

NORD STREAM 2 PIPELINE –
NORTH-WESTERN ROUTE
Cultural heritage target assessment
and exclusion zone recommendations

VIR 2740



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VIKINGESKIBS
MUSEET

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Appendix 1 – Targets

Abstract

Nord Stream 2 AG has asked the Viking Ship Museum to identify potential cultural heritage objects potentially conflicting with the installation of new pipelines around Bornholm. This report covers a route north and west of Bornholm, whereas the Base Case route east and south of Bornholm is covered in a previous report. Through an iterative process, the Viking Ship Museum has identified a number of objects on the seabed and assigned suggested exclusion zones to protect objects from damage during installation and operation of the pipeline. No objects have been recovered, and no further mitigation measures have been imposed.

Dansk resumé

Nord Stream 2 AG har bedt Vikingskibsmuseet udpege kulturhistoriske genstande, som potentielt berøres af et nyt sæt rørledninger ved Bornholm. Nærværende rapport behandler en rute nord og vest om Bornholm; den foretrukne rute øst og syd om Bornholm er behandlet i en tidligere rapport. Gennem en iterativ proces har Vikingskibsmuseet udpeget et antal objekter på havbunden og tildelt foreslåede friholdelseszoner, som vil forhindre skade på objekterne under anlæg og drift af rørledningen. Ingen genstande er blevet bjærget, og der er ikke pålagt yderligere mitigerings tiltag.

Background

In advance of finalising the route design for a set of new Baltic pipelines traversing the Danish EEZ around Bornholm, Nord Stream 2 AG (NS2) has asked the Viking Ship Museum (VIR) to identify and assess the cultural significance of objects potentially conflicting with the design, as well as to recommend possible mitigation measures.

The originally applied route east and south of Bornholm, now called the Base Case route, was reported in January 2018 (Thomsen & Hyttel 2018). Later the same year, NS2 asked VIR to perform a similar assessment of an alternative route north and west of Bornholm (called the North-Western Route). The present report covers this latter route alternative.

Administrative data

The desk-based assessments were completed at the Viking Ship Museum in Roskilde, Denmark, by maritime archaeologist Mikkel H. Thomsen.

The entire NS2 project archive is filed at VIR under file no. 2740.

Process overview

Several route revisions and amendments/additions hereto, totalling more than 2500 survey line kilometres, have been surveyed by three different survey contractors between November 2017 and February 2019.

For the northernmost route sections DK33-DK37 all instruments (MBES, SSS, SBP and MAG) were acquired from the MMT S-ROV, on board the *M/V Stril Explorer*.

For sections DK38-DK39, survey data was acquired from the *M/V Icebeam* using hull-mounted MBES and towed SSS, SBP and MAG sensors.

Table 1: Summary of survey parameters

Campaign	Line spacing (nominal)	SSS range	SSS altitude	SSS coverage (nominal)	MBES resolution
<i>Stril Explorer</i> Reference Line	100 m	120 m	18-23 m	200 % (LF) - 500 m	0,5 m
<i>Stril Explorer</i> Prime low pass	(single pass)	100 m		100 m	0,2 m
<i>Icebeam</i> recon	300 m	100 m		100 %	1,0 m
<i>Icebeam</i> reference line	70 m	100 m	10-12 m	100 % - 500 m	0,5 m

Data from these campaigns were successively forwarded to VIR for archaeological screening; initially targeted at route revision 9-5, ending with route revision 9-8. Initially geophysical data (primarily SSS, but also MBES - particularly in the nadir gaps of the sparse *Icebeam* data acquired in shallow sections over Ronne Bank) was screened. Later, targets picked during this screening phase were subject to ROV-based visual inspection where the target conflicted with the current

route design. The video footage was screened by VIR to aid identification of the target and adjustment of any exclusion zone buffer.



Fig. 1. Nord Stream 2 Pipeline, Danish sector. Route design 9-8 north and west of Bornholm, DK.
Drawing: Mikkel H. Thomsen © Vikingeskibsmuseet. Base map: Styrelsen for Dataforsyning og Effektivisering (Skærmkort, dæmpet).

Definitions

Route revisions

The North-Western route data was delivered to VIR as it became available from the engineering contractor, and progressed from route revision 9-5 to 9-8 during the period of the archaeological screening.

The confliction analysis was performed on route revision 9-8 as defined by the GIS file:

Route_9_8_NoB (equivalent to W-EN-OFP-POF-DWG-804-D72001EN-03)

However, any future route revisions respecting the exclusion zones while still staying within the surveyed, and archeologically screened, area can be permitted on the same terms as route 9-8.

Confliction

A target is considered *outside* the affected area if its assigned exclusion zone does not intersect the lay corridor. It should be noted that other types of intervention works can be applied to segments of the route, necessitating a wider footprint on the seabed. These areas too must respect the exclusion zones. Objects outside the affected area have been assigned (usually circular) exclusion zones (see Appendix 1), and no other mitigation has been carried out.

Conversely, a target is said to be *conflicting* if its final exclusion zone intersects with design route centre line (Figure 2B).

A target is said to be *marginally conflicting* if the target exclusion zone intersects with the pipelay corridor (or, eventually, intervention work areas), but does not intersect the design route centre line. Minor pipelay re-routing within the lay corridor is feasible so that the ‘as-laid’ position of the pipeline does not intersect with the exclusion zone (Figure 2A). In this case the pipelay contractor must manoeuvre away, maintaining a minimum of half the lay corridor (8.25 m) from any target exclusion zone; the so-called *lay-avoid* procedure. If this should prove impossible (for example because of proximity of another object on the opposite side of the lay corridor), further mitigation may be required by the Danish Agency for Culture and Palaces (Slots- og Kulturstyrelsen, SLKS), e.g. further investigation, rerouting the pipeline, removing the object, or securing it *in situ*.

Contrary to the Base Case route methodology, no *outside* exclusion zones have been discarded during the process. Therefore future additional rerouting without renewed assessment is possible as long as only previously surveyed areas are used and exclusion zones respected.

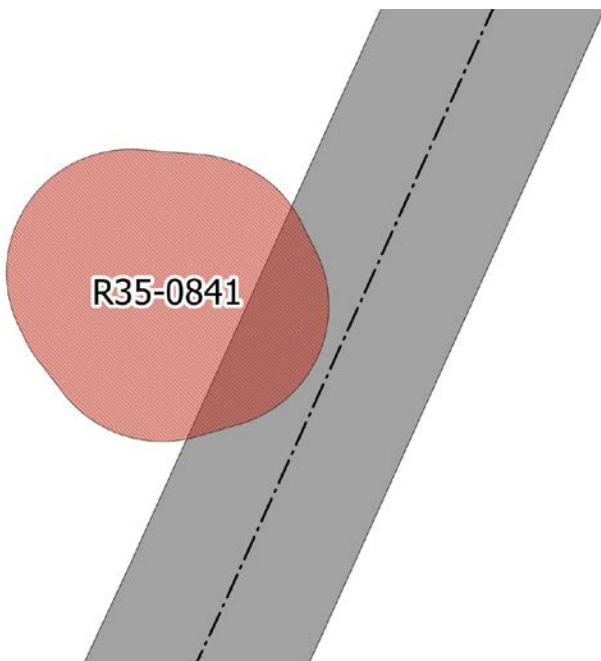


Fig. 2A. Marginally conflicting exclusion zone.

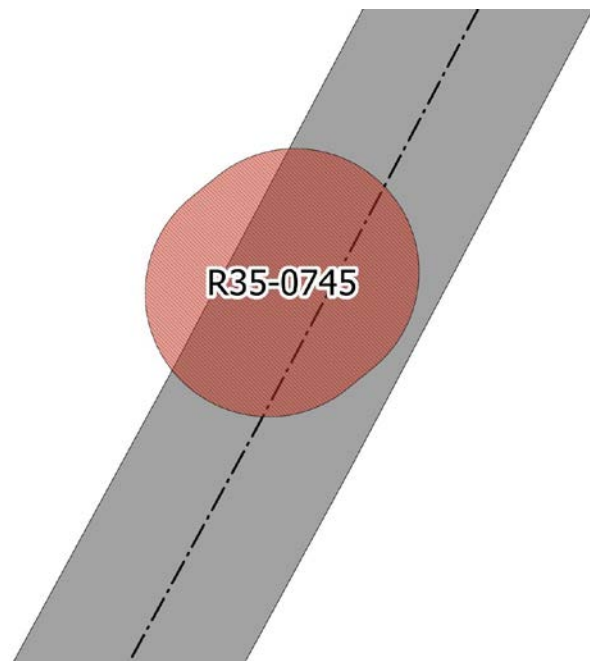


Fig. 2B. Conflicting exclusion zone.

Examples from Base Case route. Drawing: Frederik D. Hyttel © Vikingeskibsmuseet.

Table 2: Abbreviations.

CHO	Cultural history object	Kulturhistorisk objekt
EEZ	Exclusive Economic Zone	Eksklusiv økonomisk zone
GIS	Geographical information system	Geografisk informationssystem
LF	Low frequency	Lavfrekvent
MAG	Magnetometer, magnetic	Magnetometer, magnetisk
MBES	Multibeam echo sounder	Flerstråleekkolod
MMO	Man-made object	Menneskeskabt objekt
NS2	Nord Stream 2 AG	
ROV	Remotely operated vehicle	Fjernstyret undervandsfartøj
SBP	Sub-bottom profiler	Sedimentekkolod
SLKS	Agency for Culture and Palaces	Slots- og Kulturstyrelsen
SSS	Side scan sonar	Sideseende sonar
UCH	Underwater cultural heritage	Undersøisk kulturarv
VIR	Viking Ship Museum, Roskilde	Vikingskibsmuseet i Roskilde

Desk-based assessment

All side scan sonar data for the current route revision was screened and potential archaeological objects selected. Selected objects were assigned a first-generation, standard, exclusion zone defined as a circle centred on the target coordinates (single point) – usually 50 or 200 m radius was defined depending on the nature and size of the target.

Zones not intersecting the installation corridor were accepted without further scrutiny, whereas efforts were made to create smaller but better informed zones for objects where the circular first generation zone intersected the installation corridor. This was based on side scan and multibeam sonar imagery which was possible as the sonar coverage was, for obvious reasons, often denser near the installation corridors, justifying screen digitising of observed object perimeters (allowing for the inevitable towed sonar navigation inaccuracies). These perimeters were then buffered; usually by 10 m; occasionally more, depending on the nature of the object. In this process, one zone was eliminated entirely, the remainder usually greatly reduced.

In a separate, parallel, process the same group of targets (those with intersecting first-generation zones) were visually inspected by ROV and the video footage screened by VIR with the aim of identifying and/or dating the object. Where possible, this has led to rejection of a number of confirmed non-cultural history objects (non-CHO), but the inspection coverage was too sparse to influence exclusion zone design.

Finally a small number of *intersecting* objects have been subjected to renewed ROV inspection with the aim of 1) increasing coverage in order to enable the creation of a smaller exclusion zone and 2) collecting imagery suitable for the creation of photogrammetric 3D-models which can serve for preservation by record of the objects *in lieu* of physical preservation in situ or in a collection, should this be deemed appropriate by the Danish Agency for Culture and Palaces.

Following completion of field inspections, a meeting was held (10-04-2019) between NS2, VIR and SLKS, where *conflicting* and *marginally conflicting* objects were assessed and exclusion zones eliminated or further adjusted where possible.

Results

Appendix 1 includes all 238 targets initially selected as potential cultural history objects (p-CHO) based on SSS interpretation by VIR. The column *UCH status* indicates whether, upon visual

inspection wherever possible, the object is classed as protected (Yes, No, or Inconclusive) or written off as modern MMO, geology, or not found (No).

Of these, 193 have been assigned an exclusion zone (first generation circular zone or smaller, perimeter-based and/or adjusted as indicated in the column *Exclusion zone R (m)*). Only four of these are *marginally conflicting* (as indicated in the column *Confliction*), requiring the abovementioned lay-avoid procedure to be observed. There are no *conflicting* objects left after the final evaluation.

Two objects positively identified as CHOs are reported to the national sites & monuments register *Fund & Fortidsminder (F&F)*:

Table 3: Cultural Heritage Object IDs.

Project-specific ID	VIR file no.	F&F no.	Desc.
SD-DK34-20091	2903	401752-397	Wreck timbers
TO-DK-35-50004	2902	401752-396	Fighting top or railing

Further action

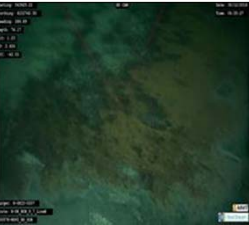
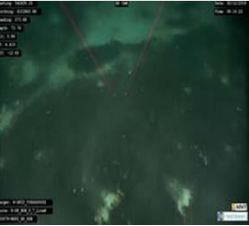
In conclusion to the continuous dialogue between Nord Stream 2 AG, the Viking Ship Museum and the Danish Agency for Culture and Palaces (Slots- og Kulturstyrelsen), the latter has evaluated the present target assessments.

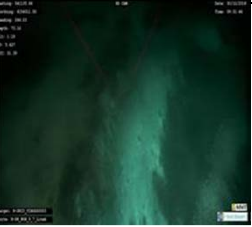
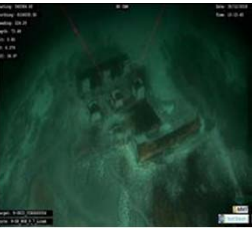
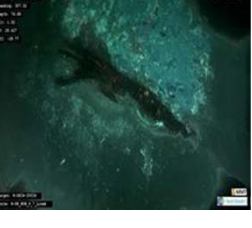
Pipelay according to route revision 9-8 can be carried out respecting exclusion zones as defined in the GIS file:

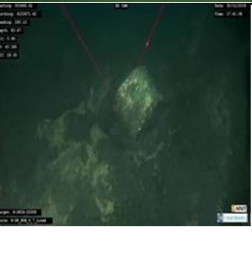
NoB_all_VIR_tgts_buff

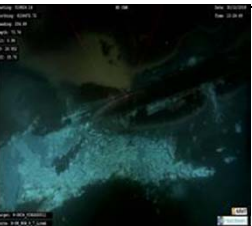
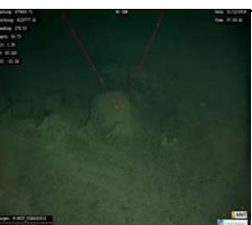
In case of marginally conflicting objects, a so-called lay-avoid procedure can be followed, whereby the pipeline is micro-rerouted; staying within the proposed installation corridor but shifted sideways so as to maintain a distance of half the corridor width to *any* exclusion zone. The lay avoid procedure will be applied to the offshore construction contractor via amendments to the pipelay alignment drawings.

This assessment relates exclusively to route design rev. 9-8 (W-EN-OFP-POF-DWG-804-D72001EN-03). However, within the surveyed area, the same methodology can be applied to all charted exclusion zones without necessitating renewed analysis.

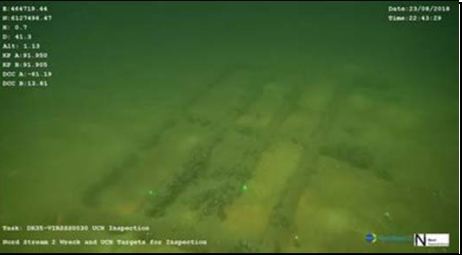
Name	Side scan sonar					UTM33_X	UTM33_Y	Visual			Exclusion zone R (m)	Confliction
	Original description	Original classification	Tlength	Twidth	Theight			Image	UCH interpretation	UCH status		
SD-DK33-0053		Boulder	0.87	0.35	0.62	524625.17	6154629.61				50	
SD-DK33-0054		Boulder	0.70	0.52	0.48	524626.45	6154626.56				50	
SD-DK33-0087	No shadow, possible buried	Debris	1.48	0.18	0.00	526640.06	6154518.11				50	
SD-DK33-0088		Debris	3.18	0.75	0.26	527131.57	6154463.63				50	
SD-DK33-0104	No shadow, possible buried	Boulder	1.12	0.55	0.00	529780.68	6154463.84				50	
SD-DK33-0146	Possible a wire	Linear object	12.45	0.84	0.36	536422.6	6153859.32				50	
SD-DK33-0183	Possible wire/fishing net	Linear object	16.32	3.46	0.00	541331.92	6153924.61		Wire	N	0	
SD-DK33-0207	No shadow, possible buried	Boulder	1.57	1.42	0.00	543924.77	6153742		Coverage insufficient	I	Perimeter-based	
SD-DK33-0219	No shadow, possible buried. Same as SOB S-R33-0486	Linear object	5.12	0.53	0.06	544583.68	6154059.61				50	
SD-DK33-0220	No shadow, possible buried. Same as SOB S-R33-0487	Linear object	2.31	0.35	0.05	544589.54	6154064.22				50	
SD-DK33-20170	Possible buried linear debris	Linear object	8.18	0.32	0.00	534784.31	6154153.75		Steel wire rope	N	0	
SD-DK33-20174	No shadow, possible buried	Boulder	0.51	0.41	0.04	542439.49	6153960.77				0	
SD-DK33-20175		Linear object	1.71	0.31	0.05	542406.74	6153956.42		No 360 video (already exists?) Not convinced by this footage	I	Perimeter-based, adjusted	Marginally conflicting
SD-DK33-20177		Linear object	2.50	0.33	0.05	529798.46	6154242.11		Wooden plank (pres. section of wale; poss. w. P-shaped cross-section or made of two piecesd; age indet.)	I	Perimeter-based	
DK33_VIRSSS0002	Poss. MMO; poss. semi-buried	Debris	16.07	10.81	0.48	542434.61	6153843.48		Coverage insufficient	I	Perimeter-based, adjusted	Marginally conflicting

DK33_VIRSSS0003	Linear object; dragged	Linear object	2.31	0.32	0.10	541135.47	6154010.8		Coverage insufficient. Linear seabed features	I	Perimeter-based	
DK33_VIRSSS0004	Area of smaller objects	Unknown	4.09	3.07	0.13	540384.54	6154034.51		Wooden pallet (sonar anomaly seemingly larger - poor coverage; however, other objects likely to be of same nature)	N	0	
DK33_VIRSSS0006	Linear object	Linear object	2.65	0.41	0.29	524022.16	6154387.18				Perimeter-based	
DK33_VIRSSS0007	Linear object; LF only	Linear object	17.90	2.00	0.48	538234.17	6153910.4				50	
DK33_VIRSSS0009	Poorly defined object; part solid, part blurry	Unknown	54.39	16.27	7.67	544200.67	6153733.77				Perimeter-based	
DK33_VIRSSS0010	Linear object NMH; LF only. Same as SOB VIRSSS-0005 (has custom ex-zone)	Linear no height	19.26	1.20	0.35	545641.73	6153825.23				Perimeter-based	
DK33_VIRSSS0011	Poss. wreck; semi-buried; LF only	Wreck	17.55	6.36	1.03	546622.49	6154273.33				Perimeter-based	
DK33_VIRSSS0013	Linear object; LF only	Linear angled	5.56	0.58	0.47	544915.3	6154104.1				50	
DK33_VIRSSS0014	Linear object; LF only	Linear angled	5.87	0.77	0.21	524648.8	6154615.34				50	
DK33_VIRSSS0015	Linear object	Linear object	28.91	0.49	0.68	540821.31	6154172.45				50	
SD-DK34-0087	No shadow, possible buried	Linear object	6.52	0.40	0.00	519748.48	6154667.2		Wooden plank (c. 10 cm wide; semi-buried; age indet.). Sector dir. towards pipeline clear	I	Perimeter-based, adjusted	
SD-DK34-0072	Cable/wire?	Linear object	5.20	0.63	0.00	514064.38	6154924.5				50	
SD-DK34-0044	No shadow, possible buried	Linear object	3.45	0.68	0.00	504321.99	6153884.88				50	
SD-DK34-0057	No shadow, possible buried	Linear object	2.65	0.82	0.00	506254.18	6154165.74				50	
SD-DK34-0004	No shadow, possible buried	Linear object	10.36	0.35	0.00	493981.06	6151829.51				50	
SD-DK34-0038		Linear object	3.79	0.79	0.27	502239.07	6153409.79		Natural tree trunk	N	0	
SD-DK34-20022		Linear object	3.33	0.37	0.09	516506.09	6154737.08		Metal pipe. Poss. modern gun barrel?	N	0	
SD-DK34-20034		Linear object	1.69	0.29	0.08	518347.88	6154653.83		Natural branch (poor coverage; however, object strongly resembles sonar anomaly; most likely correctly identified)	N	0	

SD-DK34-20049		Linear object	2.26	0.16	0.19	519212.08	6154593.15		Twisted piece of metal	N	0	
SD-DK34-20083		Linear object	7.00	0.13	0.00	511359.7	6154642.9		Steel wire rope	N	0	
SD-DK34-20088		Linear object	16.45	0.51	0.00	500869.63	6153243.74		Coverage insufficient	I	Perimeter-based	
SD-DK34-20091		Linear object	2.83	0.31	0.13	494658.07	6151902.07		Plank attached to beam/frame/bitt; semi-buried. Pot. buried wreck. Also some linear feature closer to pipeline. Poor coverage	Y	Perimeter-based, adjusted	
SD-DK34-20093		Debris	2.48	1.03	0.06	499699.89	6153142.72		Steel wire rope	N	0	
SD-DK34-20095	No shadow, possible buried	Debris	2.63	1.04	0.00	498189.73	6152933.98		Steel wire rope	N	0	
SD-DK34-20099	No shadow, possible buried	Debris	3.68	0.85	0.00	503492.57	6153671.05		Metal bucket (poor coverage, but location spot on, so probably correctly identified)	N	0	
DK34_VIRSSS0003	Wreck w. line extending from one end. Poss. fishing vessel	Wreck	28.59	10.84	7.84	508725.79	6154773.55				200	
DK34_VIRSSS0004	Wreck w. line extending from one end; some surrounding debris	Wreck	18.86	6.29	2.53	495309.94	6151719.16				200	
DK34_VIRSSS0005	Two parallel linear objects; NMH	Linear no height	14.27	1.71	0.00	496630.84	6152609.38				Perimeter-based, adjusted	Marginally conflicting

DK34_VIRSSS0006	Oval area of harder texture; poss. wreck	Mound	25.21	13.53	0.30	500679.22	6153361.6				50	
DK34_VIRSSS0008	Linear object; poss. seabed scar	Linear angled	30.48	1.07	0.55	507905.8	6154513.05				50	
DK34_VIRSSS0009	Poss. debris field/wreck. Oval patch of linear and point objects	Unknown	14.72	6.68	0.00	508048.69	6154207.25		Coverage insufficient	I	Perimeter-based	
DK34_VIRSSS0011	Poss. wreck/wreck part	Unknown	4.86	1.48	0.10	519824.25	6154671.55		Wooden plank (c. 10 cm wide poss.w. pres. hood end; age indet.). Sector dir. towards pipeline clear	I	Perimeter-based	
DK35_VIRSSS0100	Linear object	Linear object	20.31	0.92	0.36	466463.49	6129667.74				Perimeter-based	
DK35_VIRSSS0101	Linear object	Linear object	4.82	0.71	0.40	473141.03	6137304.89		Abandoned fishing net and boulders	N	0	
DK35_VIRSSS0003	Linear object; poss. tapered or semi-buried	Linear object	5.86	1.26	0.61	471519.79	6128943.46				50	
DK35_VIRSSS0004	Linear object NMH; near poss. wreck	Linear no height	7.64	0.78	0.00	472092.18	6129625.88				50	
DK35_VIRSSS0005	Poss. wreck NMH	Hollow contour no height	27.11	7.45	0.00	472073.68	6129641.96				200	
DK35_VIRSSS0006	Poss. wreck. Oval area of rough texture; seemingly w. linear features within	Mound	19.16	7.60	0.45	476272.01	6134173.65				200	
DK35_VIRSSS0007	Linear object	Linear object	5.51	0.72	0.60	492598.64	6150969.84				50	
DK35_VIRSSS0008	Boat-shape; shadow only; not vis. on other files	Unknown	20.43	7.92	0.58	490516.67	6150477.65				100	
DK35_VIRSSS0009	Seemingly rectilinear structure	Unknown	13.88	5.01	0.30	472405.6	6130149.12				50	
DK35_VIRSSS0010	Debris field w. linear features	Debris	27.34	17.63	1.21	473830.96	6138067.31		Fishing net	N	0	
DK35_VIRSSS0012	Linear object	Linear angled	8.42	0.91	0.52	470548.28	6134217.53				50	
DK35_VIRSSS0013	Boat-shaped anomaly; perhaps some surrounding debris. NMH	Hollow contour no height	21.90	8.36	0.00	490297.88	6150087.22				200	
DK35_VIRSSS0014	Poss. wreck. Poss. some debris to one side	Wreck	38.52	8.51	0.15	493505.67	6151592.55				0	
DK35_VIRSSS0015	Linear object	Linear angled	3.32	0.38	0.17	474812.4	6139508.49		Tarp/textile snagged on boulder; two other boulders in vicinity (poor coverage but high deg. of resemblance to sonar object)	N	0	
DK35_VIRSSS0016	Linear object; poss. something attached one end	Linear object	3.15	0.18	0.15	470658.82	6133777.75		Row of boulders (poor coverage but high deg. of resemblance to sonar object)	N	0	

DK35_VIRSSS0017	Linear object; poss. semi-buried	Linear angled	2.95	0.16	0.12	469426.48	6132650.21		Inconclusive	I	Perimeter-based, adjusted	Marginally conflicting
DK35_VIRSSS0018	Linear object	Linear object	8.41	0.31	0.05	466150.78	6129459.22		Fishing net	N	0	
DK35_VIRSSS0019	Linear object	Linear object	4.92	0.33	0.16	468578.68	6125276.27				50	
DK35_VIRSSS0020	Linear object	Linear angled	4.48	0.45	0.08	473168.19	6131568.63				50	
DK35_VIRSSS0022	Poss. wreck/ballast pile	Mound	23.96	10.26	0.97	474971.97	6133509.84				200	
DK35_VIRSSS0023	Linear object	Linear object	3.31	0.24	0.32	474444.8	6133171.91				50	
DK35_VIRSSS0024	Poss. wreck. Several curved and straight lines; poss. wreck, semi-buried and/or partly out of range	Unknown	24.57	8.54	0.29	473698.38	6132317.12				200	
DK35_VIRSSS0025	Linear object	Linear object	1.85	0.41	0.15	478804.32	6137515.53				50	
DK35_VIRSSS0026	Linear object	Linear object	4.16	0.23	0.07	475009.82	6139172.3		Plank; c. 7 cm wide (poor coverage but high deg. of resemblance to sonar object; age indet.)	I	Perimeter-based	
DK35_VIRSSS0027	Linear object	Linear object	2.89	0.30	0.13	475178.06	6139416.86		Plank; c. 10-12 cm wide. Bottle (?) (poor coverage but high deg. of resemblance to sonar object; age indet.)	I	Perimeter-based	
DK35_VIRSSS0028	Linear object	Linear object	5.49	0.37	0.07	473731.78	6137734.27		Plank; c. 7 cm wide (poor coverage but high deg. of resemblance to sonar object; age indet.)	I	Perimeter-based	
DK35_VIRSSS0029	Linear object; poss. objects attaced either end; poss. line debris	Linear object	6.25	0.12	0.23	468028.26	6131355.24		Fishing net	N	0	

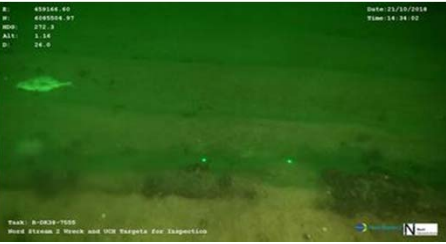
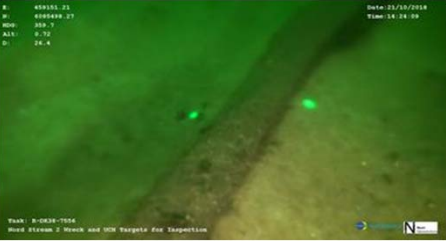
DK35_VIRSSS0030	Pres. MMO. Parallel lines	Unknown	2.28	0.99	0.10	464719.74	6127497.42		Modern metal railing	N	0	
DK35_VIRSSS0031	Pres. MMO. Poss. ass. w. similar nearby	Debris	3.23	0.46	0.07	469558.46	6126556.08				50	
DK35_VIRSSS0032	Pres. MMO. Poss. ass. w. similar nearby	Debris	8.51	3.76	0.12	469567.54	6126537.37				200	
DK35_VIRSSS0033	Linear object	Linear object	4.84	0.73	0.13	469381.89	6126348.3				50	
DK35_VIRSSS0034	Linear object	Linear object	8.03	0.55	0.16	476292.3	6134320.23				50	
DK35_VIRSSS0035	Linear object	Linear object	2.76	0.26	0.36	473014.26	6131301.61				50	
DK35_VIRSSS0036	Linear object	Linear object	3.05	0.39	0.11	472544.33	6130674.25				50	
DK35_VIRSSS0037	Linear object	Linear object	2.49	0.53	0.12	472506.84	6130636.41				50	
DK35_VIRSSS0038	Linear object; poss. semi-buried	Linear no height	9.92	0.20	0.10	469985.25	6127019.92				50	
SD-DK35-0514		Boulder	0.86	0.64	0.47	471617.48	6128703.78				50	
SD-DK35-0664		Debris	2.50	1.38	2.34	474442.05	6139180.65				50	
SD-DK35-0682		Linear object	1.84	0.76	0.14	474662.9	6138948.24				50	
SD-DK35-0850	Possible mound	Boulder	4.19	1.45	1.30	477375.06	6135441.91				50	
SD-DK35-0935	No shadow	Debris	4.62	0.93	0.07	482386.78	6141120.83				50	
SD-DK35-1138		Linear object	1.85	0.40	0.17	472129.47	6136200.96		Boulder (poor coverage but high deg. of resemblance to sonar object)	N	0	
SD-DK35-1235	Possible mound	Linear object	4.49	0.90	0.32	469038.16	6132639.61				50	
SD-DK35-1238		Linear object	1.89	0.51	0.25	468870.91	6132435.54				50	
SD-DK35-1322	Possible boulder	Linear object	2.17	0.54	0.21	468402.65	6131950.21				50	
SD-DK35-1331		Linear object	6.36	1.17	0.38	468187.44	6131656.23		Coverage insufficient. Small plank snagged under boulder and bottle seen	I	0	
SD-DK35-1340	Possible boulder	Linear object	2.64	0.78	0.40	468152.64	6131581.86				Perimeter-based	
SD-DK35-1468		Linear object	2.53	0.58	0.47	466940.44	6130232.87				Perimeter-based	
SD-DK35-2000225	Pos linear object	Linear object	4.15	0.88	0.21	465856.7	6129037.46		Flexible hose	N	0	
SD-DK35-2000321		Linear object	3.50	0.56	0.22	473412.13	6132008.98				50	
SD-DK35-2000351		Linear object	3.28	0.23	0.10	475572.51	6133987.62				50	
SD-DK35-2000401		Linear object	1.78	0.41	0.12	478245.62	6136707.24				50	
SD-DK35-2000421		Linear object	3.19	0.50	0.06	481513.47	6141096.46				50	
SD-DK35-2000424	Elongated debris	Debris	3.21	0.58	0.12	483607.46	6143774.17				50	
SD-DK35-200094	Poss. part of something larger, semi-buried	Linear object	2.90	0.64	0.29	472766.47	6137190.25		Coverage insufficient. Boulders; one angular, some w. plastic debris snagged underneath	I	Perimeter-based	

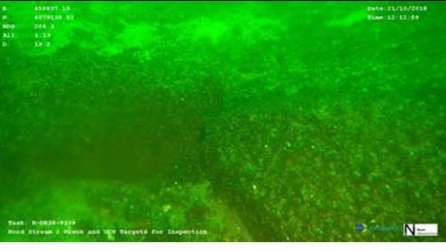
SD-DK35-200457	Possible linear object. Partially buried.	Linear object	1.56	0.17	0.00	493345.17	6151421.35		Coverage insufficient. Curved metal band (barrel hoop?) Age indet.	I	Perimeter-based	
SD-DK35-2057	No shadow possible buried	Boulder	1.18	0.84	0.00	469377.4	6126352.18				50	
SD-DK35-20712	Linear debris	Linear object	2.88	0.12	0.08	472253.4	6136359.91		Half buried hollow pipe	N	0	
SD-DK35-20877	Pres. wreck	Wreck	15.37	0.61	1.06	475482.33	6133709.12				200	
SD-DK35-20886	Strange object - appears as a linear depression? Poss. ass. w. similar nearby	Linear object	2.48	0.20	0.06	469533.1	6126503.46				50	
SD-DK35-21023		Linear object	1.72	0.27	0.26	472109.7	6129983.92				50	
SD-DK35-21057		Linear object	4.23	0.26	0.23	475854.69	6134018.06				50	
SD-DK35-21104	Linear debris	Linear object	4.85	0.18	0.13	474259.04	6132821.71				50	
SD-DK35-21108		Linear object	10.36	0.50	0.22	473887.24	6132459.55				50	
SD-DK35-21126	Associated with larger linear object	Linear object	4.38	0.39	0.13	475481.09	6133710.6				50	
SD-DK35-21127	Associated with larger linear object	Linear object	1.73	0.38	0.00	475481.52	6133709.81				50	
SD-DK35-21128	Associated with larger linear object	Linear object	7.30	0.77	0.00	475479.13	6133708.76				50	
SD-DK35-21129	Associated with larger linear object	Linear object	2.68	0.18	0.00	475481.2	6133714.22				50	
SD-DK35-2115	Possible mound	Linear object	5.17	1.64	0.30	473427.36	6130735.52				50	
SD-DK35-21223		Linear object	1.31	0.35	0.25	485434.48	6145886.81				50	
S-DK35-30007	Debris ass. w. S-DK35-30008	debris	4.43	2.84	1.67	488135.47	6149284.03				0	
S-DK35-30008	Length 130 m (measurements from LF file). More debris than the two picked targets. Charted wreck. Undoubtedly MS SAIVO; wrecked 07-06-1955, LOA of which is listed as 131,44 m (beam 17,29 m)	wreck	0.00	19.42	9.98	488068.14	6149282.05				0	
S-DK35-30009	Debris ass. w. S-DK35-30008	linear object	10.89	0.21	0.25	488129.87	6149274.42				0	
S-DK35-30083	nmh	debris	6.78	1.67	0.00	471646.11	6136091.97				50	
DK35-WIDE-VIRSSS-0004	Poss. partly covered wreck	Unknown	27.82	7.50	3.09	474252.33	6138161.53		Boulder field on sharp, steep terrain	N	0	
SD-DK36-3100		Linear Object	4.41	0.30	0.22	462144.13	6121032.14				50	
SD-DK36-3791		Wreck	13.42	5.84	4.00	461857.79	6121463.44				200	
SD-DK36-3792	Debris from wreck	Debris	8.37	6.39	0.66	461851.31	6121442.13				50	
SD-DK36-3806		Linear Object	3.59	0.41	0.35	462024.95	6119577.56				50	
DK36_SL_VIRSSS0000	Linear Object	Linear Object	6.28	0.66	0.07	462018.85	6121249.9				50	
DK36_SL_VIRSSS0001	Linear Object	Linear Object	4.58	0.57	0.09	462021.03	6122865.22				50	
DK36_SL_VIRSSS0002	2-3 linear objects; poss. line debris	Linear Object	19.96	0.73	0.10	462460.08	6120489.67				50	
DK36_SL_VIRSSS0003	Linear Object	Linear Object	3.73	0.53	0.31	460984.1	6121122.41				50	
DK36_SL_VIRSSS0004	Linear Object	Linear Object	3.07	0.53	0.31	460656.36	6122374.73				0	
DK36_SL_VIRSSS0005	Poss. wreck/ballast pile	Mound	18.71	10.84	0.55	460760.2	6121445.77				50	
DK36_SL_VIRSSS0006	Linear object	Linear object	5.32	0.57	0.25	460695.77	6120108.52				200	
DK36_SL_VIRSSS0007	Linear object	Linear object	14.60	0.60	0.30	460693.69	6120122.96				50	
S-DK36-5003	Unknown wooden cargo ship w. diesel engine. Reported to Maritime Authorities 2010	Wreck	51.87	27.82	1.07	458034.91	6111891.92				200	
DK36_VIRSSS0001	Poss. wreck. Three linear objects in larger area of harder texture	Debris	23.07	12.72	0.17	460793.1	6122493.23		(seen)		Perimeter-based	
DK36_VIRSSS0002	Linear object. Lying on area of harder texture	Linear object	16.54	0.69	0.15	462694.98	6125061.74		(seen)		Perimeter-based	
DK36_VIRSSS0003	Linear object	Linear object	6.10	0.76	0.27	466135.73	6122231.38				50	
SD-DK37-0144	Linear debris	Linear object	9.81	0.68	0.14	452568.71	6092745.65				50	
SD-DK37-0667		Linear object	3.59	0.67	0.05	453510.44	6098523.16				50	
SD-DK37-0727		Wreck	26.15	7.06	3.05	456948.45	6094392.34				200	
SD-DK37-0946		Linear object	6.11	0.43	0.79	455882.78	6088272.29				50	
SD-DK37-0973		Linear object	4.80	0.46	0.00	452064.93	6081267.17				50	
SD-DK37-20444		Debris	5.96	0.67	0.18	457453.52	6099286.93		Nothing found (trawl scars and small mound/depression)	N	0	
SD-DK37-20699		Debris	1.83	0.61	0.08	453524.37	6097121.74				50	
SD-DK37-1006	Elongated object	Debris	6.71	0.65	0.22	457013.33	6096651.32				50	
SD-DK37-1017		Boulder	2.39	0.48	0.47	456851.65	6094426.8				50	
SD-DK37-1018	Debris associated with SD-DK37-0727	Debris	1.30	0.64	0.51	456971.92	6094400.99				50	
SD-DK37-1047		Linear object	4.40	0.40	0.59	456911.24	6091127.55				50	
SD-DK37-1170	possible elongated object	Linear object	9.22	1.04	0.55	448581.57	6074134.19				50	

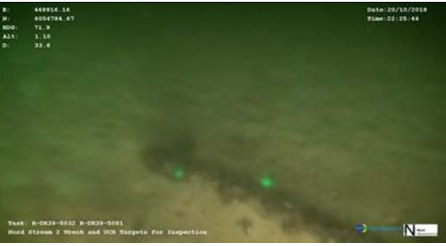
Nord Stream 2 Pipeline, NW alternative route

SD-DK37-21085	Possible boulder	Linear object	2.41	0.77	0.21	457175.28	6102666.15		Boulder	N	0	
SD-DK37-21384		Linear object	3.08	0.32	0.13	456937.77	6098463.15				50	
SD-DK37-21398		Linear object	4.82	0.43	0.14	456931.16	6097351.64				50	
SD-DK37-21413		Linear object	4.22	0.27	0.13	456841.72	6095884.2				50	
SD-DK37-21416		Linear object	5.07	0.37	0.22	456769.19	6095066.36				50	
SD-DK37-21417		Linear object	3.11	0.21	0.23	456768.31	6095064.71				50	
SD-DK37-21500	pos object in ripples	Linear object	2.42	0.56	0.10	450761.04	6079251.37				50	
SD-DK37-30054		Linear object	24.40	0.68	0.28	451494.78	6081709.03				50	
SD-DK37-300351	Possible piece of chain. No measurable height.	Debris	5.36	0.31	0.00	451656.07	6081794.16				50	
SD-DK37-300352	Possible piece of chain	Debris	44.45	0.16	0.14	451688.26	6081782.06				100	
SD-DK37-300353	Possible piece of chain. No measurable height.	Debris	56.05	0.25	0.00	451684.66	6081778.64				50	
DK37-N2K-VIRSSS0000	Debris field/poss. wreck	Debris	42.90	8.84	0.18	457282.33	6103804.56				200	
DK37-N2K-VIRSSS0004	Poss. wreck. Wheel-defined area of rougher texture w. linear features within	Mound	44.66	35.99	0.47	456473.89	6089353.32				200	
DK37-N2K-VIRSSS0005	Debris area. Rather scattered. Partly obscured by halocline noise on only visible file	Debris	70.35	34.70	0.84	457194.01	6093859.42				100	
DK37-N2K-VIRSSS0006	Linear object	Linear object	9.07	0.27	0.14	450461.7	6083690.51				50	
DK37-N2K-VIRSSS0007	One or more linear object(s)	Linear object	4.21	0.37	0.15	454998.4	6103856.07				50	
DK37-N2K-VIRSSS0008	Poss. wreck/ballast pile	Mound	11.62	7.72	0.55	450803.26	6084722.77				200	
DK37-N2K-VIRSSS0009	Linear object	Linear object	4.99	0.43	0.18	448888.39	6075755.64				50	
DK37-N2K-VIRSSS0010	Linear object	Linear object	2.06	0.37	0.05	456687.52	6094362.76				50	
DK37-N2K-VIRSSS0011	Linear object	Linear object	2.14	0.18	0.03	456613.23	6094494.05				50	
DK37-N2K-VIRSSS0012	Boat-shaped area of differing reflection, NMH	Mound no height	19.59	9.91	0.00	455364	6106623.74				200	
S-DK38-10277		Linear object	5.36	0.20	0.13	463095.11	6075118.48				50	
S-DK38-10278		Linear object	8.54	0.64	0.21	463000.93	6075118.23				50	
S-DK38-10279		Linear object	7.12	0.62	0.10	463106.14	6075111.47				50	
S-DK38-10282	Possible geology	Linear object	4.91	0.29	0.14	463045.75	6075097.18				50	
S-DK38-10283	No Shaddow	Linear object	5.04	0.58	0.00	463029.76	6075092.15				50	
S-DK38-10286		Linear object	8.33	0.20	0.12	463077	6075054.03				50	
S-DK38-10287		Linear object	5.55	0.20	0.15	463101.76	6075013.92				50	
S-DK38-10295		Linear object	4.23	0.52	0.11	463641.84	6074288.5				50	
S-DK38-10302		Debris	3.21	0.95	0.14	466232.84	6072452.79				50	
S-DK38-10319		Linear object	3.88	0.74	0.18	467045.1	6071346.93				50	
S-DK38-10328		Linear object	4.11	0.41	0.23	466451.67	6071259.26				50	
S-DK38-10369		Boulder	2.93	0.62	0.30	466770.64	6070878.9				50	
S-DK38-10380		Linear object	2.86	0.51	0.20	466753.84	6070775.08				50	
S-DK38-10381		Linear object	2.56	0.57	0.24	466612.35	6070775.06				50	
S-DK38-10423		Linear object	3.74	0.30	0.09	467859.03	6069905.3		(seen)		Perimeter-based	
S-DK38-10438		Linear object	2.49	0.46	0.09	468992.01	6068555.69		Debris (poss. metal fitting in one end. Tiller?)	I	Perimeter-based	
S-DK38-10441		Linear object	4.79	0.45	0.08	469053.45	6068202.59		Narrow wooden batten	I	Perimeter-based	

S-DK38-10447	No Shaddow	Debris	3.85	1.62	0.00	469307.56	6067640.86		Raincoat and (metallic?) debris; the latter heavily covered in marine growth	N	0	
S-DK38-5054		Debris	5.53	1.52	0.22	457527.96	6100211.89		Boulder	N	0	
S-DK38-5132		Debris	3.82	0.60	0.18	457676.17	6099342.39		Debris	N	0	
S-DK38-5139	No shaddow, possible scar	Linear object	10.71	0.45	0.09	457451.2	6099283.89		Nothing found (trawl scars and small mound/depression)	N	0	
S-DK38-5154		Debris	2.37	1.38	0.07	457468.71	6099081.89		Boulder	N	0	
S-DK38-5269		Linear object	3.48	0.20	0.10	457484.53	6097208.68				50	
S-DK38-5368		Linear object	4.20	0.42	0.07	457801.45	6096766.62		Pres. boulder	N	0	
S-DK38-5372		Linear object	3.48	0.56	0.21	457785.51	6096763.21		Boulder	N	0	
S-DK38-5374		Debris	3.44	0.56	0.28	457778.88	6096760.87		Boulder	N	0	
S-DK38-5401		Linear object	6.30	0.42	0.22	457542.4	6096680.2				50	

S-DK38-5442		Debris	3.98	2.18	0.24	457775.29	6096444.95		Debris	N	0	
S-DK38-5504		Linear object	4.07	0.64	0.23	458324.9	6096133.41				50	
S-DK38-5564		Debris	5.08	0.58	0.57	458266.65	6095795.15				50	
S-DK38-5648		Linear object	4.18	0.67	0.10	458457.44	6095242.95				50	
S-DK38-5766		Linear object	7.56	0.86	0.08	458668.92	6094168.81				50	
S-DK38-5983		Linear object	4.76	0.22	0.27	458491.68	6092786.75				50	
S-DK38-6693		Linear object	2.62	0.19	0.18	459154.57	6089875.25		Spar/log; slightly tapered	I	50	
S-DK38-6798		Linear object	5.58	0.45	0.25	459622.7	6089307.19				50	
S-DK38-7541		Linear object	4.62	0.70	0.19	458487.2	6085668.7				50	
S-DK38-7546		Linear object	4.39	0.60	0.31	459258.36	6085608.52		Poss. spar/crane boom; mortise or lugs in one end	I	50	
S-DK38-7552		Linear object	4.14	0.43	0.15	459267.06	6085546.47		Spar/log/stake	I	50	
S-DK38-7555		Boulder	7.37	0.60	0.10	459167.63	6085505.19		Spar/log/stake/wale (cam not properly focused)	I	Perimeter-based	
S-DK38-7556		Boulder	1.38	0.74	0.24	459151.5	6085500.79		Log/stake; poss. pointed	N	0	

S-DK38-8063		Debris	4.09	2.07	0.75	459004.91	6083461.28		Log, sawn	N	0	
S-DK38-9157	Maybe S/S EKATERINA PEPPA, wrecked Feb. 1938, although this is charted at considerable distance to this	Wreck	81.94	22.76	2.01	459895.11	6079559.32				200	
S-DK38-9339	Stretched	Boulder	3.05	0.61	0.71	459835.53	6079139.11		Boulder	N	0	
DK38-VIRSSS-0000	Linear object	Linear object	7.12	0.63	0.75	460054.15	6079446.23				50	
DK38-VIRSSS-0001	Linear object	Linear object	6.98	0.27	0.14	458591.64	6094185.18				50	
DK38-VIRSSS-0005	Poss. wreck. Very large debris field	Debris	92.66	18.56	0.26	461612.4	6076829.78				Perimeter-based	
DK38-VIRSSS-0006	Linear object	Linear object	8.53	0.49	0.09	458806.11	6093452.79				50	
S-DK39-5022		Boulder	7.19	1.77	0.12	469761.14	6064370.09		Beam/plank/wale/log	I	50	
S-DK39-5044		Debris	3.10	0.94	0.14	469739.48	6061789.2				50	
S-DK39-5077	No shadow. Partially buried boulder or hard sediment	Other	6.80	1.20	0.12	469080.69	6056713.49		Debris	N	0	
S-DK39-5081		Debris	7.40	0.88	0.23	468815.99	6054782.06		Poss. tree; cam. not focused	I	50	
DK39-ICEBEAM-VIRSSS0001	Unknown object; obscured by thermocline noise. Poss. drifting object same as S-DK39-5077	Other	86.62	7.46	0.20	468975.6	6056720.86		(seen)		50	
DK39-ICEBEAM-VIRSSS0002	Unknown object, NMH. Poss. drifting object same as S-DK39-5044	Other	9.13	1.63	0.00	469844.95	6061780.41				50	
SD-DK39-20138	No shadow	Linear object	2.97	0.57	0.00	469553.89	6063161.81		Plank/wale/spar/handspike	I	Perimeter-based	
SD-DK39-20193		Linear object	2.39	0.38	0.09	469462.7	6061661.54		Spar/log/pipe; material unknown	I	Perimeter-based	

SD-DK39-20207		Linear object	1.76	0.24	0.09	469307.2	6061243.56		40-50 m from target area: spar/log/pipe; material unknown	N	0	
SD-DK39-20244		Debris	4.77	3.16	0.24	469412.26	6060532.6		(very dark video)		Perimeter-based	
SD-DK39-20349		Debris	2.05	0.47	0.09	469266.36	6058955.14		(very dark video)		Perimeter-based	
SD-DK39-20518	No shaddow	Debris	1.82	0.71	0.00	468469.77	6054420.85				Perimeter-based	
DK39-VIRSSS-0001	1 or 2 linear objects	Linear object	5.25	0.38	0.06	469692.01	6063761.26		Log/stake/beam; poss. pointed. Smaller poss. iron obj. nearby. Also net debris	I	50	
DK39-VIRSSS-0002	Linear object	Linear object	7.40	1.09	0.13	469762.76	6064365.88		Plank/wale	I	50	
DK39-VIRSSS-0003	Linear object w. surrounding/attached (net?) debris	Linear object	7.40	0.68	0.12	469118.85	6066463.48				50	
S-DK39-5005		Boulder	1.30	0.18	0.05	469358.62	6063636.82		(seen)		50	
S-DK39-5008		Debris	3.10	0.94	0.14	469739.23	6061786.15				50	
S-DK39-5028		debris	6.80	1.20	0.00	469080.54	6056712.73		(= 5077?)		Perimeter-based, adjusted	
S-DK39-5032		Debris	7.40	0.88	0.23	468817.28	6054784.56		(= 5081?)		50	
TO-DK-35-50004	Wooden railing	Debris	0.00	0.00	0.00	486887.68	6147840.79		Poss. fighting top or railing	Y	200	