any reference to a minefield. If a minefield had existed some reference could be expected as the guns and searchlights under the Regiment's control, in that case, would have been coordinated with the operation of the minefield. It appears certain that submarine mines played no part in the defence of Esquimalt during the First World War.

In 1928, the Joint Staff Committee, Pacific Coast of Canada, in their recommendations for improving the defences of Esquimalt, considered that a small number of controlled mines at the harbour entrance, and other mines layed by submarine and surface vessels in the Straits of Juan de Fuca,

were a necessary part of the overall defence plan for Esquimalt. No action appears to have been taken on the Committee's recommendations in the years of financial stringency and economic depression which followed the Committee's report. In 1937, when money was at last voted by the Canadian parliament for rearmament to begin, the emphasis was placed on gun and naval surface vessel defence of Esquimalt, particularly on the former. There appears to be no indication that a minefield was laid at the entrance to Esquimalt before 1939.

There is no doubt that in the history of the defences of Esquimalt between 1893 and 1939 the authorities concerned

20. Fort Rodd Archives. Department of National Defence V.S. 101-2-50. Secret. 27.12.28. Defence of Pacific Coast of Canada, Fortess of Esquimalt. Minutes of a Meeting of the Joint Staff Committee, Pacific Coast of Canada, haeld at Work Point Barracks, on December 24, 1928. Part 1V. p. 27.

between 1906 and 1939.

did give serious consideration at various times to the inclusion of a submarine minefield at the entrance to Esquimalt harbour as part of the overall defence plan. A minefield actually existed for only a few years of the period. Troops specially trained in the techniques of submarine mining, were included in the British garrison at Esquimalt from 1893 to 1906. Initially, their presence was due to anticipation in London, England, that the minefield at Esquimalt would be provided at an early date. However, the final plan for the minefield was not approved by the Admiralty until 1898. Consequently, the early submarine mining specialists at Esquimalt, men of the Royal Marine Artillery, were not employed in minelaying, or in training the militia in minefield duties. Minefield equipment and shore establishments did exist at Esquimalt in 1902. 48 (Submarine Mining) Company Royal Engineers were responsible for these. Between 1902 and 1905, two minelaying and minefield maintenance vessels, Beryl and Topaz, were built for the Company. After they came into service it seems quite likely that mines were actually laid at the entrance to Esquimalt harbour and the minefield regularly maintained in position. It appears certain that this minefield was lifted in 1905, that all mines and mining equipment were handed over by 48 Company to the Royal Navy and that they were shipped from Esquimalt when the Royal Navy base there was evacuated. No other mines were laid at Esquimalt harbour entrance between 1906 and 1939.

BOOM AND NET DEFENCES.

The use of booms to close a harbour mouth to hostile shipping has a history stretching back into the times of ancient Rome and Greece. With modern equipment and techniques, the boom as a means of harbour defence enjoyed a revival in recent history as an obstacle to torpedo boats attacking ships at anchor. Underwater nets, suspended vertically from floats or booms, were developed in the same period as a protection against torpedo attack, causing the torpedo to prematurely explode before it reached its target. Nets, when made of steel mesh, served also to prevent the submerged entry of enemy submarines into a harbour.

There is no indication that boom or net defences were ever used, or were even seriously considered for use, at the entrance to Esquimalt harbour before 1928. In their report of 1928, the Joint Staff Committee, Pacific Coast of Canada, suggested that boom and net defences should be provided for Esquimalt harbour entrance and recommended further study of their proposal.²¹ The recommendation was never taken up. The report was largely ignored in the years of government parsimony and depression which lasted until 1937. When the necessary funds for rearmament were finally approved by the Canadian Government in that year, priority was given to the coastal gun defence of Esquimalt. The entrance to Esquimalt harbour did not have a boom or net defence before

21. Ibid.

the outbreak of the Second World War in 1939.

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The Daily Colonist [Victoria]

The Victoria Daily Times

laying out cables. Orders from the Fortress Commander would then be awaited before commencing to lay mines.

7. Action upon Orders to lay Mines. 1st Day.-- It is calculated that, with one large hired steamer and a small tug or launch to assist the junction box boats, &c., the whole of the observation mines could be laid in about three hours; those of the Friendly Channel would be laid first. The electricians, in the meanwhile, would continue priming and testing apparatus, and the mines

APPENDIX A

Extract from P.R.O. CAB 11/27. 7968. Secret. Esquimalt, British Columbia, Defence Scheme. Revised to January, 1902.

2nd Day.-- Any mines not laid on the previous day would be laid now, and the whole mine-field should be

6. Action upon Orders to Prepare.--With no suitable submarine mining vessels, it is obvious that the mine-field will take considerably longer to lay than should be the case.

1st Day.--The 48th (S.M.) Company Royal Engineers will proceed to the Submarine Mining Establishment, Signal Hill, and be encamped there, with detachments at Rodd Hill (for electric lights), and in the Naval Yard, Test Room, and Observing Station. A considerable portion of this day will be expended in pitching camp and drawing the necessary stores, ammunition, &c., from the Army Ordnance Depot.

The owners of the various steamers suitable for submarine mining work would be communicated with, and endeavours made to obtain one large laying-out steamer and one smaller launch or tug before the next morning. This would be contingent on whether any suitable steamers were in Victoria at the time they were required, as frequently this is not the case owing to their absence at the canneries, lumber camps, &c.. Twelve civilians would be hired to assist the shore party.

In the meantime, the following defence gear would be got ready for embarking, viz.: main and group cables with their moorings (boxes, &c.). All alignment marks would be placed in position. The electricians would commence priming and testing apparatus. The four electric lights would be from now on run nightly, if so ordered by the Fortress Commander, two from each side of the harbour.

2nd Day.--Assuming that the hired steamers would now be available, the main and group cables, boxes, and moorings would be laid out, and while this was being done the necessary gear for laying out mines would be fitted to the hired steamers.

The electricians would continue priming and testing apparatus, commencing with those of the observation mines of the Friendly Channel. If time permitted, these observation mines would be connected up, ready for embarking on the steamer as soon as she had finished

laying out cables. Orders from the Fortress Commander would then be awaited before commencing to lay mines.

7. Action upon Orders to lay Mines. 1st Day.-- It is calculated that, with one large hired steamer and a small tug or launch to assist the junction box boats, &c., the whole of the observation mines could be laid in about three hours; those of the Friendly Channel would be laid first. The electricians, in the meanwhile, would continue priming and testing apparatus, and the mines would be connected up by the shore party as soon as possible. With favourable weather, the majority of the E.C. mines should have been laid before dark.

2nd Day.-- Any mines not laid on the previous day would be laid now, and the whole mine-field should be complete in every respect.

3rd Day and succeeding days would be employed in maintaining the mine-field and laying improvised boat mines on its flanks. A telephone cable would be laid across the harbour to connect Rodd Hill with the eastern portion of the defences.

Manual of Submarine Mining. Vols. I, II. London: War Office
1911, 1908.

P.R.O. SECRET 1971, 1968. Secret. Esquimault, British
Columbia, Defence Scheme, Revised to January, 1952.

Map.

Canadian Hydrographic Service. ESQUIMAULT HARBOUR chart 3416.
1972.

APPENDIX B

Map showing Estimated Location of Esquimalt Minefield 1900-1905.

Technical Sources.

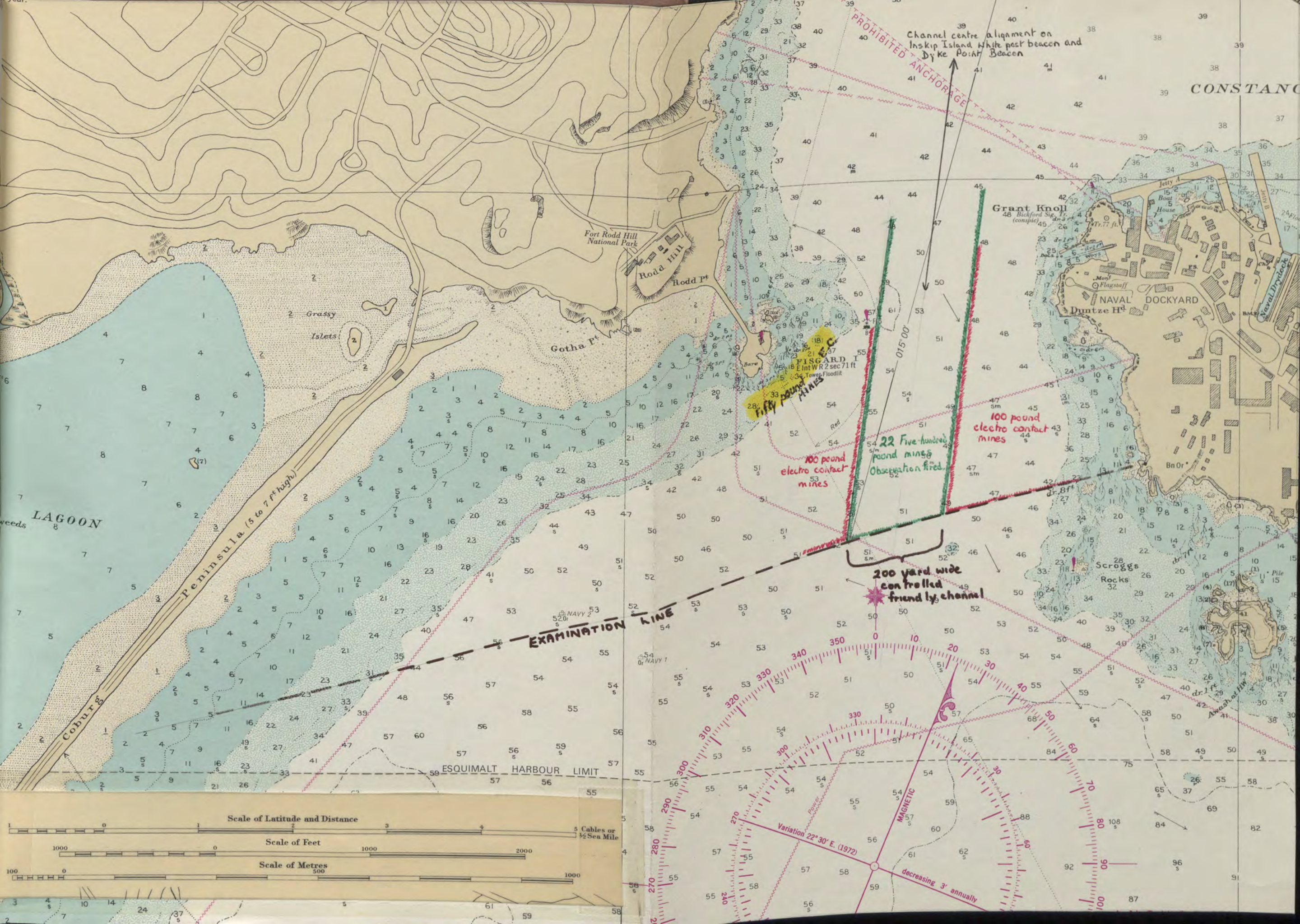
Baker-Brown, Lieutenant-Colonel W. History of Submarine Mining in the British Army. Chatham: Royal Engineers Institute, 1910.

Manual of Submarine Mining. Vols. I, II. London: War Office 1901, 1904.

P.R.O. CAB 11/27. 7968. Secret. Esquimalt, British Columbia, Defence Scheme. Revised to January, 1902.

Map.

Canadian Hydrographic Service. ESQUIMALT HARBOUR chart 3416, 1972.



CONSTANCO

Channel centre alignment on Inskip Island White post beacon and Dyke Point Beacon

PROHIBITED ANCHORAGE

Fort Rodd Hill National Park

Rodd Hill

Gotha Pt.

Grant Knoll

NAVAL DOCKYARD

Duntze Hd.

LAGOON

Peninsula (5 to 7 ft high)

EXAMINATION LINE

200 yard wide controlled friendly channel

Scale of Latitude and Distance

Scale of Feet

Scale of Metres

Cables or 1/2 Sea Mile

Variation 22° 30' E. (1972)

decreasing 3' annually