Karljohansvern
Horton Ren Indre Havn: Historical Investigation

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Aircraft flying in formation over Karljohansvern (photo Marinemuseet)

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Table 01. The document’s version history (ADEDE).

3 ABBREVIATIONS AND DEFINITIONS

<table>
<thead>
<tr>
<th>Item</th>
<th>Meaning</th>
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<tbody>
<tr>
<td>AA</td>
<td>Anti Aircraft</td>
</tr>
<tr>
<td>A/C</td>
<td>Aircraft</td>
</tr>
<tr>
<td>EO</td>
<td>Explosive Ordnance</td>
</tr>
<tr>
<td>EOD</td>
<td>Explosive Ordnance Disposal</td>
</tr>
<tr>
<td>ERW</td>
<td>Explosive Remnants of War</td>
</tr>
<tr>
<td>FT</td>
<td>Feet</td>
</tr>
<tr>
<td>Gardening</td>
<td>Overall designation of the aerial minelaying policy adopted by the British to hinder the movement of German naval and mercantile shipping in</td>
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European waters. Such minelaying was usually undertaken at night by bombers.

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
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<tr>
<td>GIS</td>
<td>Geographical Information System</td>
</tr>
<tr>
<td>Gp</td>
<td>Group</td>
</tr>
<tr>
<td>GP</td>
<td>General Purpose</td>
</tr>
<tr>
<td>HE</td>
<td>High Explosive</td>
</tr>
<tr>
<td>HOD</td>
<td>Historical Ordnance Disposal</td>
</tr>
<tr>
<td>H/P</td>
<td>Height/Pressure</td>
</tr>
<tr>
<td>Lbs/LB</td>
<td>Pounds</td>
</tr>
<tr>
<td>MC</td>
<td>Medium Capacity</td>
</tr>
<tr>
<td>MTB</td>
<td>Motor Torpedo Boat</td>
</tr>
<tr>
<td>NATO</td>
<td>North Atlantic Treaty Organization</td>
</tr>
<tr>
<td>NEQ</td>
<td>Net Explosive Quantity</td>
</tr>
<tr>
<td>NIL</td>
<td>None, zero</td>
</tr>
<tr>
<td>RAF</td>
<td>Royal Air Force</td>
</tr>
<tr>
<td>SAA</td>
<td>Small Arms Ammunition</td>
</tr>
<tr>
<td>SNMCMG1</td>
<td>Standing NATO Mine Counter Measures Group 1</td>
</tr>
<tr>
<td>Sqn</td>
<td>Squadron</td>
</tr>
<tr>
<td>TI</td>
<td>Target Indictator</td>
</tr>
<tr>
<td>TNA</td>
<td>The National Archives</td>
</tr>
<tr>
<td>T.D.</td>
<td>Time Delay</td>
</tr>
<tr>
<td>TNT</td>
<td>Trinitrotoluene</td>
</tr>
<tr>
<td>TOT</td>
<td>Total</td>
</tr>
<tr>
<td>UK</td>
<td>United Kingdom</td>
</tr>
<tr>
<td>USA</td>
<td>United States of America</td>
</tr>
<tr>
<td>UXO</td>
<td>Unexploded Ordnance</td>
</tr>
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Table 02. Table of abbreviations and definitions (ADEDE).
4 INTRODUCTION

4.1 PROJECT DESCRIPTION

On the Karljohansvern site at Horten, Norway, a remediation project will be conducted in the Indrehavn (inner harbour). The project follows a preventive safety policy, and has thus included several security measures relating to Unexploded Ordnance (UXO) in its procedures. As the Karljohansvern site is known to have been bombed during the Second World War, ADEDE was contracted by the project on the 24th of November, 2017, to conduct historical research on the possibility of finding UXO at the site.

The main goal of the historical research is to determine the risk of finding UXO during the future works. The parties involved are thus given a base to determine the further policy on this issue. The study of historical accounts results in a number of technical details that are important for further risk analysis of the UXO problem, such as types, calibres, nationality, and amounts of UXO suspected to be present. Apart from many other historical sources, aerial photographs and maps are also analysed and interpreted, in order to limit the risk area to its true extent. All sources used are cited in footnotes and the ‘Sources’ chapter at the end of the report.

A geographical information system (GIS) was used to georeference any geographical information mentioned in the textual sources, and any charts or aerial photographs which were encountered during the investigation. Due to the nature of the source data, a degree of inaccuracy needs to be considered when using the delivered georeferenced data.

DISCLAIMER

It should be further noted that certain incidents occurring throughout history were either never recorded in historical sources, or recorded incompletely or incorrectly. Sources have been lost, deliberately destroyed, or are still inaccessible to historians and researchers. All these problems are inherent to historical research and are insurmountable. Although the available sources were consulted and analysed with scientific caution, ADEDE cannot be held liable for the completeness and accuracy of the sources used, or the conclusions that were drawn from them.
5 PROJECT AREA

The research area of Indrehavn and Karljohansvern is located in the territory of the municipality of Horten, located in the county of Vestfold in southern Norway. The site lies on a peninsula about one kilometer northwest of Horten centre. The size of the project area is approximately 392 hectares. The harbour of Indrehavn is protected from Oslofjord by four islands: Vealøs, Østoya, Mellomøya, and Løvøya. An isthmus connects Løvøya with the mainland, closing off Indrehavn.

Figure 01. Chart showing Project Area, divided into zones (ADEDE).

5.1 METHODOLOGY

The historical investigation was conducted by consulting the various available sources in civilian and military archives, both within and outside of Norway. The sources were analysed and the relevant information compiled in the following report.
5.2 BACKGROUND OF KARLJOHANSVERN

Horten is a city on the Oslofjord in southern Norway. A naval base was established there in 1819 and was in service until 1963. This base, Karljohansvern, named in 1854 by then-King Oscar I for his father Karl Johan, was the main base for the Royal Norwegian Navy for almost 150 years. The naval base began work on ships immediately, and launched its first frigate in 1828. The local shipyard on the base was known as Krim. The naval base served as the main base in Norway through both World Wars, until 1953 when it was decided to relocate the headquarters of the Navy to Haakonsvern in Bergen (a move that would take a decade to complete). After functions of the Navy relocated to Bergen, the shipyards at Karljohansvern were used for twenty years by the National Government.

Figure 02. Aircraft flying in formation over Karljohansvern (photo Marinemuseet)

5.2.1 MARINENS FLYVEBAATFABRIKK

Marinens Flyvebaatfabrikk (Naval Aircraft Factory) was established in May 1915, and was built to manufacture aircraft for the Royal Norwegian Navy Air Service (which would eventually combine with the Norwegian Army Air Service in 1944, creating the present-day Royal Norwegian Air Force). Marinens Flyvebaatfabrikk would later come to include a flight school, an air observer school, a mechanics school, and a radio & telegraphy school. 128 aircraft were built at the factory prior to WWII. The construction of Hangars A and B had just started at the
beginning of the war and was completed by the Germans during the occupation of Norway. Torpedo trials were conducted in Indrehavn by Marinens Flyvevesen. Marinens Flyvebaatfabrikk was closed down in 1965.

![Figure 03. Map of Indrehavn, showing the location and detail view of the Marinens Flyvebaatfabrikk (Modified by ADEDE).](image)

5.2.2 **MARINENS MINEVESEN**

Torpedovæsenet (torpedo administration) was established at Karljohansvern in 1870 under the command of Karljohansværn verft. From 1876 until 1887 the personnel of the Torpedo – Mine department were subordinate to this administration. In 1896 the Torpedovæsenet was renamed Minevæsenet (mine administration). A reorganization was conducted in 1901, and the Mine Administration became an independent military-technical administration directly subordinate to the Ministry of Defence, with the administrator receiving the title of “Minedirektør”.

11/42
Mines were produced at the naval base. The production of mines (*Marinens* 60 kg.s *Lodmine*, type 1911) took place in a workshop which was built in 1910 at Krim, close to the torpedo magazine. In 1913, the *Minevesenet* prepared a new series of 125 mines which differed in outer form from the first in that they were spherical. In addition TNT (trinitrotoluene) had been introduced in 1912 as the main charge. Also in 1913, it was decided to have a national production of torpedoes and the plans for a new major workshop at Karljohansvern also took into account the manufacture of mines. Construction of the new torpedo/mine workshop was started in 1914 just before the First World War broke out. Along with production, there must come test trials. Both mine and torpedo trials would have been conducted in Indrehavn. There might be M/1911, N29 and N49 mine anchors left in the harbour from mine trials. Torpedo trials were conducted at Horten at least three times: 7 April 1919 (the first completely Norwegian-built torpedo), and again in 1924 and 1932, all of which may have left residue (propeller parts, etc).

30 *Hortenstorpedoen* Model F. 1 were seized by the German invading forces in 1940.

In 1946 the *Mineinspeksjonen* (mine inspectorate) was established and this was incorporated into the *Maskininspeksjonen* (machine inspectorate) in 1952. In 1963 the *Mineinspeksjonen* was transferred to Haakonsvern, Bergen.

5.3 **Vealøs**

Vealøs is the first of the islands surrounding the harbour, 0.1 km², located just off the coast of Horten, but connected to the mainland by bridge. A fortress, called “Norske Løve” (“Norwegian lion”), was built to protect Karljohansvern in 1852. The island is still a military area, but mostly for administrative use. Just after World War II, two Motor Torpedo Boat (MTB) hangars were built on the northwest side of Vealøs. The island has been used as a base for MTB ca. 1990.
Figure 04. Map of Indrehavn, showing the location of Vealøs (Modified by ADEDE).
Figure 05. Rapp Class Moter Torpedo Boat (*photo Marinemuseet*)

5.4 ØSTØYA

Østøya, the larger island (0.7km²) directly to the west of Vealøs, was also used as part of the naval base. In the 1870’s and 1890’s, storage sheds and buildings were constructed for storing gunpowder, ammunition, and torpedoes. This continued during WWI—despite the fact that Norway was officially neutral in the First World War. When Norway was occupied during WWII, the Germans appropriated these storehouses on Østøya and even built more on the island, including at least one bunker. Their main storage for torpedo warheads was located here.

This trove was too tempting a target to be ignored by the Norwegian Resistance. An attack to sabotage and explode the torpedo storage was conducted by the Resistance on 21 January 1945. A single member of the Resistance, Hjalmar Berge, set timed explosives in the bunker on Østøya where the torpedo warheads were stored. Next to the bunker was a gunhouse storing spare parts for torpedoes. In the explosion, 184 torpedo warheads and the gunhouse, comprising almost 70 tons of ammunition, were obliterated.

There are accounts of windows in the vicinity blowing out due to the explosion, of citizens of Horten thinking there was an earthquake, of a column of smoke rising from Østøya. The possibility of UXO remaining in the water around the island is therefore highly likely.
Figure 06. Map of Indrehavn, showing the location of the island of Østøya (Modified by ADEDE).
After WWII, a facility was built on the island to extract explosives from sea mines, which operated until at least 2006. The Royal Norwegian Navy’s first diving school was established on Østøya in 1953. It was that same year that relocations of the Navy base to Haakonsvern in Bergen began. The Navy’s diving school also eventually relocated to Haakonsvern, in 1966. In 1955 Østøya and Mellomøya were connected by bridge, and a railway was built on the islands to transport mines, torpedoes, and ammunition between workshops, depots, and quays. Østøya is still military property and as such is closed to the general public.

5.5 **Mellomøya**

Mellomøya, 0.4 km², lies between Østøya and Løvøya, connected by bridge to both. The Royal Norwegian Navy bought Mellomøya in 1819, and it was used for the storage of ammunition and the production of TNT. The Germans appropriated these buildings and operations during the Occupation, as they did buildings and operations on neighboring Østøya. Like Østøya, there were gunpowder, ammunition, and explosives magazines located on Mellomøya. There was also a TNT steam house and supervisors’ residence.
Figure 08. Map of Indrehavn, showing the location of the island of Mellomøya (Modified by ADEDE).
6   GERMAN INVASION

Germans attempted to take over Karljohansvern on 9 April 1940, the first day of the invasion of Norway in WWII. Despite resistance, the Germans succeeded in overpowering the naval base in Horten by outflanking the Norwegians overland.

Karljohansvern would remain occupied for the rest of World War II, with Germany utilizing the buildings of the Norwegian naval base and constructing more. Ships operating out of the base of Karljohansvern were forced into German war service.

6.1   THE BATTLE OF HORTEN HARBOUR: 9 APRIL 1940

There were two operational ships at Karljohansvern on 9 April: one was a minelayer (Olav Tryggvason) which had 12cm guns, 67mm flak, a 12.7mm machine gun, 46cm torpedo tubes, and 280 mines. The other was a minesweeper (Rauma) which was equipped with a 76mm gun and 2 machine guns. Almost half the crew of these two ships were on shoreleave the morning of the attack. Whereas the German force Kampfgruppe 5, ordered to launch the attack on Horten, comprised 50+ soldiers, two torpedo boats (each with 10.5cm and 3.7cm guns, 2cm flak guns, 53,3cm torpedo tubes, and 30 mines), two minesweepers (both equipped with 2cm machine guns and 12 mines), and a light cruiser (equipped with 15cm, 10,5cm, 3,7cm, and 8.8cm guns, 6x2cm machine gun, 12 torpedoes to go into 53,3cm torpedo tubes, and 120 mines).
At 05:35 on 9 April, the two German minesweepers, *R17* and *R21*, having sailed up the Oslofjord, entered Indrehavn and prepared to land. The Norwegian minelayer *Olav Tryggvason* began attacking the invading minesweepers, sinking *R17* in the harbour before it could successfully land. The depth charges of *R17* did not detonate as the minesweeper sank. These UXO could possibly remain on the seafloor at Indrehavn.

![Figure 10. The damaged and sinking German minesweeper *R17* at Indrehavn. (ADEDE Archives)](image)

The Norwegian minesweeper *Rauma* attacked the second German minesweeper *R21*, but both ships soon disengaged after sustaining damage, with *Rauma* retreating back to Karljohansvern.

One of the German torpedo boats, *Albatros*, having held back until now, attempted to sail Indrehavn. But the channel between the islands of Østøya and Vealøs was too narrow, and *Albatros* was eventually forced to retreat after taking damage from *Olav Tryggvason*.

Soldiers from the last German ship, the light cruiser, were sent ashore to outflank the naval base. This manœuvre proved successful and the Norwegians surrendered Horten and Karljohansvern.
However, an additional 10-12 German aerial bombs were dropped on Karljohansvern that morning before the German troops on the ground were able to signal that the base was captured.

Figure 11. Map of the Battle of Horten Harbour (map Marinemuseet)
6.2 **German Occupation (1940-1945)**

From April 1940 – May 1945, Horten and Karljohansvern was occupied by German forces. All the ships captured at Horten were brought into service by the Kriegsmarine and renamed. Olav Tryggvason became the Brummer, and Rauma was renamed the Kamerun.

6.2.1 **Sabotage Attack by Milorg, September 1944**

A 10kg charge of explosives was placed onboard the ship "Hull 129" on 26 September 1944 by Ragnvald Teien, a member of the Norwegian Resistance (Milorg). The ship was extensively damaged. The ship sustained further damage from the bomb attack on 23 February 1945.

6.3 **British Bombing: 23 February 1945**

On 23 February 1945, British aircraft dropped aerial bombs on the German-occupied navel base at Horten. The Norwegian Resistance and other intelligence sources had been in contact with London, and they coordinated this aerial attack.

The afternoon of Friday, February 23, 1945, 72 Lancaster bombers and 10 Mosquito reconnaissance aircraft took off from their base in Lincolnshire, England. 53 Lancaster flew across the North Sea to Lindesnes. 19 aircraft broke off at Lindesnes and flew up Oslofjord to Moss to attack Horten.

At seven minutes past eight (20:07) that evening, the British aircraft dropped hundreds of incendiary bombs on the naval base at Horten. Many of the airplanes flew over the Braarudåsen, where German anti-aircraft batteries started firing at them. Bastøya Island and the Garnison church were encircled by green incendiary bombs, and the islands were eventually encircled with red incendiary bombs.

The aircraft came in at high altitude and dropped their bombload at 8000-12000 feet (see Table 3). One source also mentioned aircrafts diving vertically to an altitude of 200m before dropping their bombs. The first bombs fell on Karljohansvern, causing fires in the shipyard and in the northern magazine. The bombing lasted for approximately one hour. Some aircraft remained over Horten to evaluate and record the effect of the attack on the shipyard. It was almost completely destroyed. There were fires in the coal piles and on an oiler (boat). The cranes in the yard were hit and damaged, and three small vessels had direct bomb hits. There is no known information about any German submarines that were damaged or put out of service. It is estimated that between 500 and 600 incendiary bombs and high explosive bombs were dropped in the attack, half of which fell on the shipyard.

In total, Bomber Command dropped (see Table 3):
• 12 1000 LB T.I.
• 8 250 LB T.I.
• 16 1000 LB M.C. bombs
• 939 500 LB M.C/USA bombs

975 bombs were dropped in total, 240 of which have been accounted for (plus nine “duds”). This leaves a discrepancy of 735 of Explosive Ordnance (EO) not accounted for in the sketch from the shipyard (see Figure 14).

In addition 1132 flares were also dropped in this operation.

That same night 126 mines (MK VI) were dropped in Oslofjord by the Lancaster bombers.

Figure 12. Bomber Command Summary of Operations. “HORTON. 72/73 Lancasters and 10/10 Mosquitoes of 5 Group attacked U-boats and shipping in clear weather. A/C bombed on markers and the targets appears to have been well covered by bomb bursts. No shipping was seen. Negligible H/P and no fighters in target area. 1 A/C is missing. T.O.T. 2030/2050 hrs. MINELAYING. 9/10 of Lancasters of 5 Group, 11/12 Lancasters of 6 Group laid mines in enemy waters.” (photo The National Archives Kew)
Figure 13. Aerial photo showing damage to Karljohansvern after the bombing of February 23, 1945. (photo The National Archives Kew)
Figure 14. Bomber Command Summary of Operations. “HORTEN (OSLO FJORD). Was attacked on the night 23/24th February for U-Boats and Shipping. Photos taken on the 24th February show very severe damage to the Dockyard Area which has been practically devastated. Buildings on both sides of the Dry Dock and Wet Dock have been gutted, while the Northern end of the peninsula including the Coal Quay and adjoining buildings are on fire or have already been destroyed. Without stereoscopic cover it cannot be said if there is much damage to shipping.” (photo The National Archives Kew)

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<thead>
<tr>
<th>H.E. BOMBS</th>
<th>1000lb M.C.</th>
<th>500lb M.C.</th>
<th>500lb USA</th>
<th>TONS</th>
<th>250 LB T.I.</th>
<th>1000lb T.I.</th>
<th>Flares</th>
<th>TONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>HORTEN (Oslo Fjord) – Shipping</td>
<td>1000lb</td>
<td>500lb</td>
<td>500lb USA</td>
<td>TONS</td>
<td>250 LB T.I.</td>
<td>1000lb T.I.</td>
<td>Flares</td>
<td>TONS</td>
</tr>
<tr>
<td>5 Lanc. 73</td>
<td>16</td>
<td>625</td>
<td>314</td>
<td>216.7</td>
<td>8</td>
<td>1132</td>
<td>3.6</td>
<td></td>
</tr>
<tr>
<td>5 Mos. 10</td>
<td>NIL</td>
<td>8</td>
<td>4</td>
<td>2.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTALS: 83</td>
<td>16</td>
<td>625</td>
<td>314</td>
<td>216.7</td>
<td>8</td>
<td>12</td>
<td>1132</td>
<td>6.3</td>
</tr>
</tbody>
</table>

BOMB LOAD – BUFFER (MAX 500 lb MC/GP FUSED TD .025)
STICK SPACING – 15 YARDS
BOMBING HEIGHTS 8000 – 12000 FT A/C TO BE SPREAD EVENLY OVER THIS HEIGHT BAND

Table 03. Bomber Command Summary of Operations (information The National Archives Kew)
Figure 15. A sketch of Karljohansvern showing locations of bomb hits of the attack of 23 February. Indicated are positions of UXO. (sketch The National Archives Kew, modifications ADEDE)

6.4 **ALLIED AERIAL MINELAYING OPERATIONS IN WWII**

Throughout World War II, the Allies upkept two minefields, one in the Oslofjord approaches and one in the fjord itself. The Allies’ codename for minelaying was “gardening.” The codenames for the Oslofjord area minefields were:

- "Onions" (Oslofjord)
- "Tomato" (Oslofjord approaches)

German minesweepers were active in the Oslofjord during the Second World War, but the unit assigned to Oslofjord was undermanned and could not keep up with Allied minelaying efforts. Over 1500 British mines (MK IV pre-1944, MK VI starting 03-1944) were laid by aircraft in the approaches to Oslo and in the fjord itself during WWII.
Standing NATO Mine Counter Measures Group 1 (SNMCMG1) conducted Historical Ordnance Disposal (HOD) operations in Oslofjord in April 2017: "Operasjon Østerled 2017". The operation was conducted for three weeks, and in that time more than fifty British mines, all with Net Explosive Quantities (NEQ) exceeding 500 kg, were destroyed. Many of the mines were located north of Bastøy (Horten). The Norwegian Navy had conducted similar HOD operations in 2012 and in 2014.

It is estimated that there are still over 1000 British mines in Oslofjord after the aerial minelaying operations of the Second World War.
8 Conclusion and Recommendations

In order to be able to compare the chances of finding the several sorts of ammunition discussed in this research, a classification from Very Low to Very High is used:

<table>
<thead>
<tr>
<th>Risk</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Low</td>
<td>No indications of the use of this munition in the wide area of the project site were found.</td>
</tr>
<tr>
<td>Low</td>
<td>This type of munition can only sporadically have ended up in or around the project area.</td>
</tr>
<tr>
<td>Low Average</td>
<td>Uncommonly used munition / possibly ended up in the project area.</td>
</tr>
<tr>
<td>Average</td>
<td>Commonly used munition / possibly ended up in the project area.</td>
</tr>
<tr>
<td>High Average</td>
<td>Very commonly used munition / probably ended up in the project area.</td>
</tr>
<tr>
<td>High</td>
<td>Munition which has – with certainty – ended up in the project area, and is possibly still present.</td>
</tr>
<tr>
<td>Very High</td>
<td>Munition which is – with certainty – still present in the project area.</td>
</tr>
</tbody>
</table>

Table 04. Risk matrix (ADEDE).

These classifications are also taken into consideration when formulating recommendations. Commonly, a very low score will result in a written ‘free of explosives’ certificate. When only low scores are attributed, additional security measures will also be discouraged. A classification between Low Average and High Average will in most cases result in a more differentiated classification, while a High or Very High risk will result in a clear recommendation for additional measures.

Aerial Bombs

Very high risk in zones bordering Karljohansvern (10, 11, 1M, 1N, 1S, 3S); low average risk elsewhere.

The Karljohansvern site was bombed in April 1940 and February 1945. The bombing resulted in hundreds of 1000lbs, 500lbs and 250lbs UK and USA aerial bombs landing in the area. At least nine unexploded bombs were retrieved during the war and during post-war demining activities. How many of those unexploded aerial bombs remain and at what depth is currently unknown. A risk attribution of very high has been assigned to the project area zones immediately bordering the naval base, and a low average risk to all other project area zones.
Figure 17. Project Area showing risk attribution for aerial bombs. (ADEDE)
Figure 18. Project Area showing risk attribution for aerial bombs, superimposed over a georeferenced aerial photo taken after the bombing of Karljohansvern. Note the locations indicated of bombs dropped. (*photo The National Archives Kew, georeferenced by ADEDE*)

**GRENADES AND SMALL ARMS AMMUNITION**

High risk in zones bordering mainland coast (4, 5, 10, 11, 1N, 1M, 1S, 3S, 3MS, 3N, 3MN); very high risk surrounding Østøya (9, 7, 8Y, 8I); low risk elsewhere.

During the Battle of Horten Harbour, German troops were landed on the mainland shore to outflank the naval base. It is safer to assume that at least some of these troops would have been armed with grenades, hence the high risk attribution for mainland-coastal zones. A low risk was attributed to all other zones, with the exception of the area surrounding Østøya, which has a high risk attribution. UXO remains in the water near Østøya as a consequence of the exploding ammunition warehouses during the sabotage attack of 21 January 1945.

Figure 19. Project Area showing risk attribution for grenades and small arms ammunition. (*ADEDE*)
TORPEDOES
High risk in all zones.

There are three different instances which lead to a risk attribution of high for torpedoes in all risk areas. The first is the sabotage attack on Østøya in January of 1945. The torpedo storage which was exploded was the Germans’ biggest storage of torpedo warheads. Before the attack there were 180 warheads—after the attack there were five. The second instance is the torpedo trials which were conducted in Indrehavn by Marinens Flyvevesen, the Royal Norwegian Navy Air Service. The third, to a lesser degree, is the Battle of Horten Harbour. Part of the German forces assigned to attack Horten consisted of two torpedo boats.

Figure 20. Project Area showing risk attribution for torpedoes. (ADEDE)
MINES
High average risk in zones bordering Oslofjord (5, 6N, 6Y, 6S, 7, 8I, 8Y, 9, 10); low risk elsewhere.

British aircraft laid mines systematically in Oslofjord during WWII. As multiple aerial dropped mines were discovered just outside of Horten during Operasjon Østerled 2017, we give a risk attribution of high average to the zones bordering Oslofjord to account for migrated mines, or mines which were dropped early, with low risk in all other zones.

Figure 21. Project Area showing risk attribution for mines. (ADEDE)
**DEPTH CHARGES**

Very high risk attribution in zone where the *R17* sank (3MN); high in neighboring zones (3N, 2N, 3MS); low risk elsewhere.

As it sank into the harbour after sustaining damage during the Battle of Horten Harbour, the depth charges of *R17* did not detonate. Therefore the zone in which it sank, near land, is given a risk attribution of very high, neighboring zones have a risk attribution of high due to the possibility of migration, and low risk is attributed to all other zones.

![Risk Attribution: Depth Charges](image)

**Figure 22.** Project Area showing risk attribution for depth charges. (ADEDE)
NAVAL ARTILLERY

Very high risk attribution in zones of combat (2N, 11, 10, 9, 5, 1M, 2S, 1N, 1S, 3MN); high risk elsewhere.

The Battle of Horten Harbour consisted of German and Norwegian naval forces firing at one another in Indrehavn. This leads to a risk attribution of very high in combat zones, and high risk for all other zones due to the chance of migration of UXO.

Figure 23. Project Area showing risk attribution for naval artillery. (ADEDE)
9 RECOMMENDATIONS

Based on the historical evidence, a full seafloor survey of the project area (all zones) is recommended. Further safety steps should be taken in order to secure any works in the defined risk areas, and safely remove any present unexploded ordnance possibly still present. It is generally known that an average of about 5-10% of used ordnance does not explode on impact. These can still be found and pose a real threat today. Shortly after the war some of these remaining unexploded items were removed by de-miners. Some were also excavated during ground works. However, removal of ordnance in the risk area is poorly documented. Based on our comprehensive experience in de-mining, we expect to find about 50 to 100 airplane bombs in the risk area. Consequently, no works should be performed before the risk areas has been declared free of explosives.

ADEDE advises to perform an extensive UXO survey in the high risk zones by way of gradiometry supplemented by sidescan sonar, electromagnetic techniques, and sub-bottom profiling.

A gradiometer consists of two or more marine magnetometers set up along a horizontal axis. The technique allows for the detection of any deviations to the Earth’s magnetic field caused
by ferro-metallic objects, while the calculation of the magnetic gradient allows for the reduction of the influence magnetic noise has on the obtained dataset. The use of magnetometry is an industry standard and allows for an efficient, full-coverage survey of the project area. The technique is best employed in combination with high-resolution sidescan sonar. A sidescan sonar transmits an acoustic signal and measures the intensity of the signal's reflection, resulting in an image of the seabed resembling an aerial picture. The sidescan data can be used to identify UXO visible on the seabed, but also to discard magnetic anomalies recorded using the gradiometry as non-UXO objects.

The historical investigation has concluded that torpedoes might have been employed within Indrehavn. As torpedoes were manufactured with a-magnetic metals and alloys, these might be missed if only using gradiometry. ADEDE advises to survey those areas where dredging works will be conducted by way of electromagnetometry or electroresistivity. The techniques are active methods which transmit an electromagnetic wave. Respectively they measure the decay of the electromagnetic radiation of a metallic object influenced by the wave, or the resistivity the signal encounters as it travels through the seabed.

Lastly, as metallic-contaminated areas are to be expected within harbour areas, these should be surveyed using a sub-bottom profiler with a high horizontal resolution. A sub-bottom profiler transmits an acoustic signal with a low resolution which penetrates the seabed and reflects on layers and objects within the seabed. As the technique is based on acoustics and not magnetics or electromagnetics, it will not be influenced by the metallic noise.
10 SOURCES

10.1 ARCHIVAL SOURCES

The National Archives, Kew (UK)

- TNA, WO252/492 Inter-Service Topographical Department. Norway. Horten port and town

- TNA, AIR 24/307 Air Ministry and Ministry of Defence: Operations Record Books, Commands, Including Bomber Command Intelligence Reports and Intelligence Narrative of Operations. Feb 1945

- TNA, AIR 24/308 Air Ministry and Ministry of Defence: Operations Record Books, Commands, Including Bomber Command Intelligence Reports and Intelligence Narrative of Operations. Feb 1945

- TNA, AIR 24/209 Bomber Command, ORB, Administrative and Operations Branches, January – December 1945


- TNA, AIR 27/483 series, 49 Squadron

- TNA, AIR 27/689 series, 83 Squadron

- TNA, AIR 27/768 series, 97 Squadron

- TNA, AIR 27/835 series, 106 Squadron

- TNA, AIR 27/1152 series, 189 Squadron

- TNA, AIR 27/2148 series, 627 Squadron

10.2 DIGITAL SOURCES

10.2.1 KARLJOHANSVERN

- http://www.forsvaretmuseer.no/Marinemuseet/Om-Marinemuseet


• http://www.forsvaretsmuseer.no/Marinemuseet/Sjoeforsvaret-organisasjon-avdelinger-og-drift-1814-2016/Sjoeforsvarets-baser-stasjoner-og-anlegg/Karlijohansvern


• http://www.forsvaretsmuseer.no/Marinemuseet/Sjoeforsvaret-organisasjon-avdelinger-og-drift-1814-2016/Sjoeforsvarets-baser-stasjoner-og-anlegg/Karlijohansvern/Sjoeforsvaret-i-Horten-og-distriktet


• http://forsvaretsmuseer.no/Marinemuseet/Sjoeforsvaret-organisasjon-avdelinger-og-drift-1814-2016/Sjoeforsvarets-baser-stasjoner-og-anlegg/Karlijohansvern


• https://www.forsvarsbygg.no/no/festningene/finn-din-festning/karlijohansvern/

• https://www.forsvarsbygg.no/no/verneplaner/karlijohansvern/historikk/bakgrunn-for-oppbyggingen-av-marinens-hovedstasjonpa-horton/

• https://www.forsvarsbygg.no/no/verneplaner/landsverneplan-for-forsvaret/ostlandet/karlijohansvern-orelogsstasjon

• https://www.vfk.no/Tema-og-tjenester/Kulturav/Hvordan-deler-vi-innførtiden/Krigshistorie-og-militare-anlegg/Karlijohansvern/


• https://www.horten.kommune.no/omrader/kultur-og-samfunnsutvikling/kommuneutvikling/byutvikling/karlijohansvern/

• https://www.ut.no/finn/?types=trip&id=2.7432&type=tur

• https://www.ut.no/tur/2.7632/

• https://www.ut.no/tur/2.7660/

• https://describe.kulturminne.no/describe/?url=https%3A//data.kulturminne.no/askeladen/lokalitet/97163

• https://www.gjengangeren.no/nyheter/forsvaret-river-pa-kjv-og-ostoya/s/2-2.426-1.6725724

• https://snl.no/Karlijohansvern

• https://snl.no/Horten

• https://snl.no/Marinemuseet
• http://www.hip.no/
• https://no.wikipedia.org/wiki/Karljohansvern
• https://lokalhistoriewiki.no/wiki/Karljohansvern
• https://lokalhistoriewiki.no/wiki/Karljohansvern_(kulturminnel%C3%B8ype)

10.2.2 **MARINENS FLYVEBAATFABRIKK**

• http://www.forsvaretsmuseer.no/Marinemuseet/Sjoeforsvaret-organisasjon-avdelinger-og-drift-1814-2016/MARINENS-FLYVEVAAPEN-1912-1944/Marinens-flyvevaapens-historie/Marinens-flyfabrikk
• https://www.forsvarsbygg.no/no/festningene/gr/karljohansvern/flyfabrikken-/
• https://www.forsvarsbygg.no/no/verneplaner/karljohansvern/
• https://digitaltmuseum.no/021015640428/flyfabrikken-moringa-karljohansvern-horten
• http://borreminne.hive.no/aargangene/1993/03-flyfabrikk.htm
• https://no.wikipedia.org/wiki/Marinens_flyvebaatfabrikk
• https://ipfs.io/ipfs/QmXoypizjW3WknFjnKLwHCnL72vedxjQkDDP1mXWo6uco/wiki/Marinens_Flyvebaatfabrikk_M.F.11.html

10.2.3 **MARINENS MINEVESEN**

• http://www.forsvaretsmuseer.no/Marinemuseet/Sjoeforsvaret-organisasjon-avdelinger-og-drift-1814-2016/Marinens-vaapen-avdelinger/Operativ-og-teknisk/Sjoeforsvarets-minevesen
• http://www.forsvaretsmuseer.no/Marinemuseet/Marinens-fartoeyer-1814-2014/Fartoeysklasser/Torpedobaater
• http://www.forsvaretsmuseer.no/Marinemuseet/Sjoeforsvaret-organisasjon-avdelinger-og-drift-1814-2016/Marinens-vaapen-avdelinger/Operativ-og-teknisk/Torpedoer
• http://www.forsvaretsmuseer.no/Marinemuseet/Sjoeforsvaret-organisasjon-avdelinger-og-drift-1814-2016/Marinens-vaapen-avdelinger/Operativ-og-teknisk/Torpedoer
tekni/Torpedoer/Sjoeforsvarets-mine-og-torpedovesen-1870-1970/Norsk-
torpedofabrikasjon

- http://www.forsvaretsmusee.no/Marinemuseet/Sjoeforsvaret-organisasjon-
avdelinger-og-drift-1814-2016/Marinens-vaapen-avdelinger/Operativ-og-
tekni/Torpedoer/Torpedoer-i-Norge

- https://no.wikipedia.org/wiki/Den_norske_marine_(1807%E2%80%931890)#Torpedo-
en
- https://www.gjengangeren.no/nyheter/nyheter/loddmine-i-hagen/s/2-2.426-1.7973479

10.2.4 VEALØS

- https://www.forsvarsbygg.no/no/verneplaner/karljohansvern/kulturmiljoene--
beskrivelse-og-vurdering/delomrade-e-vealos/

- http://www.forsvaretsmusee.no/Marinemuseet/Sjoeforsvaret-organisasjon-
avdelinger-og-drift-1814-2016/Marinens-vaapen-avdelinger/Carljohansvern-politi-og-
brandkorps/Vakholdet

- http://www.forsvaretsmusee.no/Marinemuseet/Marinens-fartoeyer-1814-
2014/Fartoeysklasser/Motortorpedobaater/RAPP-klasse

- http://www.sms1835.no/arkiv/MTB%20Va%CC%8Apenet%20125%20a%CC%8Ar.pdf


- https://no.wikipedia.org/wiki/Veal%C3%B8s_(Horten)

- https://no.wikipedia.org/wiki/Norske_L%C3%B8ve_(fort)

- https://www.gjengangeren.no/nyheter/nyheter/oppgraderer-mtb-hangarene-para-
vealos/s/2-2.426-1.7544405

10.2.5 ØSTØYA

- https://www.forsvarsbygg.no/no/verneplaner/karljohansvern/kulturmiljoene--
beskrivelse-og-vurdering/delomrade-f-mellomoya-og-ostoya/

- http://www.forsvaretsmusee.no/nor/Aktuelt/Marinens-glemte-jernbane

- http://forsvaretsmusee.no/Marinemuseet/Da-torpedolageret-paa-OEstoeya-ble-
sprengt

- https://no.wikipedia.org/wiki/Hjalmar_Berge

- https://no.wikipedia.org/wiki/%C3%98st%C3%B8ya

- http://www.fofo.no/Minekokerne.b7C_wRzW2P.ips

- https://www.seher.no/sterke-historier/ukjente-hjalmar-sprengte-alt-alene/64167971
10.2.6 **MELLOMØYA**

- [http://www.forsvaretsmuseer.no/nor/Aktuelt/Marinens-glemte-jernbane](http://www.forsvaretsmuseer.no/nor/Aktuelt/Marinens-glemte-jernbane)
- [https://brage.bibsys.no/xmlui/handle/11250/215703](https://brage.bibsys.no/xmlui/handle/11250/215703)
- [https://no.wikipedia.org/wiki/Mellom%C3%B8ya](https://no.wikipedia.org/wiki/Mellom%C3%B8ya)

**10.2.7 **THE BATTLE OF HORTEN HARBOUR 9 APRIL 1940**

- [https://www.nrk.no/vestfold/hva-gikk-galt-9.-april-1.12298967](https://www.nrk.no/vestfold/hva-gikk-galt-9.-april-1.12298967)

**10.2.8 **GERMAN OCCUPATION (1940-1945)**

10.2.9 **SABOTAGE ATTACK BY MILORG, SEPTEMBER 1944**


10.2.10 **BRITISH BOMBING 23 FEBRUARY 1945**

- [http://www.bombercrew.com/Mining/bombercrewgardening.htm](http://www.bombercrew.com/Mining/bombercrewgardening.htm)
- [https://tailendcharlietedchurch.wordpress.com/operations/gardening-mine-laying/](https://tailendcharlietedchurch.wordpress.com/operations/gardening-mine-laying/)

10.2.11 **ALLIED AERIAL MINELAYING IN WWII**

- [https://www.nrk.no/vestfold/funn-i-horton--kan-vaere-cyanid-fra-krigen-1.1332036](https://www.nrk.no/vestfold/funn-i-horton--kan-vaere-cyanid-fra-krigen-1.1332036)
10.2.12 **HISTORICAL ORDNANCE DISPOSAL (HOD) 2017**

- [https://forsvaret.no/presse/skal-rydde-mer-enn-50-sjominer-i-oslofjorden](https://forsvaret.no/presse/skal-rydde-mer-enn-50-sjominer-i-oslofjorden)
- [https://forsvaretsforum.no/sprengte-for-n%C3%A6r-bast%C3%B8y-fengsel](https://forsvaretsforum.no/sprengte-for-n%C3%A6r-bast%C3%B8y-fengsel)
- [https://www.abcnheter.no/nyheter/2017/04/21/195296925/over-50-miner-i-oslofjorden-skal-sprenges-de-neste-ukene](https://www.abcnheter.no/nyheter/2017/04/21/195296925/over-50-miner-i-oslofjorden-skal-sprenges-de-neste-ukene)
- [https://www.gjengangeren.no/nyheter/nyheter/rystet-av-mine-sprenging-i-oslofjorden/s/2-2.426-1.8364043](https://www.gjengangeren.no/nyheter/nyheter/rystet-av-mine-sprenging-i-oslofjorden/s/2-2.426-1.8364043)
- [http://www.ohv.oslo.no/no/nyheter/2014/Detonerte+britiske+miner+ved+Nesodden.b7C_wlrQ4p.ips](http://www.ohv.oslo.no/no/nyheter/2014/Detonerte+britiske+miner+ved+Nesodden.b7C_wlrQ4p.ips)
- [http://www.klikk.no/produkthjemmesider/vimenn/50-000-miner-truer-norskekysten-3085011](http://www.klikk.no/produkthjemmesider/vimenn/50-000-miner-truer-norskekysten-3085011)
- [https://www.nrk.no/vestfold/minerydding-i-oslofjorden-1.13485954](https://www.nrk.no/vestfold/minerydding-i-oslofjorden-1.13485954)
- [https://vimeo.com/210584587](https://vimeo.com/210584587)
- [https://www.barentswatch.no/artikler/bomber-og-miner/](https://www.barentswatch.no/artikler/bomber-og-miner/)
- [https://www.jarlsbergavis.no/nyheter/smorstein/holmestrand/hus-ble-evakuert-etter-mulig-minefunn-i-holmestrand/s/5-26-85984](https://www.jarlsbergavis.no/nyheter/smorstein/holmestrand/hus-ble-evakuert-etter-mulig-minefunn-i-holmestrand/s/5-26-85984)